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Study of Economic Growth in IKN based on Autoregressive and Distributed Lag Approach

Dita Amelia[1], Suliyanto[1], Alfian Iqbal Zah[2], Astrid Mutyaravica[2]
[1]Department of Mathematics, Universitas Airlangga, Surabaya, Indonesia
[2]The Bachelor of Statistics Study Program, Universitas Airlangga, Surabaya, Indonesia
dita.amelia@fst.unair.ac.id

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ABSTRACT

Indonesia's economy plays an important role in supporting national development and government policies in various sectors such as education, health, and infrastructure. In the first quarter of 2024, Indonesia's economy experienced an increase from the same period in 2022. East Kalimantan experienced significant growth supported by the mining sector, metal industry, and the National Capital City project. However, East Kalimantan is dependent on raw material exports and faces challenges in economic transformation. The government aims to increase exports of processed products to reduce poverty and unemployment. This study analyzes whether economic growth in IKN affects the economy of East Kalimantan, by considering inflation, CPI, export value, and GRDP. This study uses quantitative research methods using Autoregressive Distributed Lag (ARDL) with the advantage that it can be used in models with different levels of stationary and does not matter the number of samples with the data used is secondary data from BPS. The best model obtained is ARDL (3, 3, 4, 3, 4) based on the smallest AIC value which shows the long-term and short-term relationship. Economic growth, export value, and GRDP from the previous quarter affect growth negatively, while GRDP from the same period and the previous quarter affect growth positively. In the long run, export value and GDP significantly affect growth. These results provide insights for the government in managing East Kalimantan's growth, supporting sustainable development and SDG achievement. The results of this study are expected to be a reference for the central government to make policies related to factors that affect Economic Growth in the hope of increasing economic growth in East Kalimantan.

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A. INTRODUCTION

Indonesia's economy plays an important role in supporting national development, government policies, and sectoral projects. Economic growth from 2022 to 2024 increases by 0.7%, indicating an improvement in people's welfare in line with development indicators (BPS, 2024). Spatially, East Kalimantan's economic growth is ranked third with a growth of 6.22% in 2023 (BPS, 2023). Economic growth is driven by the mining sector, metal industry, and the development of IKN, which is expected to contribute significantly to the success of the economy and long-term development.

The development of the National Capital City (IKN) Nusantara aims to create inclusive economic growth by presenting a new growth center outside Java. IKN Nusantara is designed as a catalyst to optimize national economic potential, create jobs, reduce poverty, and become a symbol of national identity. IKN development that focuses on infrastructure, such as Smart

Transportation and Smart Grid Technology, is closely related to the education sector as it requires the development of human resources skilled in technology through specialized education and training programs (Kemensetneg, 2022). East Kalimantan's economic growth has been hampered by limited infrastructure, regulations, and institutions that still need to be improved. With the relocation of the capital city to this region, it is expected that East Kalimantan can develop into a new economic center and economic driver of Indonesia, as well as have a positive impact on surrounding provinces. However, challenges include maintaining political stability and policy consistency to keep investment attractive. In addition, rapid development in IKN in the short term may lead to social inequality (Simanjuntak et al., 2024).

The economic structure of East Kalimantan Province is dominated by the mining sector with the highest percentage of exports amounting to 75.76%. According to the RPJMN 2020-2024, the relocation of IKN from Java Island to Kalimantan Island is expected to encourage economic diversification (Bappenas, 2020). The economic development policy for 2023 includes an economic stabilization strategy with a growth target of 3.5±1 percent. The development of IKN is in line with the RPJMD and sustainable development goals (SDG's), especially point 8 (decent work and economic growth). Economic growth reflects the welfare of society. Inflation had a negative impact on Indonesia's economic growth from 1983 to 2014, so government and business collaboration is needed to increase production (Simanungkalit, 2020). CPI reflects the cost of living and has a significant effect on economic growth, with a positive relationship through total loans in Bali (Maharani et al., 2017). Agricultural GRDP plays an important role in food security, community welfare, and economic growth in South Aceh (Suharmi, 2019). Increased exports have a positive and significant impact on Indonesia's economic growth (Apriliani, 2024).

Time series analysis is a method used to predict future conditions by analyzing and recognizing patterns in historical data, especially those considered to have stability or minimal change over time (Santoso, 2001). Time series data is usually nonstationary, so regression with dynamic models is needed to overcome this (Husna, 2023). Time-varying linear regression models, such as Distributed Lag and Autoregressive, are used when past data of independent variables or explanatory variables are involved. The combination of the two is known as the Autoregressive Distributed Lag (ARDL) model (Pakpahan, 2022). Based on the description above, researchers are interested in analyzing the influence and prediction of factors affecting economic growth in East Kalimantan Province with the transfer of the IKN capital for the upcoming period using time series analysis with the Autoregressive Distributed Lag (ARDL) method which is new from previous research. The results of this study are expected to be a reference for the central government to make policies related to factors that affect Economic Growth in the hope of increasing Economic Growth in East Kalimantan.

B. METHODS

This research uses quantitative research methods to examine specific populations or samples and analyze quantitative / statistical data to test predetermined hypotheses (Sugiyono, 2014). The analysis technique in this study uses the Autoregressive Distributed Lag (ARDL) statistical method by determining the best model using the AIC value.

1. Data

This study uses secondary data on Economic Growth in East Kalimantan from 2011 to 2023, with quarterly data obtained from the official website of the Central Bureau of Statistics (bps.go.id). Endogenous Variable (Y) is a variable that is influenced by the independent variable which can be said to be the affected variable. The dependent variable in this study is Economic Growth. Meanwhile, the Exogenous Variable (X) is a variable that influences or is tested for its effect on other variables. The exogenous variables in this study consist of Inflation, CPI, Export Value, and GRDP. The following Research Variables are shown in Table 1.

Table 1. Research Variables

Variable	Variable Description	Unit	Measurement Scale	Variable Type
Y	Economic Growth	Percent	Ratio	Continuous
X_1	Inflation	Percent	Ratio	Continuous
X_2	Consumer Price Index	Index	Ratio	Continuous
X_3	Export Value	US dollar (million)	Ratio	Continuous
X_4	Gross Regional Domestic Product	Rupiah (Billion)	Ratio	Continuous

2. *Autoregressive Distributed Lag* (ARDL)

The ARDL method is an econometric technique for estimating linear regression, especially in analyzing the long-run relationship between time series variables through cointegration tests (Elkadhi & Hamida, 2014). ARDL is a dynamic model that combines Autoregressive (AR) and Distributed Lag (DL). Where, Lag is Lag in the context of time series econometric analysis refers to the time shift between a variable and itself (Rohman, 2024). AR involves past values of the endogenous variable (Y), while DL includes current and past values of the exogenous variable (X). The form of the model function equation in Autoregressive Distributed Lag (ARDL (p,q)) with one exogenous variable can be expressed as follows:

$$Y_t = \alpha_0 + \alpha_1 t + \psi_1 Y_{t-1} + \cdots + \psi_p Y_{t-p} + \beta_0 X_t + \beta_1 X_{t-1} + \cdots + \beta_q X_{t-q} + \varepsilon_t \tag{1}$$

where Y_t is the observed endogenous variable, α_0 is the intercept, α_1 is the coefficient of the time effect parameter, $(\psi_1, \ldots, \psi_p)$ is the parameter coefficient of the lag effect of endogenous variables, $(\beta_0, \beta_1, \ldots, \beta_q)$ is the parameter coefficient of the exogenous variable, $(\{t-1\}, \ldots, \{t-p\})$ is the lag of the endogenous variable, $(\{t-1\}, \ldots, \{t-q\})$ is the lag of the exogenous variable, ε_t is the error in period t. Based on equation (1), the general ARDL model with k exogenous variables is written ARDL $(p, q_1, \ldots, q_k)$ as follows:

$$Y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \psi_i Y_{t-i} + \sum_{j=1}^{k} \sum_{l_j=0}^{q_j} \beta_{j,l_j} X_{j,t-l_j} + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma^2) \tag{2}$$

If $t = 1, 2, \ldots, T$ is known, then the model in equation (2) can also be expressed in the following matrix form:

$$\boldsymbol{y} = \boldsymbol{X}\boldsymbol{\delta} + \boldsymbol{\varepsilon} \tag{3}$$

where $\boldsymbol{y} = (Y_1, Y_2, \dots, Y_T)^T$ is a dimensionless vector $(T \times 1)$, $\boldsymbol{\varepsilon} = (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_T)^T$ is a dimensionless error vector $(T \times 1)$, $\boldsymbol{\delta} = \left(\alpha_0, \alpha_1, \psi_1, \dots, \psi_p, \beta_{10}, \beta_{11}, \dots \beta_{kq_k}\right)^T$ is a dimensionless parameter vector $(\kappa \times 1)$ with $\kappa = p + 2 + \sum_{i=1}^{k} q_i$, and $\boldsymbol{X}$ is a matrix of size $(T \times \kappa)$ as follows.

$$\boldsymbol{X} = \begin{pmatrix} 1 & 1 & Y_{1,t-1} & \cdots & Y_{1,t-p} & X_{1,1t} & X_{11,t-1} & \cdots & X_{1k,t-q_k} \\ 1 & 2 & Y_{2,t-1} & \cdots & Y_{2,t-p} & X_{2,1t} & X_{21,t-1} & \cdots & X_{2k,t-q_k} \\ \vdots & \vdots & \vdots & \cdots & \vdots & \vdots & \vdots & \cdots & \vdots \\ 1 & T & Y_{T,t-1} & \cdots & Y_{T,t-p} & X_{T,1t} & X_{T1,t-1} & \cdots & X_{Tk,t-q_k} \end{pmatrix}$$

The parameter vector $\boldsymbol{\delta}$ in equation (3) can be estimated by the Ordinary Least Square (OLS) method as follows.

$$\widehat{\boldsymbol{\delta}} = (\boldsymbol{X}'\boldsymbol{X})^{-1}\boldsymbol{X}'\boldsymbol{y} \tag{4}$$

Based on equation (4), we can know the expectation value and covariance as follows.

$$E\left(\widehat{\boldsymbol{\delta}}\right) = \boldsymbol{\delta};\ cov\left(\widehat{\boldsymbol{\delta}}\right) = \sigma^2(\boldsymbol{X}'\boldsymbol{X})^{-1} \tag{5}$$

The advantages of the ARDL model include its non-dependence on the degree of stationarity of the data, where the variables do not need to be cointegrated at the same order. The model is also more efficient with small sample sizes and allows for simultaneous long-run and short-run estimation, helping to avoid autocorrelation problems (Zaretta & Yovita, 2019).

3. ARDL Method Prerequisite Test

In conducting regression using the ARDL model, there are several stages that must be met to see if the data used has met the requirements.

a. Stationarity Test

Data non-stationarity can affect the quality of tests, such as the classical assumption test, potentially resulting in an invalid regression model (spurious regression). The Augmented Dickey-Fuller (ADF) test is an advanced version of the Dickey-Fuller test to test stationarity. The equation used in the ADF test is as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \gamma Y_{t-1} - \sum_{i=1}^{p-1}\sum_{j=i+1}^{p}\psi_j \Delta Y_{t-i} + \sum_{j=1}^{k}\sum_{l_j}^{q_j}\beta_{j,l_j}X_{j,t-l_j} + \varepsilon_t \tag{6}$$

where ΔY_t is the form of first difference, Y_{t-i} is the value of the $t - i$ period variable, α is the parameter, p is the lag length used in the model, ε is the error. The hypothesis for stationarity testing is as follows. H_0 is $\gamma = 0$ (ARDL model is not stationary); H_1 is $\gamma < 0$ (stationary ARDL model). If the ADF t-statistic > critical value or $P - value\ < \alpha$ then H_0 is rejected, meaning that the variable is stationary at a certain level.

b. Cointegration Test

The cointegration test is the next step after the stationarity test to evaluate the existence of a long-term relationship between the variables in the study (Faudzi & Asmara, 2023).

1) Johansen Cointegration Test

Cointegration test can be done with Johansen test with Johansen cointegration test hypothesis as follows. H_0 is Does not have a cointegrating equation; H_1 is Has a cointegrating equation. If the $p-value$ is smaller than α. This means that there is a long-run relationship between the variables in the research model (Atmaja et al., 2015).

2) Bound Test Cointegration Test

The hypothesis in this F test is as follows: H_0 is $\psi_1 = \psi_2 = \cdots = \psi_p = \beta_{10} = \beta_{11} = \cdots = \beta_{1,q_1} = \cdots = \beta_{k,q_k} = 0$ (No long-term relationship); H_1 is There is at least one $\psi_j \neq 0$ with $j = 1,2,\ldots,p$ and $\beta_{s,l_s} \neq 0$ with $s = 1,2,\ldots,k$ and $l_s = 0,1,2,\ldots,q_s$ (There is a long-term relationship). If the F-Statistic value of the Bound Test is greater than the upper critical value of I(1), then H_0 is rejected, indicating the existence of a long-run relationship or cointegration. (Nulhanuddin & Andriyani, 2020).

c. Optimum Lag Test

The optimal lag test aims to determine the best lag length in the analysis (Gujarati, 2004). In the ARDL model, lags represent the impact of time delays on observations, and this test is important to overcome autocorrelation problems. The optimal lag selection is based on the Akaike Information Criterion (AIC), with the AIC formula as follows (Serdawati, 2009):

$$AIC = log\left(\frac{1}{T}\sum_{t=1}^{T}\varepsilon_t^2\right) + \frac{2k}{T} \quad (7)$$

where k is the number of exogenous variables in the model.

4. Classical Assumption Test

a. Normality Test

Normality tests can be performed using the Jarque-Bera test (Faudzi & Asmara, 2023). To test this normality, the Jarque-Bera test is used which involves the calculation of skewness and kurtosis with the hypothesis of: H_0 is Error is normally distributed; H_1 is Error is not normally distributed. The test statistics used based on the hypothesis in the normality test are as follows:

$$JB = \left[\frac{{S_k}^2}{6} + \frac{(k-3)^2}{24}\right] \quad (8)$$

with $k = \frac{\hat{\mu}_4}{{\hat{\mu}_2}^2} = \frac{\frac{1}{T}\sum_{i=1}^{T}(X_i-\bar{X})^2}{\left(\frac{1}{T}\sum_{i=1}^{T}(X_i-\bar{X})^2\right)^2}$ and $S_k = \frac{\hat{\mu}_3}{\hat{\mu}_2^{\frac{3}{2}}} = \frac{\frac{1}{T}\sum_{i=1}^{T}(X_i-\bar{X})^3}{\left(\frac{1}{T}\sum_{i=1}^{T}(X_i-\bar{X})^2\right)^{\frac{3}{2}}}$

where T is the number of time observations, S_k is skewness, k is kurtosis. With the test criteria that H_0 rejected if $JB > \chi^2_{(\alpha,2)}$ or $p - value < \alpha$, which means the error is not normally distributed (Jarque & Bera, 1987).

b. Heteroscedasticity Test
If the residual variances are different, this is called heteroscedasticity, which can cause the estimation of regression coefficients to be inefficient and impact the accuracy of the analysis results (Faudzi & Asmara, 2023). Testing can be done using the Breusch-pagan test, the following is a test hypothesis using the Breusch-pagan test. H_0 is ${\sigma_t}^2 = \sigma^2$ with $t = 1,2, \dots, T$ (there is homoskedasticity); H_1 is There is at least one ${\sigma_t}^2 \neq \sigma^2$ (ada heterokedastisitas). The Breusch-pagan test statistics used for heterogeneity testing are as follows:

$$BP = \left(\frac{1}{2}\right) \boldsymbol{f^T Z}(\boldsymbol{Z^T Z})^{-1}\boldsymbol{Z^T f} \sim \chi^2_k \tag{9}$$

Elements of the vector $\boldsymbol{f}$ is $f_t = \left(\frac{e_t^2}{\sigma^2} - 1\right)$ with e_t is the least square residual for the t-th observation. $\boldsymbol{Z}$ is a matrix of size $T \times k$ which contains vectors that have been normalized for each observation. H_0 rejected if $BP > \chi^2_k$ with k is many exogenous variables or if the value of *p-value* < α. It means that there is spatial heterogeneity so that the assumption of spatial heterogeneity is fulfilled.

c. Autocorrelation Test
To find out whether there is an autocorrelation problem, the autocorrelation test can use the Breusch-Godfrey test or the LM Test. The autocorrelation test using Breusch-Godfrey is done by regressing the error variable using the autoregressive model of order ρ (Paramitha, 2023), that is

$$\varepsilon_t = \rho_1 \varepsilon_{t-1} + \rho_2 \varepsilon_{t-2} + \cdots + \rho_p \varepsilon_{t-p} + v_t \tag{10}$$

where ε_t is the residual of the current regression model, ε_{t-1} is the residual of the previous regression model, ρ is the autocorrelation coefficient, v_t is the error of the residual ε_t. The hypothesis for the autocorrelation test is explained as follows. H_0 is $\rho_1 = \rho_2 = \cdots = \rho_p = 0$ (There is no autocorrelation); $H_1$is There is at least one $\rho_j \neq 0$ with $j = 1,2, \dots p$ (There is autocorrelation). The Breusch-Godfrey test or LM Test is by looking at the Chi-Square probability value. If the Chi-Square value is greater than α then there is no autocorrelation problem (Faudzi & Asmara, 2023).

5. Hypothesis Test

a. Determination Test (R^2)
Sum of Square Regression (SSR) and Sum of Square Total (SST) are used to calculate the (R^2) value, which measures how much total variation can be explained by the model (Soedibjo, 2013).

$$R^2 = \frac{SSR}{SST} \tag{11}$$

b. Simultaneous Test (F)

The F test is used to test whether exogenous variables jointly affect endogenous variables (Paramitha, 2023). The hypothesis for simultaneous testing is explained as follows.

$$F = \frac{SSR}{\kappa-1} / \frac{SSE}{T-\kappa} \sim F(\kappa-1, T-\kappa) \quad (12)$$

The hypothesis for simultaneous testing is explained as follows. H_0 is $\alpha_1 = \psi_1 = \cdots = \psi_p = \beta_{10} = \cdots = \beta_{1,q_1} = \cdots = \beta_{k0} = \cdots = \beta_{k,q_k} = 0$; H_1 is There is at least one $\psi_j \neq 0$ with $j = 1,2,\dots,p$ and $\beta_{s,l_s} \neq 0$ with $s = 1,2,\dots,k$ and $l_s = 0,1,2,\dots,q_s$. With a significance level of α, the test criteria for the simultaneous test (F) are explained, namely if $F > F\ (\alpha, \kappa-1, T-\kappa)$ or $P - value\ < \alpha$ then H_0 is rejected, meaning that there is a significant influence between the lag of endogenous variables and the lag of exogenous variables on Y_t simultaneously.

c. Partial Test (T)

The T test is used to measure the extent of the influence of each exogenous variable on the endogenous variable, assuming that the other exogenous variables remain constant (Paramitha, 2023). The partial test hypothesis for the ARDL method is explained as follows:

1) Partial Test of Parameters α_1

The formula used for the T test with parameter α_1 is as follows.

$$t = \frac{\hat{\alpha}_1}{S(\hat{\alpha}_1)} \quad (13)$$

$H_0: \hat{\alpha}_1 = 0$ (There is no effect of time variable) $H_0: \hat{\alpha}_1 \neq 0$ (There is an effect of time variable). With significance level α, explained the test criteria in the partial test (T), namely if obtained $|t| > t_{\frac{\alpha}{2};(T-\kappa)}$ or $P - value < \alpha$ then H_0 is rejected.

2) Partial Test of Parameters $\hat{\psi}_i$

The formula used for the T test with parameters $\hat{\psi}_j$ is as follows.

$$t_j = \frac{\hat{\psi}_j}{S(\hat{\psi}_j)} \text{ dengan } j = 1,2,\dots,p \quad (14)$$

$H_0: \hat{\psi}_j = 0$ (There is no effect of the j-th endogenous variable at a certain lag); $H_0: \hat{\psi}_j \neq 0$ (There is an effect of the j-th endogenous variable at a certain lag). With significance level α, explained the test criteria in the partial test (T), namely if obtained $|t_j| > t_{\frac{\alpha}{2};(T-\kappa)}$ or $P - value < \alpha$ then H_0 is rejected.

3) Partial Test of Parameters $\hat{\beta}_{j,l_j}$

The formula used for the T test with parameters $\hat{\beta}_{j,l_j}$ is as follows.

$$t_{j,l_j} = \frac{\hat{\beta}_{j,l_j}}{s\left(\hat{\beta}_{j,l_j}\right)} \text{ dengan } j = 1,2,\dots,k \text{ dan } l_j = 0,1,2,\dots,q_j \tag{15}$$

$H_0: \hat{\beta}_{j,l_j} = 0$ (There is no effect of the j, l_j-th exogenous variable at a certain lag); $H_0: \hat{\beta}_{j,l_j} \neq 0$ (There is an effect of the j, l_j-th exogenous variable at a certain lag). With a significance level of α, the test criteria for the partial test (T) are explained, namely if obtained $\left|t_{j,l_j}\right| > t_{\frac{\alpha}{2};(T-\kappa)}$ or $P - value < \alpha$ then H_0 is as follows.

C. RESULT AND DISCUSSION

1. ARDL Prerequisite Test

a. Stationarity Test

Stationarity test is conducted to determine at what degree the data will be stationary. In this study, data stationarity was tested with a unit root test using the Augmented Dickey Fuller Test (ADF test).

Table 2. Augmented Dickey-Fuller (ADF) Stationarity Test Results

Variable	Unit Root	ADF t-Statistic	Critical Value 5%	Prob.	Description
Y	Level	-7.890439	-2.919952	0.0000	Stationarity
	1st Diff	-9.421208	-2.923780	0.0000	Stationarity
X_1	Level	-7.985023	-2.919952	0.0000	Stationarity
	1st Diff	-6.434518	-2.925169	0.0000	Stationarity
X_2	Level	-1.912302	-2.919952	0.3242	Non-Stationarity
	1st Diff	-6.758511	-2.921175	0.0000	Stationarity
X_3	Level	-1.698425	-2.919952	0.4260	Non-Stationarity
	1st Diff	-7.828963	-2.921175	0.0000	Stationarity
X_4	Level	0.033833	-2.919952	0.9571	Non-Stationarity
	1st Diff	-7.086700	-2.921175	0.0000	Stationarity

Based on Table 2 from the results of unit root testing which explains that all variables, namely Economic Growth, Inflation, CPI, Export Value, and GRDP are stationary at the first difference level with a significance level smaller than the confidence level. Variables become stationary after first differencing as this process removes any long-run trends, shocks, or patterns, thereby producing data suitable for econometric analysis and preventing biased estimates. The stationary test is a prerequisite of the cointegration test, ensuring the variables have the same level of integration I(1). If the variables are not stationary in levels but stationary in first differences, a cointegration test is performed to evaluate the long-run relationship between the variables.

b. Cointegration Test

Cointegration tests are used to identify the long-run relationship between two or more non-stationary variables in a regression model. If such a relationship exists, the ARDL model can be used for analysis and prediction (Laloan et al., 2023).

1) Johansen Cointegration Test

Johansen cointegration test is conducted to ensure that the suitable model is ARDL. If the exogenous variables and endogenous variables are stationary and there is no initial cointegration, then the suitable model is ARDL. The results of the Johansen cointegration test are presented in Table 3.

Table 3. Johansen Cointegration Test

Hypothesized	***Trace Statistic***	**0.05 *Critical Value***	***P-value***
None	73.95286	69.81889	0.0225
At most 1	38.63104	47.85613	0.2752
At most 2	17.32554	29.79707	0.6160
At most 3	6.672955	15.49471	0.6159
At most 4	0.737955	3.841465	0.3903

Based on Table 3. it can be seen that there is no initial cointegration because the $p-value$ is greater than 0.05. Thus, it can be further analyzed using the ARDL method.

2) Bound Test Cointegration Test

ARDL Bound Test Cointegration is conducted to determine whether there is a long-term equilibrium relationship in this study. The results of the Bound Test cointegration test are shown in Table 4. with a significance level of 5%.

Table 4. Bound Test Cointegration Test

F-statistic	***k***	**Actual sample size**	**Finite Sample: n=45**	
			I(0)	**I(1)**
6.435009	4	48	2.85	3.905

Based on the cointegration test results with the Bound Test Cointegration Test method, the $F-statistic$ value is 6.435009. This value is greater when compared to the upper bound value at the 5% significance level of 3.905. Thus, it can be concluded that the exogenous variables have a long-term relationship to economic growth.

c. Optimum Lag Test

In this study, the optimum lag test was conducted using the Akaike Information Criteria (AIC) approach, where the optimum lag selection was determined from the AIC value. Based on the results of the analysis, it can be seen that the optimum lag test produces the best model with the smallest AIC value, namely the ARDL (3, 3, 4, 3, 4) model with an AIC value of 1.698525. This indicates that the economic growth variable has 3 lags, the inflation variable has 3 lags, the consumer price index variable has 4 lags, the export value variable has 3 lags, and the GRDP variable has 4 lags.

2. Classical Assumption Test

The fulfillment of classical assumptions ensures that the ARDL model provides unbiased and efficient estimates. This increases the validity of the results obtained for both long-run and short-run relationships so that a valid model is easier to interpret and provides a more accurate picture of the dynamics of the data.

a. Autocorrelation Test

In this test, the Breush-Godfrey LM Test is used with the following test results. Based on the analysis results, the chi-square probability value is 0.5033 which is greater than $\alpha = 5\% \ (0.05)$. So it can be concluded that there is no autocorrelation in this study and fulfills the assumptions of the ARDL model.

b. Normality Test

Based on the Jarque-Bera test, the following results were obtained.

Table 7. Jarque-Bera Normality Test

	Sig.
Jarque-Bera	1.230305
P-value	0.540558

Based on Table 7 obtained a probability value of 0.540558 which is greater than $\alpha = 5\% \ (0.05)$. So it gives the conclusion that the resulting residuals follow a normal distribution. So in this case the normality assumption is fulfilled.

c. Heteroscedasticity Test

Testing heteroscedasticity in this study using the Breusch-Pagan-Godfrey test with the following research results.

Table 8. Breusch-Pagan-Godfrey Heteroscedasticity Test

	Sig.
Prob. chi-square	0.2853
Prob. chi-square	0.9993

Based on Table 8. obtained Chi-Square probability value greater than $\alpha = 5\% \ (0.05)$ so it can be said that there is no heteroscedasticity problem and fulfills the assumptions of the ARDL model.

3. Modeling and Hypothesis Testing

a. Determination Test (R^2)

Based on the results of the analysis, the R^2 value is 0.966705, which means that 96.67 percent of the variation in the economic growth variable can be explained by the lag of endogenous variables and the lag of exogenous variables, namely inflation, consumer price index, export value, and GRDP.

b. Simultaneous Test (F Test)

The overall F test results above show a $P - value$ of 0.000 smaller than 0.05 so that H_0 in the F test is rejected. This shows that the lag of endogenous variables and lag of exogenous variables, namely inflation, consumer price index, export value, and GRDP together have a significant influence on the economic growth of East Kalimantan Province.

c. Partial Test (T Test)

The variables in the ARDL (3, 3, 4, 3, 4) estimation model that are significant to the economic growth of East Kalimantan Province are presented in Table 9.

Table 9. ARDL Short-Term Estimation Results

Variable	Coefficient	Prob.	H_0	Description
Y_{t-3}	- 0.413566	0.0311	Reject	Significant
$X_{3,t-3}$	- 0.000612	0.0485	Reject	Significant
$X_{4,t}$	8.93E-07	0.0000	Reject	Significant
$X_{4,t-1}$	-8.09E-07	0.0000	Reject	Significant
$X_{4,t-4}$	- 3.99E-07	0.0315	Reject	Significant

From the results of the ARDL short-term estimation with significant variables, it can be seen that Y_{t-3} on the lag 3 economic growth variable or the economic growth variable in 3 quarters with the largest coefficient value of 0.413566, meaning that the economic growth factor in the previous 3 quarters is the dominant factor affecting economic growth.

Table 10. ARDL Long-Term Estimation Results

Variable	Coefficient	Prob.	H_0	Description
X_1	0.641935	0.0692	Fail to Reject	Non-Significant
X_2	0.007749	0.1106	Fail to Reject	Non-Significant
X_3	- 0.000286	0.0072	Reject	Significant
X_4	2.85E-08	0.0036	Reject	Significant
C	- 4.095924	0.0107	Reject	Significant

To be able to conduct an economic analysis of the effect of X_1, X_2, X_3, X_4 The effect of inflation, CPI, export value, and GRDP on economic growth is based on short-term and long-term relationships. From the results of the long-term ARDL estimation in Table 10, it can be seen that the variable X_3 and X_4 namely the value of exports and GRDP is a significant variable on economic growth in the long run. Based on the optimum lag selection results obtained, parameter estimation will be carried out with the model. Therefore, the general form of the estimation model obtained is as follows.

$$\begin{aligned} Y_t = {} & \alpha_0 + \alpha_1 t + \psi_1 Y_{t-1} + \psi_2 Y_{t-2} + \psi_3 Y_{t-3} + \beta_{10} X_{1t} + \beta_{11} X_{1,t-1} + \beta_{12} X_{1,t-2} + \beta_{13} X_{1,t-3} + \\ & \beta_{20} X_{2t} + \beta_{21} X_{2,t-1} + \beta_{22} X_{2,t-2} + \beta_{23} X_{2,t-3} + \beta_{24} X_{2,t-4} + \beta_{30} X_{3t} + \beta_{31} X_{3,t-1} + \\ & \beta_{32} X_{3,t-2} + \beta_{33} X_{3,t-3} + \beta_{40} X_{4t} + \beta_{41} X_{4,t-1} + \beta_{42} X_{4,t-2} + \beta_{43} X_{4,t-3} + \beta_{44} X_{4,t-4} \end{aligned} \tag{16}$$

By entering the parameter coefficients for each variable contained in Table 10. into the equation above, the ARDL (3, 3, 4, 3, 4) estimation model used to predict the economic growth of East Kalimantan Province in the coming period is obtained as follows:

$$Y_t = -7.593583 - 0.118354\,Y_{t-1} - 0.322016\,Y_{t-2} - 0.413566\,Y_{t-3} + 0.218110\,X_{1,t-1} + 0.267177\,X_{1,t-2} + 0.180974\,X_{1,t-3} + 0.523846\,X_{2,t} - 0.002800\,X_{2,t-1} + 0.000182\,X_{2,t-2} + 0.005105\,X_{2,t-3} - 0.009895\,X_{2,t-4} + 0.021773\,X_{3,t} + 0.000290\,X_{3,t-1} - (6.23\times10^{-6})X_{3,t-2} - 0.000202\,X_{3,t-2} - 0.000612\,X_{3,t-3} + (8.93\times10^{-7}) + (8.93\times10^{-7})X_{4,t} + (8.09\times10^{-7})X_{4,t-1} + (2.77\times10^{-7})X_{4,t-2} + (9.10\times10^{-8})X_{4,t-3} - (3.99\times10^{-7})X_{4,t-4} \quad (17)$$

4. ARDL Stability Test

This study uses the structural stability test of the Cumulative Sum Recursive Residual (CUSUM) and CUSUM of Squares models. The stability test is used to determine parameter stability in the long term and short term. The model is considered stable if the blue line does not cross the red line. The results of the CUSUM test using economic growth variables as endogenous variables, as shown in Figure 1.

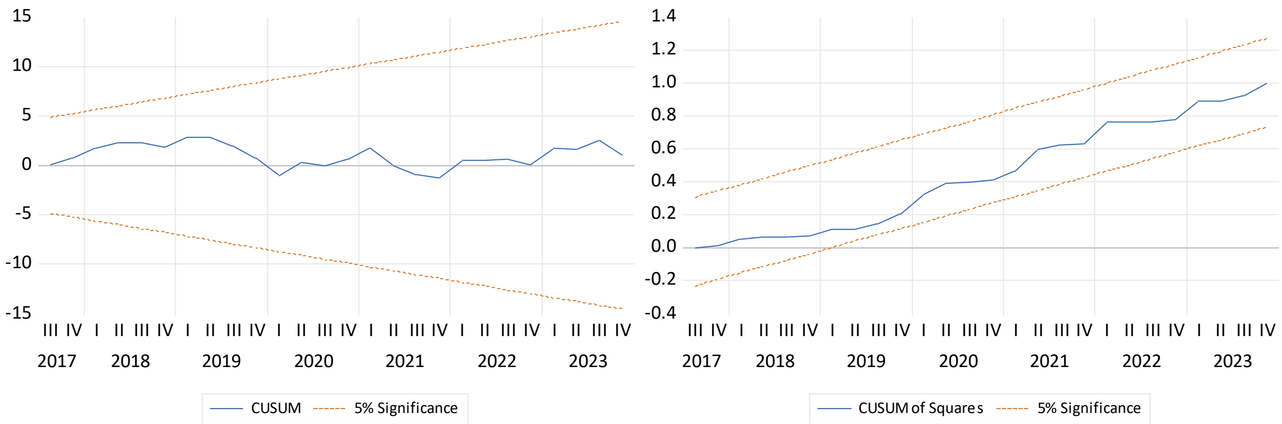

Figure 1. (a) CUSUM testing and (b) CUSUMQ testing

Based on Figure 1 the CUSUM and CUSUM of Squares test results show that the quantity plot (recursive residual) does not cross the boundary line at the significance level of $\alpha =$ 5% (0.05) and makes a linear line. The model stability test results explain that the regression coefficients are stable.

5. ARDL Model Interpretation and Discussion

Based on the results of hypothesis testing and a series of classical tests that have been carried out, the estimated model obtained meets the requirements and test assumptions so that the model obtained in the study is valid. As for the ARDL model (3, 3, 4, 3, 4) obtained by the Autoregressive Distributed Lag (ARDL) method in equation (17) and partial tests in Table 9. which have been carried out in the study, it can be interpreted that the Economic Growth variable with lag 3 (Y_{t-3}) has a significant and negative effect on economic growth. The value of -0.413566 indicates that if economic growth in the previous three quarters increases by 1%, current economic growth will decrease by 0.413566. Export Value variable with lag 3 $(X_{3,t-3})$ has a significant and negative effect on economic growth. The value of -0.0006 indicates that if exports in the previous three quarters increase by 1%, economic growth decreases by 0.0006. GRDP variable at the time of prediction $(X_{4,t})$ significant and positive effect on economic growth. The value of 8.93×10^{-7} means that a 1% increase in GRDP will increase economic growth by 8.93×10^{-7}. GRDP variable with lag 1 $(X_{4,t-1})$ significant and negative effect on economic growth. The value of -8.09×10^{-7} indicates that a 1% increase in GRDP in the previous quarter will reduce economic growth by 8.09×10^{-7}. GRDP variable with lag 4 $(X_{4,t-4})$ has a significant and negative effect on economic growth. The value of -3.99×10^{-7} indicates that a 1% increase in GRDP in the previous four quarters reduces economic growth by 3.99×10^{-7}.

Economic growth has a significant short-term effect on the previous 3 quarters because in the fourth quarter of 2020 it has decreased due to the implementation of policies related to tackling the spread of Covid-19 such as social restrictions so that it can reduce economic activity in East Kalimantan Province. As a result of Covid-19, it also affected GRDP in the previous 1 quarter, as evidenced in the first quarter of 2021 there was a decrease in economic growth (q-q) of 0.61%. The Covid-19 pandemic has had a major impact on the Indonesian economy, causing significant disruptions to people's welfare. Indonesia's economy contracted significantly, with GDP growth recorded at -5.3% YoY in the second quarter of 2020, for the first time since the Asian financial crisis. This economic downturn affected households, MSMEs, corporations, and the financial sector, posing the threat of unemployment, poverty, and rising uncollectible debt (Ministry of Finance, 2021). In addition to Covid-19, there is also the impact of a decrease in economic growth, namely GRDP in the previous 4 quarters to Quarter I-2022, which is influenced by a decrease in the size of the GRDP component by expenditure due to the import component of goods and services which amounted to 13.98% when compared to Quarter IV-2021. However, economic growth had an upward impact on GRDP when predictions related to an increase in the fourth quarter of 2023 from the first quarter of 2024 by 0.16%. This increase is supported by the government's readiness to design the development of IKN based on GRDP growth parameters. The short-term effect related to economic growth in East Kalimantan is stated that the value of exports in the previous 3 quarters, namely in Quarter I-2019, has decreased due to a decrease in export transactions in both oil and gas and non-oil and gas commodities.

Economic growth has a significant effect on exports in the long run (Astuti & Ayuningtyas, 2018). This is in line with the increase in exports that support the development of IKN through long-term investment, infrastructure improvement, and the development of education, technology, and research. In the long run, GRDP serves as an indicator of a country's or region's economic growth as evidenced by the stability of the increase in GRDP, as it reflects an increase in productivity, investment, and people's income. The development of projects such as IKN can accelerate the increase in GRDP and expand economic growth to more equitable areas.

With the relocation of the capital city to IKN, the impact of the first phase of development for East Kalimantan has been seen in the increase in economic activity. The region's economic growth continues to experience impressive growth, especially since the fourth quarter of 2022. Based on Sakernas August 2023, there were 1.85 million people working in East Kalimantan, an increase of around 100.37 thousand people compared to August 2022 (Central Bureau of Statistics of East Kalimantan Province, 2023a). The ongoing IKN infrastructure development project has caused many workers to be absorbed in the construction sector. It is noted that the percentage of labor in the construction sector has increased so that it can reduce the unemployment rate (Central Bureau of Statistics of East Kalimantan Province, 2023b).

D. CONCLUSION AND SUGGESTIONS

Based on the analysis that has been done, an Autoregressive Distributed Lag model is obtained which has a long-term and short-term relationship with the ARDL (3, 3, 4, 3, 4) model based on the results of the optimum lag selection which has the smallest AIC value of 1.70 with the economic growth variable consisting of 3 lags, the inflation variable consisting of 3 lags, the CPI variable consisting of 4 lags, the export value variable consisting of 3 lags, and the GRDP variable consisting of 4 lags. The Autoregressive Distributed Lag approach is suitable for knowing the factors that affect economic growth in East Kalimantan Province. The relocation of the capital city is expected to attract substantial investment in the infrastructure, property and services sectors. This increased investment is expected to boost economic growth, both in the short term through development projects, and in the long term through the development of more sustainable economic sectors.

Suggestions that can be given by researchers in increasing the economic growth of IKN, determining and selecting leading export commodities in East Kalimantan Province, such as mining commodities, has an important role in increasing the amount of export value. And further research can be conducted on monthly or annual data. If focusing on short-term dynamics and more detail, monthly data can be used. However, if interested in more stable macroeconomic trends, quarterly data is more appropriate. This selection also depends on the availability of data and the desired model stability in the ARDL analysis. In addition, the determination of variables that affect economic growth can also be related to labor.

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