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by Danang Dwi Gusti

Representation of Economic Growth in Cambodia with The ARDL Approach

Abstract

This study tries to find out how the long-term and short-term relationship between several variables related to economic growth such as CO2 emissions, internet literacy, and education in Cambodia. We use the World Bank as a supplementary source for statistics data, namely data from 2000 to 2020. We learn from our estimating findings that the elements we predicted, including economic development and internet literacy, have both long- and short-term associations, as well as economic growth and education, which in the short term internet literacy has a significant positive effect on economic growth. In line with that, the level of education also has a significant positive effect on economic growth. In contrast to the statistically significant inverse association between the economic growth variable for this year and the economic growth for the prior year, there is also a relationship between co2 emissions and economic growth. This shows that increasing internet literacy, in the short and long term will also increase economic growth, as well as education levels. In contrast, CO2 emissions have an inverse correlation with the gross domestic product which represents economic growth in Cambodia.

Background

Long-term economic issues include economic growth, economic growth is an important phenomenon been in the spotlight lately because of the pandemic. Economic growth may be seen as a long-term process of increasing production per person (Astuti & Prabowo, 2021). There are several problems that often occur in various countries related to the economy, namely the low growth rate which often occurs in developing countries, which results in people's welfare and economic success is not easy to achieve. Economic growth is a long-term economic problem and always occurs in every country (Widarni & Bawono, 2022).

Economic development to increase economic growth is closely related to the exploitation of natural resources and the environment (Li, Song, Cai, Bian, & Mohammed, 2022). Continued exploitation of the environment and nature without regard to environmental conditions can cause damage to the environment. Climate change brought on by greenhouse gas emissions is one of the repercussions of environmental harm (Khezri, Heshmati, & Khodaei, 2022). The greenhouse gas effect itself comes from CO2, N2O, and CH4 emissions. CO2 emissions are the largest gas in increasing the effect of greenhouse gases which in turn can cause climate change (Jeon, 2022; Le, 2022).

Energy is a crucial component of everyday life and manufacturing, as well as one of the key inputs for economic growth. A region's policy on energy usage is directly influenced by the interaction between the two (Wang, 2022). Understanding the causal relationship between economic development and energy demand is essential to understanding energy economics. In the near and mid-term, economic growth and energy use are causally related in a unidirectional nonlinear manner. There is no nonlinear causal link between them, nevertheless, over the long term (Kim & Park, 2022).

Economic issues common to developing nations include high inflation rates and sluggish economic development (Doan Van, 2019). Inflation is a key economic indicator, In order to prevent macroeconomic illnesses that may later have an influence on economic instability, it is always aimed for growth rates to be modest and stable (Sequeira, 2022). Both the good and bad effects of inflation may be seen in the economy. The central bank of a nation can implement an expansionary monetary policy by cutting interest rates if the economy is weak. A nation's degree of poverty increases as a result

of persistently rising costs for goods and services caused by high and unstable inflation, which is a reflection of economic instability (Wang, et al., 2022). People who could previously satisfy their daily necessities with high costs of products and services are no longer able to do so due to the increasing inflation rate, which leads to poverty and year-to-year fluctuates in Indonesia's inflation rate (Mandeya & Ho, 2021).

According to Widarni et al. (2022) stated that economic growth has a relationship with internet users. Where there is a long-term and positive correlation between internet usage and Indonesia's economic growth. This is because internet users can accelerate the dissemination of ideas and information as well as encourage competition and the development of new products, processes, and business models, thereby increasing economic growth. This study tries to find out how the long-term and short-term relationship between several variables related to economic growth such as CO2 emissions, internet literacy, and education in Cambodia.

Methodology

We use the World Bank as a supplementary source for statistics data, namely data from 2000 to 2020, the following variables will be analyzed using two different time series models. In this study, economic growth is measured using the nation's GDP. CO2 emissions (COE), internet literacy (IL), and education are independent variables of this study because they serve as indicators of how these three variables are related in the long and short term with gross domestic product as the dependent variable. We use the following econometric model:

$$GDP_t = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 GDP_{t-2} + \beta_3 GDP_{t-3} + \beta_5 GDP_{t-4} + \beta_6 COE_t + \beta_7 E_t + \beta_8 E_{t-1} + \beta_9 E_{t-2} + \beta_{10} IL_t + e_t$$

Where the Gross domestic product is GDP, CO2 emissions is COE internet literacy is IL, and education is E, the error term is e, and time series is t.

In this study, dynamic ARDL was applied. According to Pata & Caglar (2021) when the independent variables experience a shock, the ARDL model may be used to study, simulate, and predict it. If there is a cointegration relationship between research variables, ARDL simulation models may be used.

Result and Discussion

Table 1 displays descriptive data based on the study's variables.

Table 1. Descriptive statistics

	COE	E	IL	GDP
Mean	85.09660	7.797637	11.18453	7.087714
Median	89.84346	7.778628	2.180000	7.106071
Maximum	105.1484	13.40924	37.16271	13.25009
Minimum	57.81394	3.008480	0.076956	-3.096007
Std. Dev.	16.65783	3.423172	14.70313	3.477348
Skewness	-0.435149	0.159160	0.894928	-1.345680
Kurtosis	1.639843	1.748237	2.026658	5.682919
Jarque-Bera	2.172870	1.390198	3.459147	12.03456
Probability	0.337417	0.499025	0.177360	0.002436

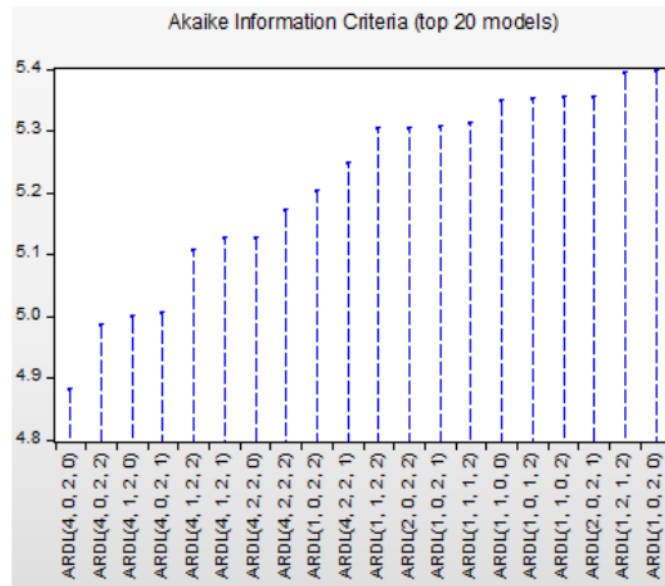|				
Sum	1701.932	155.9527	223.6907	141.7543
Sum Sq. Dev.	5272.183	222.6440	4107.459	229.7470
Observations	20	20	20	20

The results of descriptive statistics are expressed in terms of mean, min, max, and Std Dev. COE Mean 85.09, COE Min 57.81, COE Max 105.14, COE Std Dev 16.65. E Mean 7.79, E Min 3.008, E Max 13.40, E Std Dev 3.42, and so on. A stationary test should be done before utilizing the ARDL model to predict the value. By analyzing the error component, which includes any chance of autocorrelation if the series is not stationary, Augmented Dickey-Fuller (ADF) may determine whether the series is not stationary. The following are the outcomes:

Table 2. Unit Root Test on GDP, COE, E, and IL data

Variable	Unit Root	ADF Test stat.	Signif.	Description
Gross domestic product (GDP)	Level	-1.431593	0.5451	
	First Diff	-3.051408	0.0490	Stationer
CO2 emissions (COE)	Level	0.033579	0.9508	
	First Diff	-3.034884	0.0505	
	Second Diff	-4.415588	0.0035	Stationer
Education (E)	Level	0.540472	0.9829	
	First Diff	-4.939256	0.0013	Stationer
internet literacy (IL)	Level	0.833494	0.9918	
	First Diff	1.193030	0.9960	
	Second Diff	-4.128032	0.0080	Stationer

From the table above, it can be concluded that GDP and E data are stationary in the first difference data, while COE and IL data are stationary in the second difference. Since all the data are stationary, we can continue with the ARDL estimation.

Picture 1. Optimum Lag Test

Akaike Information Criteria (top 20 models)

Optimal lag testing is performed to determine which lag is appropriate for use in the next test; as shown in the picture above, 4,0,2,0 lag is the most recommended.

Tabel 3. ARDL bounds test

Stat. Test	Value	Signif.	I(0)	I(1)
F-stat.	4.053852	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Asympotic : n=1000

According to Table 4's results of the ARDL model's Limit test, the model's F-statistical value of 4.053852 is more than the upper limit value at the 5 percent level and even greater than the upper limit value at the 2.5 percent level. This demonstrates that the four variables examined in this study, namely CO_2 emissions, internet literacy, education, and gross domestic product are cointegrated across time, or the four variables move in the same direction.

Tabel 4. ARDL analysis results

	Coef.	Std. Error	t-Stat.	Prob.*
GDP(-1)	0.576305	0.340312	1.693463	0.1413
GDP(-2)	-0.626683	0.352870	-1.775959	0.1261
GDP(-3)	-0.310914	0.360225	-0.863110	0.4212
GDP(-4)	-0.853502	0.353953	-2.411341	0.0525
COE	-0.175168	0.200467	-0.873797	0.4158
E	-0.852776	0.594821	-1.433668	0.2017
E(-1)	0.060402	0.621876	0.097129	0.9258
E(-2)	-2.434771	0.732929	-3.321974	0.0160
IL	0.253369	0.144578	1.752474	0.1302
C	52.30667	28.57279	1.830646	0.1169

R-squared	0.834955 Adjusted R-squared	0.587387

The R-squared and R-squared values of the adjusted ARDL models varied between 0.83 and 0.58. The R-squared value of 0.83 implies that each of the independent variables in the ARDL model, namely CO_2 emissions, internet literacy, and education, can explain 83 percent of the variation in the dependent variable of gross domestic product. This shows that the research model is good enough to be researched.

Judging from the ARDL estimation results, the variable E(-1) has a coefficient value of 0.060 which indicates that the education factor is a factor that affects the gross domestic product which represents economic growth. For example, when the level of education in the previous year increased by 1% it would result in an increase in the economic growth of 6 percent today. However, the COE variable has a coefficient value of -0.175 which indicates that when the current level of CO_2 emissions increases by 1 percent, it will cause a decrease in the gross domestic product by 17.5 percent. This shows that when the level of education increases, it will give a positive sentiment towards a gross domestic product which in turn will encourage economic growth in Cambodia, this is also in line with other variables such as internet literacy where when there is an increase, it will also make a positive contribution. to gross domestic product.

Table 5. analysis results in the long term and short term

	Coef.	Std. Error	t-Stat.	Prob.
C	52.30667	28.57279	1.830646	0.1169
GDP(-1)*	-2.214794	0.702737	-3.151670	0.0198
COE**	-0.175168	0.200467	-0.873797	0.4158
E(-1)	-3.227145	1.238047	-2.606641	0.0403
IL**	0.253369	0.144578	1.752474	0.1302
D(GDP(-1))	1.791099	0.618649	2.895178	0.0275
D(GDP(-2))	1.164415	0.485436	2.398699	0.0534
D(GDP(-3))	0.853502	0.353953	2.411341	0.0525
D(E)	-0.852776	0.594821	-1.433668	0.2017
D(E(-1))	2.434771	0.732929	3.321974	0.0160

From the table above, the relationship between the variable GDP and GDP(-1) is significantly negative, as well as the variable E(-1) which is also significantly negative, meaning that in Cambodia in the short term the gross domestic product of the previous year and the previous year's education variable had an effect significant but inversely proportional to the flow of economic growth. In contrast to the significant positive relationship between the GDP and IL variables, this shows that the results of this analysis strengthen the ARDL estimation in Table 4 which also explains that in the short and long term the internet literacy variable has a favorable and substantial impact on the gross domestic product in Cambodia. However, the CO_2 emission variable has a significant negative effect on Cambodia's gross domestic product in the short term.

Conclusion

We discover that the estimated factors, such as economic growth and internet literacy, have both long- and short-term associations, as well as economic growth and education, which in the short term internet literacy has a significant positive effect on economic growth. In line with that, the level of education also has a significant positive effect on economic growth. In contrast to the statistically significant

inverse association between the economic growth variable for this year and the economic growth for the prior year, there is also a relationship between co2 emissions and economic growth. This shows that increasing internet literacy, in the short and long term will also increase economic growth, as well as education levels. In contrast, CO2 emissions have an inverse correlation with the gross domestic product which represents economic growth in Cambodia.

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