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Environmental Kuznets Curve for CO2 Emission in Cambodia: A Time Series Analysis

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Abstract: This study investigates the dynamic impacts of GDP, square value of GDP, population growth and education on CO2 emission using econometric approaches for Cambodia. Empirical results from Johansen cointegration testing approach shows that over the period of 1986 to 2022, the results seem not to support the environmental Kuznets curve (EKC) both in long run and short run. The results also demonstrate that both population growth and square value of income has long and short-term positive impacts with per capita carbon emission, but education and income have the negative impact on CO2 emission. Consequently, the findings from the granger causality tests suggest that in the short run education plays an essential role in reducing carbon emission whereas population growth does not contribute to the reduction in emission in Cambodia. In the light of empirical result, this paper provides policy implication in order to keep both income growth and environment intact. Hence, a significant focus on investment in education could contribute to reduce the emission and sustain the long run economic growth in Cambodia.

Keywords: *Cointegration, Economic growth, CO2 Emission, EKC, Cambodia*

1. Introduction

Undoubtedly, the world has changed radically since 1987 in terms of socially, economically, and environmentally. The global economy has expanded and now characterized as a globalization, as GDP per capita has increased from US$5927 in 1987 to US$ 8162 in 2004 [1]. However, environmental degradation has been undermining developments and threatens future development progress. Besides, it has also induced that environmental degradation gains recognition as a fundamental challenge to the whole economic growth process. [2] estimated that by 2030 the emission from developing countries will be seventy-two percent higher than OECD countries. Now, the prevalence of such problems is higher in countries such as Cambodia where economic development and environmental quality are instantaneously significant.

Yet, in Cambodia agriculture remains predominant for economic development where it contributes nearly 40 percent of the national GDP. Cambodia is an agrarian nation that largely depends upon the natural resources for food and income [3]. Evidently, in Cambodia, a mild slowdown in industry and services was mitigated by a slight pickup in agriculture. Therefore, reviving agriculture is critical to sustaining rapid growth and poverty reduction [3]. Although the economy is improving, the country is still struggling

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with environmental issues of climate change, water resources, agriculture and land degradation. In this regard, Cambodia has been facing some environmental and development challenges. These could be the major threat and problem for economic development if it is not well managed. In Cambodia context, this point relates to a series of environmental challenges which require urgent attention.

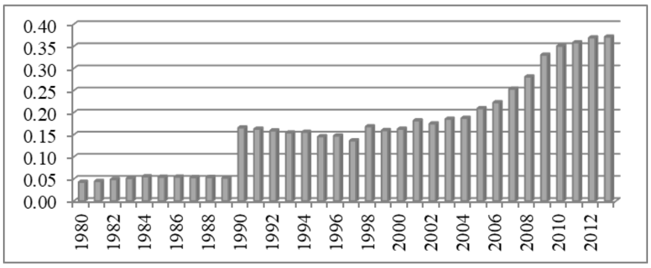

Figure 1: The CO_2 emission per capita for Cambodia
Sources: [4]

According to the environmental performance index, Cambodia ranked 162 out of 178 countries for the air quality in 2014. Where Cambodia is facing a growing air pollution challenge and the pollution trend shows that CO_2 emission is increasing. Faithfully, by 1980 the carbon dioxide (CO_2) emission was estimated to have grown to 0.37 metric tons per capita with an increase of 7.68 percent over a thirty-three-year period. These growth rates of the CO_2 emissions due to the increased contribution of coal to Cambodia's primary energy mix. Besides that, royal government of Cambodia has underlined that the annual electricity demand has risen around 16.3 percent from 2002 to 2011. Whereby, the carbon dioxide emission from energy consumption has amounted to four million metric tons per capita. Hence, disproportionately Cambodia is suffering from the impacts of emission, and it is predicted that the larger part of the responsibility to reduce carbon emission will be transferred to developing economies of Cambodia.

Theoretically, the relationship between economic development and environmental degradation is hypothesized by environmental Kuznets curve (EKC) which potentially illustrated to the inverted U-shaped relation. Based on EKC, at the early stage of economic development the environmental degradation increased but after passing a threshold point the environmental quality started to improve [5]. Arguably, EKC has received extensive empirical treatments by [6], [7] and [8] to verify the presence as well as the threshold point of the curve. Their findings clearly pointed out that the EKC hypothesis does exist in both the short and long run. However, there can be a point of argument that there is an increasing relationship between environmental problems and economic growth emerging in developing economies. This postulated that the EKC hypothesis does not exist and implies that environmental problems may persist even with economic development. If this is true, the natural enquiry to the problem of the environment is whether the EKC exists in Cambodia? Thus, in the present paper, we make further attempt to contribute to this line of enquiry. In the analysis, we focus tends to analyze the existence of EKC in Cambodia. Cambodia is chosen for two reasons. Firstly, Cambodia has ranked among the world least developed countries and severely affected by global climate change. Secondly, studies on individual countries may provide better framework than the panel or cross-sectional analysis and empirically no study is available for Cambodia.

The organization structure of the paper is as follows: section 2 discovers the literature reviews; section 3 provides data sources and model specification for this study; section 4 discusses the empirical findings and interpretations, and section 5 concludes with a summary of the main findings and policy implications.

2. Literature Review

The first strand of the literature review examines the economic growth- environmental degradation nexus. A number of empirical studies investigated the relationship between environmental pollution and economic growth for a developing and developed countries such as North America, Western Europe, Eastern Europe [8]; transition economics [9]; and BRIC countries [10]. Most of these studies focus on testing the validity of the EKC hypothesis and assume that income and the squared income have significant positive and negative impact on pollution. In an early stage of economic growth, pollution will rise with income until the turning point and then increase in income contributed to the environmental improvement. However, some review also focused this linkage on a single country for example, China [11]; Malaysia [12] and Pakistan [13].

Overall, these studies noticed that EKC curves are valid in these countries as the value of coefficient *GDP* and squared *GDP* have significant positive and negative impact on an emission respectively. Whereas the relationship between economic growth and environment degradation may appear in U- shaped curve [14], N-shaped [15] and monotonic shapes [16].

The second strand of studies that examine the relationship between economic growth and environmental degradation has focused on population growth. Population growth has been often conjectured to have a negative effect on the environmental quality. It is emphasized that higher population growth as well as population densities lead to unsustainable exploitation of environmental resources [17, 18]. They claimed that population growth has an impact on the environmental quality through the consumption of natural resources and production of resources. Many [19; 20; 21; 22] believe that population pressure may result in increased demand for forest product and land uses and that causes environmental degradation. Recently, a study by [23] hypothesized that an increase in population will lead to increase environmental degradation of deforestation in Latin America, African and Asian countries.

Finally, the debate over the relationship between education and environmental degradation has been a topic of interest in the research community and they are related to creating awareness among resource users. Awareness can play a vital role in ensuring participation of mass people to safeguard the environment and to continue sustainable and healthy as well as economic growth. [24] found that the long and short run estimates in Spain country indicate that there is a statistically significant negative association between education and environmental damages. Individuals' attitudes towards preventing environmental damage and formal and informal education were employed as a dependent and independent variable respectively. The results suggest that formal and informal education has a significant negative impact on individual's willingness to prevent environmental damages. [18], [25] and [11] supports that education is a learning process which facilitates enhancing people's awareness and knowledge about the environment. So, they have knowledge, skills, attitudes, and motivation to collectively work and solve the current environment damages efficiently. Therefore, it is imperative to educate the people about the functions of the environmental system as well as improve the environmental quality. However, there are studies that fail to provide expected findings which run counter to expectations since a higher level of education exacerbates the environmental conditions rather than improve it. They found education and environmental damages have a significantly positive relationship which indicates increasing education leads to greater environmental degradation. Overall, there seem to be sufficient amounts of evidence that shows education is statically significant variable. Thus, previous studies cited above represent the mixed result of significant which is positive and negative somewhat most of the research observed that ambiguous relationship between the environmental degradation and education.

According to the knowledge of the author, in Cambodia, no one has emphasized the dynamic impacts of economic growth, carbon dioxide emission and other variables. So, that is why in this study the principal purpose has been made to examine the importance of economic growth, population growth and education in determining the level of carbon emission for Cambodia. Also, another attempt has been made to examine the threshold point between economic growth and carbon dioxide emission for this estimation.

3. Methodology

The study used annual time series from 1986 to 2022 for Cambodia which was obtained from the world development indicator (WDI) dataset. The variables of interest included carbon dioxide emission (CO_2) metric tons per capita as a dependent variable and *GDP* per capita (*GDP)*, population growth (annual, percent) (*POP*) and education (Gross enrollment ratio, primary, both sexes, percent) (*EDU*) as explanatory variables. Hence, the rational for specifying the employed model and variables chosen is discussed as follows.

The empirical model of this study derives by the following standard EKC hypothesis, can be displayed at time *t* as follows:

$$CO2_t = f(Y_t, Y_t^2, POP_t, EDU_t)$$

(1)

In Eq. (1) *CO2* represents CO_2 emission per capita, *Y* is GDP per capita and Y^2 is *GDP* square per capita, *POP* is population growth and *EDU* is education. The above equation can be converted in to log linear equation as follows:

$$lnCO2_t = \alpha_{0+}\alpha_1 lnY_t + \alpha_2 lnY_t^2 + \alpha_3 lnPOP_t + \alpha_4 lnEDU_t + \varepsilon_t \quad (2)$$

Where *ln* is natural log of respective variables, $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ is the slope parameters to be estimated and ε_t is an error term of regression. In the analysis, we adopt a standard quadratic relation between CO_2 emission and income and incorporate population growth and education as a controlled variable. Accordingly, the focal parameters in the model are α_1 and α_2. The presence of the EKC is verified by α_1 being significantly positive and α_2 is significantly negative. Hence, based on Eq. (1) the turning point (in natural logarithm) can be estimated as $-\alpha_1/2\alpha_2$.

Hence, this study employed maximum likelihood approach by [26] over other methods of residual-based approach by [27] and autoregressive distributor lag approach proposed by [28] The reason for selecting this method is it's having attractive features which avoid the spurious regression. The Johansen method of cointegration is applicable on same order integration which helps to estimate coefficients in long run and avoid the problem of non-stationarity of data [5]. When the procedure of estimating the long run relationship is completed, the next step is to proceed with the estimation of vector error correction method (VECM) in order to evaluate short run estimates. So, in VECM, the number of the equation is equal to the number of variables as each variable is endogenous in form [5]. The equation can be written as:

$$\Delta lnCO2_t = \alpha_1 + \sum_{k=1}^{n} \alpha_{1k}\Delta lnCO2_{t-k} + \sum_{k=1}^{n} \alpha_{1k}\Delta lnY_{t-k} + \sum_{k=1}^{n} \alpha_{1k}\Delta(lnY_{t-k})^2 + \sum_{k=1}^{n} \alpha_{1k}\Delta lnPOP_{t-k} + \sum_{k=1}^{n} \alpha_{1k}\Delta lnEDU_{t-k} + \lambda_1 EC_{t-1} + u_{1t} \quad (3)$$

$$\Delta lnY_t = \alpha_2 + \sum_{k=1}^{n} \alpha_{2k}\Delta lnCO2_{t-k} + \sum_{k=1}^{n} \alpha_{2k}\Delta lnY_{t-k} + \sum_{k=1}^{n} \alpha_{2k}\Delta(lnY_{t-k})^2 + \sum_{k=1}^{n} \alpha_{2k}\Delta lnPOP_{t-k} + \sum_{k=1}^{n} \alpha_{2k}\Delta lnEDU_{t-k} + \lambda_2 EC_{t-1} + u_{2t} \quad (4)$$

$$\Delta lnY^2{}_t = \alpha_3 + \sum_{k=1}^{n} \alpha_{3k}\Delta lnCO2_{t-k} + \sum_{k=1}^{n} \alpha_{3k}\Delta lnY_{t-k} + \sum_{k=1}^{n} \alpha_{3k}\Delta(lnY_{t-k})^2 + \sum_{k=1}^{n} \alpha_{3k}\Delta lnPOP_{t-k} + \sum_{k=1}^{n} \alpha_{3k}\Delta lnEDU_{t-k} + \lambda_3 EC_{t-1} + u_{3t} \quad (5)$$

$$\Delta lnPOP_t = \alpha_4 + \sum_{k=1}^{n} \alpha_{4k}\Delta lnCO2_{t-k} + \sum_{k=1}^{n} \alpha_{4k}\Delta lnY_{t-k} + \sum_{k=1}^{n} \alpha_{4k}\Delta(lnY_{t-k})^2 + \sum_{k=1}^{n} \alpha_{4k}\Delta lnPOP_{t-k} + \sum_{k=1}^{n} \alpha_{4k}\Delta lnEDU_{t-k} + \lambda_4 EC_{t-1} + u_{4t} \quad (6)$$

$$\Delta lnEDU_t = \alpha_5 + \sum_{k=1}^{n} \alpha_{5k}\Delta lnCO2_{t-k} + \sum_{k=1}^{n} \alpha_{5k}\Delta lnY_{t-k} + \sum_{k=1}^{n} \alpha_{5k}\Delta(lnY_{t-k})^2 + \sum_{k=1}^{n} \alpha_{5k}\Delta lnPOP_{t-k} + \sum_{k=1}^{n} \alpha_{5k}\Delta lnEDU_{t-k} + \lambda_5 EC_{t-1} + u_{5t} \quad (7)$$

The EC_{t-1} is cointegrating vectors, u_{it} is error term and λ_{it} represents as an adjustment of disequilibrium over the time. Besides that, diagnostic tests such as serial correlation, functional form, normality and heteroscedasticity are performed to ensure the appropriate fit with the model. Finally, this study examines the causality among the variables and VECM identifies the direction of causality among the variables with the distinction of short-run and long-run causality. Accordingly, the F-test is conducted in the case of more than one lag for each variable and t-test is conducted to determine the coefficient's significance in error correction term for all five equations. In summary, the granger causality test is applied for joint significance of error correction terms.

4. Results and Discussion

Table 1: ADF & PP Unit Root Test Results – Level and 1st Difference

	ADF				PP			
	Level		First Difference		Level		First Difference	
Variables	*I*	*T&I*	*I*	*T&I*	*I*	*T&I*	*I*	*T&I*
lnCO2	-1.61	-2.61	-5.58***	-5.57***	-1.56	-2.62	-5.61***	-5.67***
lnY	2.47	0.22	-2.85*	-3.16*	2.01	-0.14	-2.77*	-3.10*
lnY^2	8.03	3.57	1.23**	-2.71**	7.91	3.51	-0.93***	-2.69**
lnPOP	-1.42	-2.82	-3.00**	-3.34*	-1.52	-1.64	-2.52***	-2.55**
lnEDU	-1.74	-2.22	-4.01***	-3.77**	-3.44	-4.28	-4.06***	-3.77**

Notes: Asterisks *, ** and *** denote significant at 10%, 5% and 1% critical values, respectively.

The regressions in the first difference are measured with the intercept (I) as well as the trend and intercept (T&I) term. Lag length selection is based on Schwarz Information Criterion (SIC).

Firstly, the unit roots tests are tested among the variables using ADF and PP which were proposed by [29] for these tests, the null hypothesis is that there is a unit root while the alternative hypothesis is that there is no unit root. Table 1 points out the order of integration and conclude that all the variables (CO_2, *Y*, Y^2, *POP and EDU*) are significant at first order of integration. On balance, the findings of Table 1 demonstrate that all of the series appears to contain a unit root in their level but are stationary in their first differences. As a summary, it indicating that they are integrated of order one *I(1)*. Subsequently, to examine the cointegration relationship, maximum likelihood approach by [30] and [26] was applied. Table 2 reports the result of

Johansen cointegration test. Hence, it identifies the long run relationship where maximum eigenvalue test is conducted for the null hypothesis $r_0 = 0$ with the alternative $r_0 > r$. whereby trace test under the null hypothesis of $r_0 \leq r$ with the alternative$r_0 > r$.

Table 2: Johansen Cointegration Test

Rank *r*	Trace Statistics	Maximum Eigenvalue
$r_0 = 0$	183.41**	124.47**
$r_0 < 1$	58.95	24.98
$r_0 < 2$	33.97	23.85
$r_0 < 3$	10.12	6.97
$r_0 < 4$	3.15	3.15

Notes: **Rejection of null hypothesis of none of equation(s) is cointegrated at 5 percent level

By proving the existence of long run cointegration among the variables, this study proceeds to estimate the long-run coefficients or elasticity of the respective variables on the CO_2 emissions per capita. Thus, Table 3 shows the result of the long run estimated based on Johansen cointegration test. The estimated long run coefficient of *lnY* was negative and statistically significant at five percent. It implies that initially, CO_2 emissions fell with a rise of income and consistent with [14]. Whereby the coefficient of the quadratic form of lnY^2 was positive and statistically significant, which identified an increase in GDP will increase CO_2 emission. This finding does not confirm the EKC in the Cambodia as the income has a negative sign and square income has the positive sign. Perhaps, given our sample, a U-shape EKC was existed instead of inverted U-shape in Cambodia. As the U-shape EKC hypothesis says that at the initial stage the rise in income level leads to falling in the emission but after certain tuning point income level affects carbon emission positively. Among others, our findings are in line with [31-32]. To shed further light on this, with respect to the EKC we stimulate turning point for the long run estimates are shown in Table 2. Based on the estimate model, the income turning point of per capita income turned out to be 1.074 percent compared to the highest value of 1.028 in our sample. Cambodia found that the EKC's reached this turning point outside the observed sample period and in line with [33] who found the turning point outside the sample period. In contrast, [34] and [35] indicated that the EKC's turning point within their observed sample period.

Table 3: Long-Run Estimates Based on Johansen Cointegration Test [DV=*lnCO2*]

Variable	Coefficient	*t-statistics*
CONS	-14.83	
lnY	- 0.64	-3.89**
lnY^2	4.51	10.84*
lnPOP	0.23	1.01**
lnEDU	-0.09	-0.60***

Note: Asterisks *, **, and*** denote significance at 10%, 5%, and 1% levels, respectively.

In terms of *lnPOP*, population growth shows positive sign and significant, which contribute to the environmental deterioration in Cambodia. Population growth has an essential impact on environmental degradation through the consumption of environmental resources and production of waste and emission. Note that, a few developing countries including Cambodia suffering from a rapid growth of population which in turn increases the pressure on the planet's natural resources and cause damages to the environment. Evidently, a report by [2] indicated that by 2030, the world economy is expected to nearly double and world population also grows from 6.5 billion to 8.2 billion people. Most of the growth in both income and population will be in the emerging economies of developing countries. Rising population and aspirations for better living standards will increase the pressure on the natural resources and threaten unsustainable use of natural resources and uncontrolled pollution in rapidly growing cities. Besides, the findings of positive effect on population growth and CO_2 emission are consistent with [5] who stated that the rising human population is the predominant factor that accelerating pollution and other resources problems in both developed and developing countries.

The coefficient of *lnEDU* (education) was found statistically significant which shows that education has an impact on the carbon emission negatively. Education is act as a controlled variable for pollution in Cambodia and consistent with [17] Higher education may be a prerequisite for a higher demand of a clean environment as well as create awareness among the resource users on the importance of sustainable use and protection of the environment. Our result suggests that education is essential to educate people about the functions of environmental resources and the consequences of excessive human interferences on the environment [36]. Education would affect the process of achieving sustainable development and improve the capacity to address environmental and development issues efficiently.

Table 4: Error Correction Model [DV=*lnCO2*]

Regressors	Coefficient	*t-statistics*	Prob.
ECM	-0.87	-2.74	0.01***
lnY(-1)	-1.99	-3.20	0.00***
$lnY^2(-1)$	4.44	3.71	0.00***
lnPOP(-1)	2.01	1.06	0.29
lnEDU(-1)	-0.46	-0.60	0.55**
CONS	0.144	2.93	0.00***

Note: Asterisks *, **, and*** denote significance at 10%, 5%, and 1% levels, respectively.

Like the long run relationship, the short run *lnY* led to an approximate 1.99 percent decrease while the lnY^2 led to 4.44 percent increase in CO_2 emission. One of the most important results emerges from the short run presented in

Table 4 is that these results show that EKC hypothesis does not hold in Cambodia. In addition, Table 4 reports that *lnPOP* does not foster CO_2 emission in the short run but *lnEDU* is more significant in reducing CO_2 emission. The coefficient of the equilibrium correction mechanism (ECM) was found to be statistically significant at one percent significance level and has the correct sign. The ECM implied that disequilibrium in the short run was adjusted by 87% per year towards the long run equilibrium. Finally, in the end, the diagnostic test was conducted for ECM model. The ECM model also passed several diagnostic tests (Table 5) with no serial correlation, heteroscedasticity problems of the model estimated in this study.

Table 5: Error Correction Model Diagnostic Tests

A: *Adjusted* R^2 = 0.79	B: *HET* =2.60 [0.12]
C: *Normality* = 3.58 [0.61]	D: *AR* = 22.58 [0.60]

Note: Figures in [ ] stand for p-value; A: *Adjusted* R^2; B: Heteroscedasticity *(HET)* test is based on ARCH Test; C: *Normality* test is based on *Jarque-Bera* test, D: Autocorrelation *(AR)* testis based on LM test

For robustness, the results of the short run and long run granger causality tests are reported in Table 6. Looking at the long run granger causality relationships, the error correction term reveals that CO_2 emission, income, square value of income, population and education are responding to deviations from long-run equilibrium given the statistical significance of their respective ECT. Overall, the speed of adjustment to disequilibrium is moderately high, ranging from 3 to 49 percent per year towards equilibrium. As expected, all the error correction terms were statistically significant with the expected sign of negative and indicates there is long run granger causality among the variables. Moreover, looking at the short run granger causality relationships, it is illustrated that all the variables in the model are endogenous on influences from other variables. Overall, there is unidirectional causality running from (a) CO_2 to *lnEDU*; and (b) *lnPOP* to *lnY* and lnY^2. Besides, there appears bi-directional causality effect between CO_2 and *lnY*, CO_2 and lnY^2, and *lnY* and lnY^2. Again, it is summarized that EKC hypothesis is not valid in the Cambodia economy.

Table 6: Granger Causality Tests

Dependent Variable	Short-run Granger Causality F-statistics [prob] Independent variables					Long-run Granger Causality
	$\Delta lnCO2$	ΔlnY	ΔlnY^2	$\Delta lnPOP$	$\Delta lnEDU$	ECT_{t-1} *(t-stat)*
$\Delta lnCO2$	-	11.36 [0.00]***	13.82 [0.00]***	3.95 [0.14]	1.25 [0.54]	-0.03(-0.53)**
ΔlnY	14.36 [0.00]***	-	32.58 [0.00]***	5.75 [0.06]*	0.58 [0.75]	-0.49(-1.83)*
ΔlnY^2	17.49 [0.00]***	39.47 [0.00]***	-	5.10 [0.08]*	0.81 [0.67]	-0.24(-2.34)**
$\Delta lnPOP$	1.33 [0.51]	0.33 [0.85]	0.83 [0.66]	-	1.63 [0.44]	-0.07(-1.74)*
$\Delta lnEDU$	-10.97 [0.00]***	1.51 [0.47]	1.27 [0.53]	1.51 [0.47]	-	-0.41(-3.63)***

Note: Asterisks *, **, and*** denote significance at 10%, 5%, and 1% levels, respectively. Figures in [ ] stand for p-value. ECT_{t-1} represents the error correction term lagged one period.

5. Conclusion

This paper investigated the EKC hypothesis for carbon dioxide emission in Cambodia with four major explanatory variables such as income, square income, population and education during the period 1986-2022. Cointegration analysis was conducted using the Johansen method as well as causality and stability tests. The results obtained confirm the existence of long run relations between income, square income, population, education and carbon emission both in long run and short run, whereas population found insignificant in short run. Based on time series analysis, a U-shaped relationship between carbon emission and income was found in both short and long run. As the negative and positive sign for income (*lnY and* lnY^2) respectively indicate that EKC hypothesis not valid for Cambodia. Despite the fact, these findings do not provide much information about the reasons behind observed u-shaped linkage between carbon emission and income. It indicated that a number of factors such as the introduction of cleaner production technology, environmental awareness and environmental policies should design and implement effectively in order to reduce environmental degradation in Cambodia. In addition, to complement the findings of cointegration analysis, causality tests were also performed to shed light on the causal links between the variables. The findings of the granger causality test illustrate the existence of bi-directional causality effect between carbon emission and income and square value of income and income and square value of income in the short run. Hence, it indicates that investment in pollution abatement and emission reduction policies will be a feasible policy tool for Cambodia. Besides that, there is unidirectional causality running from carbon emission to education, population to income and square value of income in the short run.

In nutshell, this paper is a timely effort to fill up the gap on income and carbon dioxide emission review for country Cambodia. Interestingly, we also find evidence suggesting rapid economic growth has led the country to face high energy consumption which in turn exposing environmental deterioration in Cambodia. Thus, the results suggest some important policy recommendations. Governments of Cambodia must promote strategies with the greater emphasis on environmental considerations which address global warming and climate change. In this regard, industrial and service sectors need the transformation of energy sources from fossil fuels to renewable energy sources and the use of more environmentally friendly technology. At the same time, efforts must be attained to encourage industries to adopt new technologies and energy efficiency to minimize emission in a country. Moreover, a significant focus on investment in education such as primary, secondary, and tertiary could contribute to reduce the emission and sustain the long run economic growth in Cambodia. Therefore, Cambodia needs to take effective steps as well as investigate the environmental implication of investment in pollution reduction strategies and appropriate forms of policy targeting aimed at achieving higher economic growth and sustainable environmental management.

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