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Article

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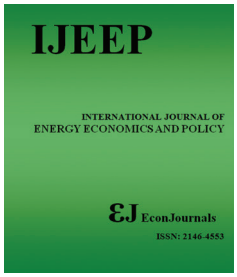

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Experimenting the Energy Economic Variables Regarding the Long-haul Consequences on Indonesia using Vector Error Correction Model

Mohd Haizam Mohd Saudi[1], Obsatar Sinaga[2], Djoko Roespinoedji[1], Arun Kumar Tarofder[3]*

[1]Widyatama University, Indonesia, [2]Padjadjaran University, Indonesia, [3]Faculty of Business Management and Professional Studies, Management and Science University, Malaysia. *Email: arun_kumar@msu.edu.my

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ABSTRACT

The Indonesian economy has recorded solid growth in the course of recent decades, and as of late, the firm pace of economic expansion has been joined by decreased yield instability and moderately stable inflation. As a sort of rare characteristic capital, energy makes increasingly more clear imperative consequences for economic growth (EG). Furthermore, energy consumption (EC) is the real wellspring of greenhouse gas emissions. This achieves the issues of the connections among energy economic variables, which is deserving of long-haul consideration between human capital (HC), EC, CO_2 emissions, and EG in Indonesia. As a close neighbour, Australia has long had critical exchange ties with Indonesia. The effect of various types of EC and HC on per capita GDP growth. The information utilized world development indicator has acquired from the World Bank database amid 1985-2017. The examination technique utilized vector error correction model. In this mainly three tests are conducted in order to know the relationship among variables which is unit root test, co-integration and temporal Granger causality the outcomes show that apportioning consumption energy and controlling carbon emissions, are probably going to have no antagonistic impact on the genuine GDP per capita. In the meantime, empirically, the development of HC has the effect on controlling CO_2 emissions and EC in Indonesia.

Keywords: Economic, Growth, Energy, Emission, Consumption, CO_2, Human capital, Vector Error Correction Model
JEL Classifications: Q55, Q50, O34

1. INTRODUCTION

The global pattern demonstrates that different nations have opposed in achieving economic growth (EG) selective of parallel watching a lift in CO_2 emissions. Then again, there has been rising apprehension over the system of "low carbon and green growth." In particular, the request of whether it genuinely is feasible to achieve steady EG excluding developing energy consumption (EC) or greenhouse gases has hovered into a subject of specific thought. Creating and underdeveloped nations have differed that a few limitations on carbon energy would thwart economic expansion and prescribed that mechanical nations should expand funds to alleviate a worldwide temperature alteration, which is broadly estimated because of emissions by modern nations. This issue is modestly associated with post-Kyoto exchanges over environmental change, and thusly, it is indispensable to watch the association between the environment and EG by utilizing empirical investigation instruments.

Energy is one of the real building squares of society, has turned into an essential piece of human life for pretty much every movement, and overruns all segments of society, for example, exchange, work, environment, global relations, nourishment, wellbeing, transportation, and so forth. Energy is fundamental for economic activities since all generation and consumption activities are straightforwardly identified with EC. The substitution of human power with energy through creative innovation on agribusiness, industry and services has by implication added to economic improvement.

The structure of Indonesia's export still relies on characteristic asset-based commodities alongside other creating nations as the primary fare goal nation. As indicated by the yearly information of world development indicator, amid the time of 2005-2014, the GDP of Indonesia at steady costs expanded by a normal of 5.7% every year. World Development Indicators (2016).

1.1. EG

Socioeconomic, human development and socio-political factors are firmly connected to economic development. Solid economic performance builds riches, particularly through delivered capital ventures, for example, those in framework, health, and advanced education (UNU-IHDP and UNEP 2014). The connection between economic development and the changing synthesis of riches after some time demonstrates that the offer of characteristic capital has declined, while that of delivered capital and immaterial capital has increased, after manufacturing and administration development (Jarvis et al. 2011; Mose, 2017; Muñoz, 2017). Regardless of this, current economic pathways are problematic for future ages since they are joined by the exhaustion of many regular assets and the disintegration of different environmental services, as reflected by the biological power of prosperity. Patterns of Economic growth in Indonesia presented in the Figure 1.

EC of household sector will keep on expanding in coming years, alongside expanding EG, economic activities, populace growth, and cost and accessibility of electronic goods (appliances) to be increasingly moderate by the network. Afterward, household EC is affected by different energy economic variables just as different elements.

1.2. Emissions of CO_2

Mirroring a worldwide wonder, many nations have attempted to accomplish EG without simultaneously seeing an expansion in CO_2 emissions. Notwithstanding, there has been growing worry over the technique for "low carbon and green growth." That is, the subject of whether it truly is conceivable to accomplish continued EG without expanding EC or greenhouse gases has turned into a theme of extraordinary intrigue. Creating and underdeveloped nations have contended that any limitation on carbon energy would block EG and proposed that created nations should raise funds to alleviate an Earth-wide temperature boost, which is generally viewed because of emissions by created nations. This issue is halfway identified with post-Kyoto arrangements over environmental change, and along these lines, it is essential to look at the connection between the environment and economic development through an empirical analysis. The CO_2 Emissions and global economic growth rate from 2000-2016 presented in the Figure 2.

1.3. Energy Use and CO_2 Mitigation

The residential sectors of the two nations assume a role in the economy growth and add to expanding CO_2 outflow. CO_2 emanation mitigation in the residential sector can be accomplished by energy productivity improvement and expanding of renewable energy use. Improved energy proficiency is a level-headed way to deal with lift EG and increment energy security and can make an important commitment to diminishing CO_2 emissions. The achievement of these plans can improve energy security and CO_2 emission decrease. It recognized four co-profits by the utilization of renewable energy, for example, advantages to the environment and atmosphere; improving energy get to, especially in rural areas; increment work openings, improve macroeconomic performance; and improving energy security, add to making an increasingly steady macroeconomic. In view of this data, the two nations have confronted comparable issues about mitigating CO_2 outflow by expanding petroleum product demand in the residential sector. Petroleum product use would firmly influence the dependability of future energy demand and CO_2 emanation in the residential sector. Consequently, this examination analyses energy funds and CO_2 mitigation of arrangement in the two nations. The trends of electricity consumption and CO_2 emission in Indonesia from 2006 to 2017 is presented in Figure 3.

1.4. Human Capital on EG

Human capital has a critical role in supporting the development of the Indonesian economy since human resources turn into

Figure 1: Economic growth of Indonesia

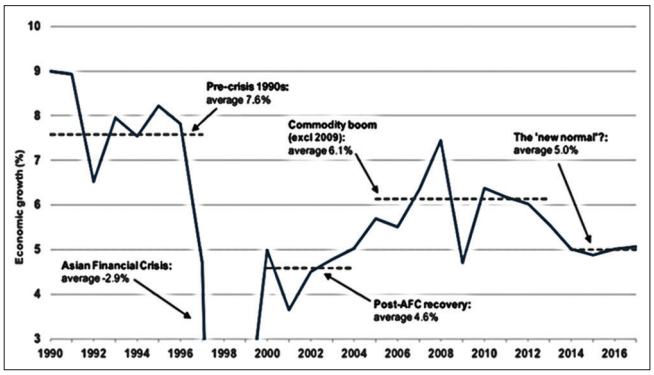


Figure 2: CO_2 emissions and global economic growth rates

Figure 3: Indonesia's electricity consumption

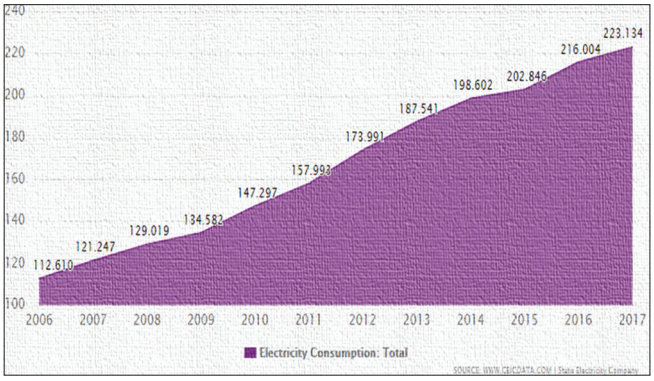


Figure 4: Outcomes of Johansen co-integration test (1)

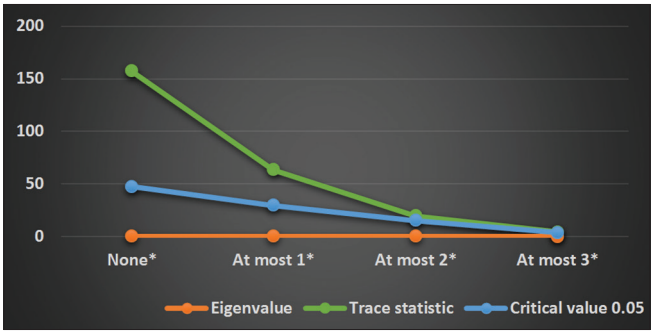
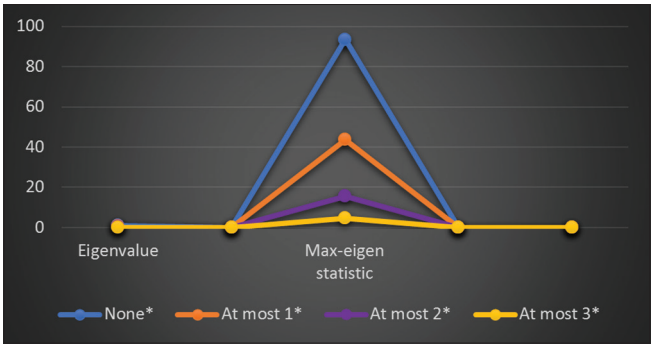


Figure 5: Outcomes of Johansen co-integration test (2)



the subject of development that has a focal role in managing resources claimed in Indonesia. Economy. In addition, economic development incorporates expanding EG, decreasing disparity pay distribution and destitution destruction, to deliver a progression of economic headways that are genuinely helpful and through a proficient procedure. We are along these lines in requirement for a method for assessing a human capital (HC) stock that incorporates both the subjective and quantitative development of aptitudes in the work drive and can be embedded in growth conditions. A large portion of the present intermediaries just incompletely complies with these requirements "Average long stretches of education" does not mirror the expansion in nature of HC either, which could prompt constant minor comes back to HC collection and, as a result, endogenous EG.

1.5. Vector Error Correction Model (VECM)

Modern econometricians call attention to a technique to build up the social model among economic variables non-structural. They are vector autoregressive model (VAR) and VECM. The VAR model is built up dependent on the factual properties of data. In the VAR model, each endogenous variable in the framework is considered as the lagged value of every single endogenous variable in the framework, in this manner the univariate autoregressive model is generalized to the "vector" autoregressive model comprising of multivariate time series variables. In 1980, Sims (Sims, 1980) brought the VAR model into the economic field and advanced the widespread application in dynamic analysis of the economic framework.

With the ultimate objective of keeping the objectives of the investigation there have not been numerous examinations connecting the factors of EC, CO_2 emissions, and EG with HC. Accordingly, the goal of this examination is to explore the causality between HC, EC, CO_2 emissions, and EG in Indonesia. In the following session, we will clarify the writing audit. The third session clarified the analytical methods and quantitative ways to deal with noting research issues. Moreover, the following session will clarify the result and discussion and the last session will show the conclusions. The outcomes of Johansen co-integration test 1, 2, 3 and 4 are presented in Figures 4-7.

Figure 6: Long-haul causality obtained from vector error correction model estimates outcomes

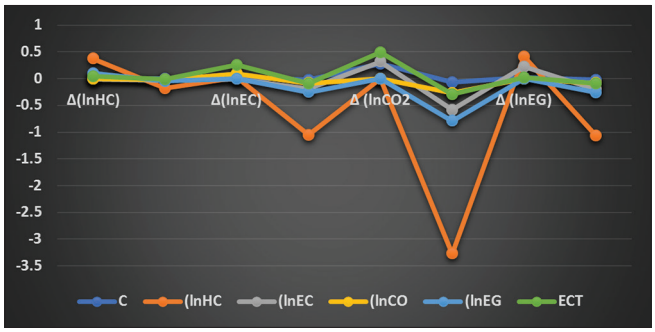
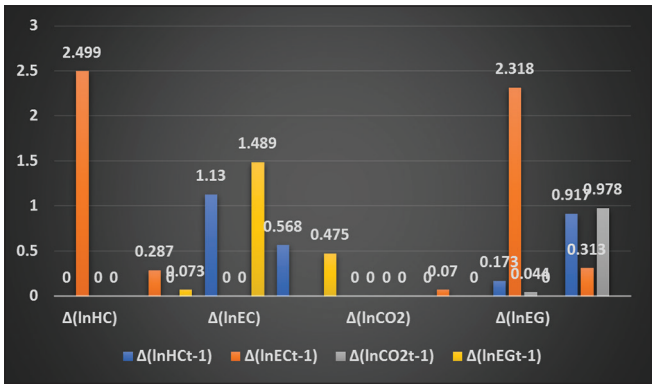


Figure 7: Short-run causality obtain from vector error correction model estimated outcomes



2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The national dimension of national EC ought to be trailed by legal policy dependent on the principles of social justice and environmental sustainability clarified that basically, the dimension of EC is contrarily with populace growth, economic development, mechanical development and diminished air and environmental quality dimensions. As far as causality and in cross-nations and inside nation explicit settings, a few examinations have discovered bidirectional causality between EC and EG, supporting the feedback hypothesis. While a few investigations have finished unidirectional causality from EC to EG and affirmed the growth hypothesis, some others have discovered unidirectional causality from EG to EC, supporting, along these lines, the protection hypothesis. Also, blended outcomes have been determined in regards to the heading of causality between various intermediary variables of EC and EG and the nonappearance of causality between EC and EG, supporting the neutrality hypothesis (Hassine and Harrathi 2017).

Almost all the portion of all vehicle energy use in Indonesia in 2014 was as gas utilized by street vehicles; another 40% was

devoured as diesel in street vehicles. Amindoni (2016) While biodiesel use expanded in the course of the most recent few years), the complete offer of biofuels in transport TFEC stayed unassuming, at about 2%. Electric mobility is as yet restricted in Indonesia. In 2014, electricity utilized in transport meant 0.6 PJ, or under 0.03% of absolute EC in transport. Electric vehicles, including electric two-and three-wheelers, are not experienced on a huge scale yet in Indonesia because of an absence of government backing and guidelines. As of late, be that as it may, some electric vehicle organizations have set up a nearness in the nation, with an expectation that the market will take off in the years to come.

Riyakad and Chiarakorn, (2015), The researcher analysed the impact of EC on greenhouse emissions, found that EC utilized underway procedures demonstrates to create greenhouse gas emissions. The emanation of greenhouse gas emitted from LPG, electricity consumption, and deterioration of calcium carbonate is 80.97, 18.62, and 0.41% respectively. Usenobong and Godwin (2012) recognized that since the 1850s the global utilization of petroleum products (coal, oil, and gas) has expanded and ruled the world's EC and supply. In the meantime, the investigation of Sheinbaum-Pardo et al. (2012) in Mexico in the period 1990-2008 found that there were several vital changes in the structural impacts that could diminish the emissions on 10 manufacturing industry subsectors the energy intensity and carbon file tried negatively affects all subsectors except for cement and several different subsectors.

The growth of household sector EC identifies with populace growth, expanding acquiring power, expanding access to energy, and EC per capita. IEO As per Nuryanti and Herdinie (2007), the components to be considered in examining the EC of household sector are the economic elements, the accessibility of framework, attitude variables, and way of life factors. In fact, Battles and Hojjati (2005) and Guertin et al (2003) have inspected that different qualities of household, for example, physical attributes of house, household expenditure, income level, and household statistic, sort of energy devoured, and hardware and supplies utilized in the home have influenced household EC.

In this examination, there is an analysis of the connection among energy and EG, for an extensive stretch of 150 years. Beginning from 1850 so as to get the transition period from one of the less fortunate nations in Europe at the mid of the nineteenth century to one of the most extravagant today. As it was an industrialization period, they checked if the switch in energies quality and the increments of EC influenced the EG. Stern and Enflo (2013) The Unit Root Test was utilized in this literature too, which is a fundamental to proceed to the integration and Granger cause test, for that PP test was utilized. All their discovering point to that EC powers the economy and accelerates the growth rate. Anyway, the range of the example periods and the as we realize that thing change other time extraordinarily other 150 years, Stern et all seen that the connection between EC and EG could have changed, what's more they focused on Energy prices have enormous role in this process in our days.

In the light of the above-mentioned literature, the current study aims to test the following hypothesis.

H_0: There is no short-term causality between consumption energy, CO_2 emission and EG toward HC.

2.1. Objectives of the Study

1. To investigate the EG, EC, CO_2 and HC of Indonesia
2. To examination the energy economic variables like HC, CO_2 discharge CO_2, EG and EC in Indonesia
3. To analyse the long-haul connection between CO_2 emissions, EC and HC and EG in Indonesia
4. To satisfy the circumstance that EG positively affects improving HC in Indonesia
5. To test the validity of long-haul balance connection between EC, CO2 emissions, and EG.

3. METHODOLOGY

3.1. Research Methodology

The extent of this examination to research the causality between HC, EC, CO_2 emissions, and EG in Indonesia. Since the carbon emissions are changed over by year as indicated by the EC and current verifiable carbon emissions are determined by year, so as to keep up the consistency of information sequences, the empirical investigation has two targets. On the off chance that the variables contain a unit root, the second step is to test whether there is a long-haul co-integrating connection between the variables. The long-run gauges demonstrate that there is a factually critical positive association between power consumption and emissions and a non-direct connection among emissions and different variables, consistent with the Environmental Kuznets Curve. The long-run gauges, in any case, don't demonstrate the course of causality between the variables.

3.1.1. Period of the data

Information perceptions amid 1985-2017, which were gotten from the world development indicator database CD-room 2017.

3.1.2. Variables of the study

The variables utilized were HC (record), EC (EC per capita), CO_2 emissions (CO_2 emissions per capita), and EG (Gross domestic production GDP real per capita).

3.1.3. Procedure of testing

Before leading static and dynamic examination certain pre-estimations like unit root and cointegration are required without which, ends drawn from the estimation may not be substantial. Along these lines, in the initial step we have completed unit root examination.

A few phases of testing that must be done are,

- Testing the unit root to see the time arrangement economic information conduct, regardless of whether the information utilized is stationary or not, can be viewed as the initial phase in the development of a period arrangement model, which among others can performed utilizing the Dickey-Fuller expanded test;
- Tested co-integration and temporal Granger causality utilizing the most extreme probability come nearer from Johansen, 1988. As indicated by Engle and Granger (1987) in the event that two variables incorporate with the principal contrasts and co-coordinated, at that point both unidirectional and

bidirectional Granger causality must exist, at any rate as long as the two variables have a typical pattern for causality in Granger wording, and not as indicated by structural phrasing, least there is unidirectional;

- The third phase incorporates supplanting the VECM and testing it's exogenity. This author demonstrates that with co-integration, there is dependably a relating error correction portrayal, which suggests that adjustments in the dependent variable are gotten by the error correction term (ECT) just as changes in explanatory variables.

3.2. Methods Used in this Study

3.2.1. Unit root test

The most well-known and broadly utilized test to stationary information test is the Augmented Dickey-Fuller test (ADF test) criteria. The idea of testing the ADF Test is that on the off chance that a period arrangement information isn't stationary at zero order (level), at that point the stationary information can be looked through the following order with the goal that the stationary level is gotten at the principal order (first distinction), and the second contrast. Before directing the ADF test, it is important to focus on the plot of information to be tried. This test has the accompanying condition displayed.

$$\Delta Y_t = \beta_1 + \beta_2 + \delta Y_{t-1} + \gamma_i \Sigma_{i-1}^{m} \Delta Y_{t-1} + \varepsilon_t \quad (1)$$

Where:

ΔYt is the first difference from Y; β_1 is a constant value or intercept; β_2 is the regression coefficient for patterns; is the regression coefficient for Y lag; is the regression coefficient for Y lag contrast; ε is error term; m is lag; and t is the timeframe.

3.2.2. Johansen co-integration test

The most well-known and broadly utilized co-integration test is the Johansen test. This examination likewise utilizes the Johansen co-integration test, to check whether there is a greatest probability of the Johansen co-integration test to determine the long-haul connection between the variables being explored. In checking Granger causality investigation additionally should be done to get great outcomes from the test results by picking the privilege ideal lag length (Johansen, 1988).

The integration structure with Johansen takes its beginning stage in the VECM model, while the condition can be introduced as pursues:

$$x_t = A_1 x_{t-p} + \ldots + Apx_{t-p} + B_{y_t} + \varepsilon_t \quad (2)$$

Where x_t is a vector of endogenous variables, and A speaks to an autoregressive framework. y_t is a deterministic vector and B speaks to the parameter matrix. εt is the vector of advancement, and p is the lag length.

3.2.3. VECM granger causality

Moreover, to researched the heading of causality between the HC, EC, CO_2 emanation (CO_2), and EG with regards to the time-series information. Engle and Granger joined integration and error correction models, to build up the follow error correction model. For whatever length of time that there is an integration connection between variables, the error correction model can be gotten from the autoregressive conveyed slack model. Furthermore, every condition in the VAR model is an autoregressive appropriated slack model; accordingly, it very well may be viewed as that the VEC model is a VAR model with integration limitations. Since there is an integration relationship in the VEC model, when there is a vast range of momentary dynamic change, VEC expressions can confine long haul conduct of the endogenous variables and be convergent to their integration connection.

4. DATA ANALYSIS AND INTERPRETATION

This session clarified the analytical methods and quantitative ways to deal with answering research issues. The symptomatic test has directed in the model, the outcome showed that no proof of serial correlation and heteroscedasticity. Moreover, the ordinariness test utilizing the Jarque-Bera test demonstrated that the invalid theory is acknowledged which implies the example estimate watched is typically circulated. In view of a criterion, for example, Akaike Information Criterion and Schwarz Bayesian Criterion demonstrated that got ideal lag length is one. The principal arranges, we tried the unit root with the ADF test criteria has introduced in Table 1.

In view of test result in Table 1 demonstrated that the by and large, the variable of HC, EC, CO_2 emissions, and EG show stationary in the main distinction, with the test statistic esteem littler than the critical value on the ADF or MacKinnon criteria for at 5% certainty level and the likelihood esteem littler than 0.05.

It is shown from the above table that abridges the aftereffects of the co-integration examination utilizing the Johansen most extreme probability approach utilizing greatest eigenvalue and follow statistics. VAR = I is utilized in the Johansen estimation method. The estimation system accepts that there is no deterministic pattern in x_t variables, and that the information age process does not contain pattern terms. At that point the consistent term is incorporated into the gauge. Both proofs to dismiss the null hypothesis that vectors are co-coordinated at zero degrees for coin vector integration at a 5% criticalness level.

Table 1: Unit root test on HC, EC, CO_2 emissions, and economic growth

Variable	ADF test	t-statistic			Summary
		1%	5%	10%	
Δ(lnHC)	−9.794175	−3.699871	−2.976263	−2.627420	*Stationary
Δ(lnEC)	−5.852157	−3.661661	−2.960411	−2.619160	*Stationary
Δ(lnCO_2)	−6.346703	−3.670170	−2.963972	−2.621007	*Stationary
Δ(lnEG)	−4.065769	−3.661661	−2.960411	−2.619160	*Stationary

*Indicates statistical significance at the 1%, 5%, and 10% level. HC: Human capital, EC: Energy consumption, ADF: Augmented Dickey-Fuller

Based on these outcomes, the long-haul connection between government spending and salary got statistical help on account of the Indonesia state in the period 1985-2017. Leftover lags from regressions that co-integrated with the perfect measure of lag are incorporated into the Granger causality test structure.

From the above table it is concluded that the estimation consequences of the four models demonstrate that there are two models that have a long-haul causality, in particular the model of HC and EC, while the model of CO_2 emissions and EG not have long haul causality. Statistically, the first model shows that the ECT coefficient is 0.044, which implies that there is the legitimacy of long-haul balance connection between EC, CO_2 emissions, and EG, this infers 4.4% irregularity of the past period stuns re-joined into long-run harmony at the present period is sure. At the end of the day, there is a long-haul causality of EC, CO_2 emissions and EG in HC.

In the model, there is a negative impact on earlier year's CO_2 emissions on HC, which is the show from the coefficient value of −0.032, this implies a 1% expansion in CO_2 emissions will lessen HC by 0.032%. This finding shows that expanding CO_2 emissions will negatively affect HC in Indonesia. While EG positively affects HC, which is shown from the coefficient value of 0.098, this suggests a 1% expansion in EG will build HC by 0.098%. These discoveries demonstrate that EG positively affects improving HC in Indonesia. Though for the earlier year's EC and HC have the inconsequential impact on HC. The outcome of Johansen co-integration test and Long-haul causality obtained from VECM are presented in Tables 2 and 3 respectively.

Similarly, the second model in EC, which has an ECT coefficient of 0.252, this implies there is the validity of long-run balance connection between HC, CO_2 emissions, and EG, this infers 25.2% awkwardness of past period stuns re-joined into long-run balance in the present period emphatically. At the end of the day, there is a long-haul causality from HC, CO_2 emissions, and EG towards EC., It is said that energy economic variables earlier year has irrelevant impact on EC (Jermsittiparsert et al., 2019).

The estimation consequences of the third model show that there is no long-haul balance between energy economic variables. In any case, mostly, the estimation results showed that HC negatively affects CO_2 emissions, as confirm from the coefficient value of −6175, which implies that expanding HC of 1%, will diminish CO_2 emissions at 6.17%. This finding demonstrates that expanding HC will negatively affect CO_2 emissions. Similarly, the fourth model shows that there is no long-haul balance between other energy economic variables toward EG. Statistically, the other three variables have no impact on EG.

It is shown from the table that After long-run balance, this segment likewise gauge the momentary causality model, in the first model testing the null hypothesis (H_0) on transient causality is that past lags of consumption energy, CO_2 outflow, and EG mutually no influence HC, as such, the null hypothesis is acknowledged. In any case, statistically, just CO_2 outflow and EG have the Chi-square

Table 2: Outcomes of Johansen co-integration test

Trace test				
Null hypothesized (H_0)	**Eigenvalue**	**Trace statistic**	**Critical value 0.05**	**Prob.****
None*	0.964678	157.5567	47.85613	0.0000
At most 1*	0.790167	63.94589	29.79707	0.0000
At most 2*	0.426719	20.22552	15.49471	0.0090
At most 3*	0.152920	4.646887	3.841466	0.0311
Maximum eigenvalue test				
Null hypothesized (H_0)	**Eigenvalue**	**Max-eigen statistic**	**Critical value 0.05**	**Prob.****
None*	0.964678	93.61085	27.58434	0.0000
At most 1*	0.790167	43.72037	21.13162	0.0000
At most 2*	0.426719	15.57863	14.26460	0.0308
At most 3*	0.152920	4.646887	3.841466	0.0311

Max-eigenvalue test indicates 4 co-integrating equation (s) at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) P values

Table 3: Long-haul causality obtained from VECM outcomes

ECM	C	($lnHC_{t-1}$)	($lnEC_{t-1}$)	($lnCO2_{t-1}$)	($lnEG_{t-1}$)	ECT_{t-1}	Summary
Δ(lnHC)	−0.002	0.372	−0.018	−0.032	0.098	0.044	R^2=0.635; Adj. R^2=0.470;
	(0.004)	(0.179)	(0.032)	(0.015)	(0.043)	(0.016)	F-stat=3.860; AIC=−6.843;
	[−0.431]	[2.077]***	[−0.570]	[−2.176]***	[2.279]***	[2.756]***	SC=−6.376
Δ(lnEC)	0.026	0.026	−0.206	0.093	−0.188	0.252	R^2=0.349; Adj. R^2=0.057;
	(0.023)	(1.058)	(0.188)	(0.087)	(0.255)	(0.094)	F-stat=1.197; AIC=−3.291;
	[1.156]	[0.024]	[−1.091]	[1.078]	[−0.738]	[2.678]***	SC=−2.824
Δ ($lnCO_2$)	0.278	−6.175	0.320	−0.509	−0.359	0.490	R^2=0.715; Adj. R^2=0.587;
	(0.070)	(3.271)	(0.584)	(0.268)	(0.787)	(0.290)	F-stat=5.571; AIC=−1.034;
	[3.969] ***	[−1.888]	[0.549]	[−1.900]	[−0.456]	[1.686]	SC=−0.567
Δ (lnEG)	0.024	0.413	0.225	0.001	−0.160	0.022	R^2=0.189; Adj. R^2=−0.175;
	(0.023)	(1.063)	(0.190)	(0.087)	(0.256)	(0.095)	F-stat=0.521; AIC=−3.283;
	[1.042]	[0.388]	[1.186]	[0.011]	[−0.626]	[0.232]	SC=−2.816

Significant level at ***1%, **5%, and *10%. AIC: Akaike Information Criterion, VECM: Vector error correction model

Table 4: Short-run causality obtain from VECM estimated outcomes

Dep. variable	X^2 and P				Inference (short-run causality)
	$\Delta(\ln HC_{t-1})$	$\Delta(\ln EC_{t-1})$	$\Delta(\ln CO_{2t-1})$	$\Delta(\ln EG_{t-1})$	
Δ(lnHC)	-	2.499	16.683***	5.227*	Δ(lnEC) on Δ(lnHC): No short-run
		0.287	0.000	0.073	$\Delta(\ln CO_2)$ on Δ(lnHC): Short-run
					Δ(lnEG) on Δ(lnHC): Short-run
Δ(lnEC)	1.130	-	4.909*	1.489	Δ(lnHC) on Δ(lnEC): No short-run
	0.568			0.475	$\Delta(\ln CO_2)$ on Δ(lnEC): Short-run
					Δ(lnEG) on Δ(lnEC): No short-run
$\Delta(\ln CO_2)$	19.866***	5.350*	-	19.865***	Δ(lnHC) on $\Delta(\ln CO_2)$: Short-run
	0.000	0.070		0.000	Δ(lnEC) on $\Delta(\ln CO_2)$: Short-run
					Δ(lnEG) on $\Delta(\ln CO_2)$: Short-run
Δ(lnEG)	0.173	2.318	0.044	-	Δ(lnHC) on Δ(lnEG): Short-run
	0.917	0.313	0.978		Δ(lnEC) on Δ(lnEG): No short-run
Test statistics					$\Delta(\ln CO_2)$ on Δ(lnEG): No short-run
Serial correlation (LM test)		Breusch-Godfrey			10.71452 (0.8268)
Normality test		Jarque-Bera test			10.32000 (0.2525)
Heteroscedasticity test		Breusch-Pagan-Godfrey			197.8683 (0.1718)

Significant level at ***1%, **5%, and *10%. VECM: Vector error correction model

likelihood value is more prominent than 0.05, at that point the null hypothesis is rejected, which implies that there is no momentary causality between CO_2 outflow and EG toward HC (Table 4). A similar procedure is rehashed in the second model to test transient causality between past lags of the HC, CO_2 emanation, and EG mutually no influence consumption energy, at the end of the day, the null hypothesis is acknowledged. Be that as it may, statistically, just CO_2 outflow have Chi-square likelihood value is >0.05, the null hypothesis is rejected, which implies that there is a momentary causality between CO_2 emanation and consumption energy.

Then, the CO_2 emission model in short-run causality showed that energy economic variables mutually have momentary causality, as it were, the null hypothesis is rejected, which implies that between other energy economic variables of CO_2 emissions has causality present moment. In any case, the EG model in short-run causality showed that energy economic variables together have no momentary causality, as such, the null hypothesis is accepted, which implies that between other energy economic variables of CO_2 emissions has no transient causality.

5. CONCLUSION

EC doesn't build GDP thus he reasons that consumption of energy ought to be decreased. This might be because of the distinction in estimation of the energy variable. the expansion in the populace growth CO_2 emissions increments and populace goes about as a substitute factor of generation. Empirical outcomes recommend a proof of a long haul and transient causality between variables in Indonesia. This exhibits the growth of carbon emissions in the US generally propel GDP growth, and EG in the country does not elevate the superfluous consumption of energy to cause a ton of carbon emissions. The experimental consequences of this investigation are for the most part steady with the examination by Acaravcı and Ozturk (2010); Soytas et al. (2007); and Akbostancı et al. (2009), and however not the same as the investigation by Halicioglu (2009) The general outcomes demonstrate that proportioning consumption energy and controlling carbon emissions, are probably going to have no unfavourable impact on the real GDP per capita. In the meantime, experimentally, the development of HC has the effect on controlling CO_2 emission and EC in Indonesia.

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