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Does Energy Consumption and Trade Openness Contribute to Economic Growth in the East Asian Growth Area?

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ABSTRACT

This paper attempts to investigate the energy consumption and trade openness by taking into consideration the economic growth among associations within countries of Asia. The database was constructed and restricted to a sub-region area in southeast Asia well knows as Brunei, Indonesia, Malaysia, and the Philippines or BIMP-EAGA. The initiative, established in 1994 aims to increase the economic development of its members. We employed panel data analysis to examine the said linkage using panel co-integration on data taken for the period between 1970 to 2016. The approaches for panel data were the dynamic ordinary least squares (DOLS) and fully modified ordinary least squares (FMOLS). From our analysis, the findings indicated a significance and positive relationship between energy consumption, trade openness and economic growth. Additionally, we noted that both indicators are important among association to foster economic wellbeing. Furthermore, the benefit of this initiative of collaboration was highly successful.

Keywords: BIMP-EAGA, Trade Openness, Economic Growth, Energy Consumption
JEL Classifications: O1, C5, Q4

1. INTRODUCTION

International trade one of indicators to develop and foster economic growth for the open economy system. This is the reason for the activities of importing and exporting goods and services were one of the focusing policies for each government. To achieve this and increasing trade for the benefit of each country, the association was developed to allow agreement in international trade. In Southeast Asia, one of the well-known association is the BIMP-EAGA initiative. The sub-region is categorised as one that encompasses the most developed countries of the region and consists of Brunei Darussalam, Indonesia, Malaysia and the Philippines. The initiative was launched in 1994 as a platform to accelerate economic growth. Like other sub-regional economic cooperation in Southeast Asia, the BIMP-EAGA (East Asian Growth Area) is intended as a tool to promote prosperity by improving cross-border connectivity through technology, boosting trade to attract foreign direct investment, and strengthening regional economic ties to build relationships among its members (Kasim, 2009).

The objective of this association was to shift economic activities from resource extraction to higher levels with clean elements and green technologies. This motivated us to study energy consumption and trade openness to foster economic growth among the association. Some studies have identified that both energy consumption and economic growth are variables that usually share a correlation. Ozturk and Acaravci (2010) note that co-integration and Granger causality tests have been extensively used to examine the presence of long-run equilibrium. It also points the direction of causality between energy consumption and economic growth. According to Murad et al. (2018), if the causality of economic growth is viewed as coming from energy consumption, a reduction in energy consumption may thus cause an energy crisis with spillover effects to production and employment. This paper will investigate a sub-region of southeast

Asia to determine the role of energy in the region. According to Bildirici (2013), energy and/or electricity consumption plays a vital role in the economic development of countries and has become a focus of many papers involved in energy economics.

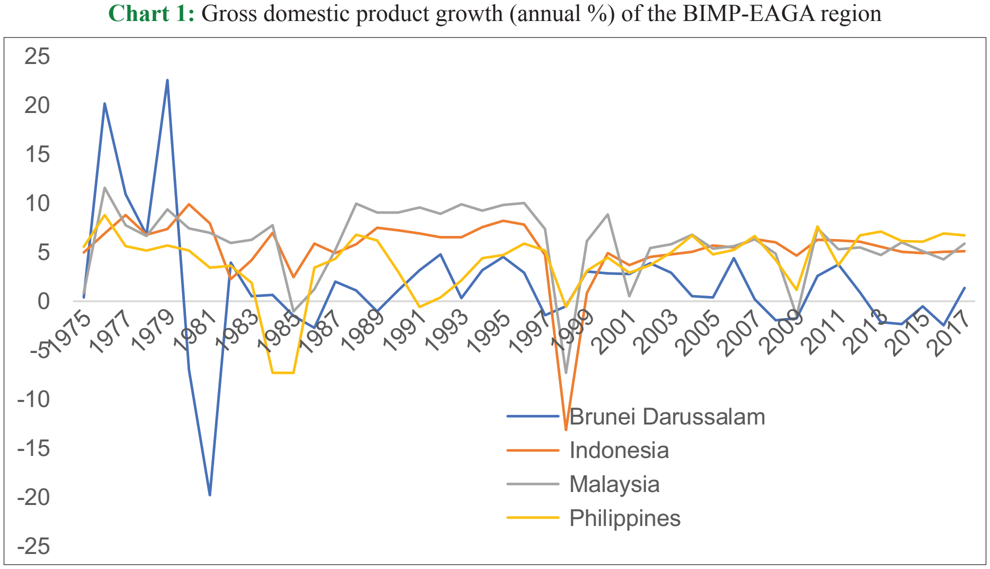
Chart 1 shows the annual growth of gross domestic product (GDP) for each country in the BIMP-EAGA. The financial crisis of 1997/1998 had a severe impact on all countries as shown by the decline in trend during the years 1998 and 1999 in Chart 1; the same trend can be observed as a repercussion of the global economic crisis in 2006. This sub-region shares the same production inputs and outputs, especially in terms of workers and environmental resources. However, the countries had charted different levels of growth according to the attraction policy implemented by their governments, especially the volume of tax and facility provided. According to Soylu (2018) postulated that economic growth leads to an unequal distribution of income in countries with low levels of development. Uniquely, this southeast Asia sub-region shows a trend of competition amongst its members. Malaysia had led in terms of GDP growth since 1989. However, positions have changed since the Philipines started showing a higher percentage of GDP growth compared to the others since 2006.

In addition, one of the goals outlined in the association roadmap is the coordination and management of natural resources for sustainable development in the sub-region. Firstly, energy is an important element in the production of goods and services. The countries would need to monitor production as to achieve sustainable development but the increasing volume of trade in order to maintain eco-friendly production. According to Beaudreau (2005), the value of economic development inclines according to the amount of energy consumed as well as the primary inputs used in the production function. From the economic perspective, the study aims to contribute to the mission of the association by identifying energy consumption among the association has incurred and was along with the roadmap. Ozturk and Acaravci (2010) mentioned that empirical literature on the energy consumption-growth nexus had yielded mixed and often conflicting results due to the different datasets, countries' characteristics and economic methodologies that were used. Following the introduction, the next section briefly reviews and discusses relevant literature. This paper will employ the fully modified ordinary least square (FMOLS), and panel dynamic ordinary least square (DOLS) approaches with information in section 3, while section 4 reports the findings. A discussion from this analysis and policy implication is offered in section 5.

2. LITERATURE REVIEW

The study of the relationship between energy consumption and economic growth nexus is not new in previous studies. There are numerous investigations employed from different perspectives on energy consumption and different methods. The energy is a fundamental issue that influences resource security (Jie et al., 2020). On the other hand, to maintain sustainable development along with economic growth, energy consumption was an important indicator. According to Soytas et al. (2007), energy is considered an essential factor of production; however, no evidence of causal links between income and carbon emissions, and income and energy consumption have been proven. This research used the long-run Granger causality test to investigate the relationship between carbon emissions, energy use and income in the United States. A study on Latin American countries by Marinaș et al. (2018); Apergis and Payne (2009) proved that high investments in energy would lead to economic growth. The study results have shown short-run and long-run causalities between energy consumption and economic growth using a panel co-integration test. Hossain (2012) applied the causality test to determine the relationship between export and electricity demand. The findings showed no causality between these variables. Finally, Erol and Yu (1987) stated that the energy and gross national product have bidirectional causality with six (6) industrialised countries. The results showed that energy and GNP for Japan, Canada, Germany and Italy have bidirectional causality; however, no causalities were found for England and France. Likewise, studies among developing countries that applied electricity use to represent energy consumption found different outcomes of electricity causality. Several regional studies were conducted with the view of assessing the

Chart 1: Gross domestic product growth (annual %) of the BIMP-EAGA region



relationship between electricity consumption and economic growth (Rafindadi and Ozturk, 2015 and Zhang et al., 2017).

Bildirici (2013) stated that one factor explaining African countries' poverty is the lack of investments in energy infrastructure and services. Each country in this region has national and local corridors that can help strengthen economic transformation, especially investment in energy. Meanwhile, in the Masterplan, the BIMP-EAGA is set to implement various priority infrastructure projects, especially those on energy, transport, trade facilitation and technology. Moreover, the study by Hdom and Fuinhas (2020) employ DOLS and FMOLS in Brazil and found that electricity generation, gross domestic product (GDP) and trade liberalization have a connection with Brazil's economy. The author mentioned in this study that open trade influences demand energy for economic production, but without the implication of policies, the volume of emissions would increase drastically. However, according to Muhammad et al. (2020), international trade has an impact on CO_2 emissions in two different situations. The study focused on urbanization for 65 countries. As a result, the volume export activity decreased CO_2 emissions, but volume import activity increased emissions in low-income countries.

In order to expand domestic and international trade, export and import activity required expansion in energy consumption with efficient production. Underlying the trade activity with full production without restrictions causes pollutants. Hence the mission to achieve sustainable development in trade would be a failure. According to Ghani (2012), trade and environment can be directly linked to energy consumption. The effect between energy and trade openness also explored in numerous studies. A study by Narayan and Smyth (2009) included the variable indicators of energy and economic growth by incorporating exports as a trade openness. Based on the study conducted in the Middle East with panel data, the findings showed an increasing volume of budgeting in electricity infrastructure and strengthened electricity conservation policies affecting economic growth. Furthermore, the most required energy consumption with economic growth signified by Wei et al. (2020) illustrates that economic growth is highly dependent on natural gas. The author conducted studies in the most developed countries like China with divisions within provinces.

Several studies have shown trade openness as an indicator of economic growth, according to Jena et al. (2008). The analysis impact of trade openness on energy consumption found that each indicator was significant and correlated using data for Germany. Likewise study by Shahbaz et al. (2013) indicated that trade openness reduces the environmental issue, which is related to market liberalization impact from new technologies adopted in energy consumption. The study was conducted in Indonesia with panel data over the period 1975Q1 until 2011Q4. For Rafiq (2016), trade openness plays a crucial role in Malaysia's improved trade performance, distance, per capita income, and exchange rate. It also plays a significant role in explaining Malaysia's trade in the period between 1990 and 2007. Additionally, Shaari et al. (2013) examined the relationship between energy consumption (electricity, oil, gas and coal) and economic growth in Malaysia using the Granger causality test. Results indicated that energy consumption does not granger to economic growth.

Regarding high-income countries, the study was employed by Tiba and Frikha (2018) highlights the existing relationship between energy consumption and income, but there are no unidirectional causalities from energy consumption and trade openness. The author applied the generalized method of moments (GMM) to identify multiple-way linkages between variables. Furthermore, Wang and Zhang (2021) employed the Tapio decoupling model with the log-linear econometric found different situations among countries. The results from analysis for high and upper-middle-income countries that trade openness decreased carbon emissions while in energy consumption. However, vice-versa for low-income countries were trade openness increasing carbon emissions. Also, increasing income and population distort the decoupling economic growth from carbon emissions effect from energy consumption. In this research, we analyse the association strategy to develop linkage economic and sustainable development. However, the evidence records among associate member between energy consumption and trade never been highlighted, although the members want to generate balanced and inclusive growth for regional integration.

3. MODEL SPECIFICATION AND DATA

In order to investigate the relationship between economic growth, energy consumption, and trade openness, annual data on energy use per capita, trade openness and real gross domestic product were collected from 1974 to 2014 with respect to the association BIMP-EAGA. The real gross domestic product or GDP is used to represent the economic growth while Kilogram of oil equivalent or KOE is utilized to proxy the level of energy used. To measure the trade openness for each member of regions, the current paper divides the sum of export and import, or the volume of trade, with the population. A similar approach has been used by researches such as Siddiqui and Iqbal (2005) to measure openness. All of the data are collected from the World Bank Databank with Equation below shows the model tested by the current paper.

$$lnGDP_{i,t}=\beta_0+\beta_1\ lg\ EC_{i,t}+\beta_2\ \mathrm{lg\ TC}_{i,t}+\mu_t$$

All variables are converted into natural logarithm with $GDP_{i,t}$ representing the real gross domestic product, while $EC_{i,t}$ and $TC_{i,t}$ are the energy consumption and trade openness for country *i* at time *t*, respectively.

3.1. Unit Root Test

The estimating procedure in testing a panel data, asymptotic behavior of the time-series and the cross-sectional dimensions need to be addressed using unit root test. To test the stationarity of data in the current paper, Levin, Lin and Chu (2002) or LLC and Im, Pesaran and Shin (2003) or IPS are employed. Both assume that all the panels contain a unit root at the null hypothesis. Based on Kunst et al. (2011), the Im-Pesaran-Shin (IPS) test is not as restrictive as the Levin-Lin-Chu test, since it allows for heterogeneous coefficients. According to Shairilizwan and Remali (2014), the aim of conducting these tests is to ensure that the chosen variables are not I(2), so as to avoid bias in the estimation.

a. LLC unit root test

The current paper applied Lin and Chu (2002) to check if the variables are stationary. The hypotheses for LLC (2002) is as follows:

H_0: Each time series contains a unit root.
H_1: Each time series is stationary.

The first step in the LLC is the utilization of the Augmented Dickey-Fuller (ADF) for each cross-section:

$$\Delta Y_{i,t} = \rho Y_{i,t-1} + \sum_{k=1}^{ni} \theta_{ik} \Delta Y_{i,t-k} + \alpha_{mi} d_{mt} + \acute{o}_{i,t} \quad (1)$$

Two auxiliary regressions are then conducted:
$\Delta Y_{i,t}$

1. $\Delta Y_{i,}$ on $\Delta Y_{i,t-k}$ and d_{mt} to obtain the residual $\hat{e}_{i,t}$
2. $Y_{i,}$ on $\Delta Y_{i,t-k}$ and d_{mt} to obtain the residual $\hat{v}_{i,t-1}$

After that, the residuals will be standardized with $\tilde{e}_{i,t} = \hat{e}_{i,t} / \hat{\sigma}_{\acute{o},i}$ and $\tilde{v}_{i,t-1} = \hat{v}_{i,t}) / \hat{\sigma}_{\epsilon,i}$. $\sigma_{\hat{\epsilon},i}$ is the standard error for each ADF. With the null hypothesis of ρ=0,ordinary least square regression will then be used on:

$$\tilde{e}_{i,t} = \rho \tilde{v}_{i,t-1} + \acute{o}_{i,t} \quad (2)$$

The lag order θ is allowed across individual countries.

a. IPS unit root

Im, Pesaran and Shin (1997) state that all individual follows a unit root test in the null hypothesis, H_0: $\rho_i=0\forall_i$. Conversely, the alternative allows some (but not all) of the individuals contain unit root:

$$H_1 \begin{cases} \rho_i < 0, for\, i = 1,2\ldots N_1 \\ \rho_i = 0, for\, i = 1,2\ldots N \end{cases}$$

3.2. Co-integration Analysis

The existence of co-integration in the panel data model is then tested based on the Pedroni (1999) study that permits for heterogeneous intercepts and trend coefficients across cross-sections.

By referring to the following regression:

$$Y_{i,t} = \alpha_i + \delta_i t + \beta_{1i} X_{1i,t} + \beta_{2i} X_{2i,t} + \ldots + \beta_{Mi} X_{Mi,t} + \varepsilon_{i,t} \quad (3)$$

Where t=1…,T;i=1…,N;m=1…,M. Y and X are assumed to be integrated of order 1, I(1). Meanwhile, α_i and δ_i are individual and trend effects that can be assumed as zero. Under the null hypothesis of no co-integration, the residual $\varepsilon_{i,t}$ that is tested based on $\varepsilon_{i,t}=\rho_i\varepsilon_{i,t-1}+\mu_{1,}$ is supposed to be I(1) for each cross-section with ρ_i=1.

If the variables were found to be co-integrated, the next step in the analysis is to estimate the co-integration between variables based on Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS).

To strengthen the analysis of co-integration, Kao (1999) is also utilized. The Kao test follows the same basic approach as the Pedroni tests but specifies cross-section specific intercepts and homogeneous coefficients on the first-stage regressors.

$$C_i = \begin{pmatrix} C_{11i} & C_{21i}^{'} \\ C_{21i} & C_{22i} \end{pmatrix} \quad (4)$$

For $Y_{i,t}=Y_{i,t-1}+\epsilon_{i,t}$ and $X_{i,t}=X_{i,t-1}+\mu_{i,t.}$ Meanwhile, t=1…,T;i=1…,N. By running the pooled auxiliary regression model, $\varepsilon_{i,t}=\rho\varepsilon_{i,t-1}+v_{i,t,}$ the residual $\varepsilon_{i,t}$ suppose to be I(1) under the null hypothesis of no co-integration.

a. Fully modified OLS (FMOLS)

Consider the following co-integrated system for a panel of i = 1,2,..,N individuals:

$$Y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad (5)$$

$$X_{it} = X_{i,t-1} + \varepsilon_{it} \quad (6)$$

Where $Z_{it} = (Y_{it}, X_{it}) \sim I(1)_{it}$ and $\vartheta_{it} = (\mu_{it}, \varepsilon_{it}) \sim I(0)$ with long-run covariance matrix $C_i = L_i L_i^{'}$ (L_i is the lower triangular decomposition of C_i). In this case, the variables are said to be co-integrated for each member of the panel, with co-integrating vector β.

The panel FMOLS for β is defined as:

$$\beta_{NT}^{*} = N^{-1}(\sum_{i=1}^{N} \left(X_{it} + \bar{X}_i\right)^2 (\left(X_{it} - \bar{X}_i\right) Y_{it}^{*} T_{\hat{\tau}_i}) \quad (7)$$

Where

$$Y_{it}^{*} = \left(Y_{it} - \bar{Y}_i\right) - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \Delta X_{it,\hat{\tau}_i} \equiv \hat{\Gamma}_{21i} + \hat{C}_{21i}^{0} - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} (\hat{\Gamma}_{22i} + \hat{C}_{22i}^{0})$$

and $\hat{L}_i$ is a lower triangular decomposition of $\hat{C}_i$ defined as $C_i = \begin{pmatrix} C_{11i} & C_{21i}^{'} \\ C_{21i} & C_{22i} \end{pmatrix}$.

b. Dynamic OLS (DOLS)

The current paper also utilizes Dynamic OLS or DOLS, where the co-integration equation (5) is augmented to form:

$$Y_{it} = \alpha_i + \beta X_{it} + \sum_{k=-K_i}^{K_i} + \mu_{it}^{*} \quad (8)$$

And that the estimated coefficient β is given by:

$$\hat{\beta}_{GD}^{*} = N^{-1}(\sum_{i=1}^{N} Z_{it} Z_{it}^{'})^{-1} (\sum_{i=1}^{N} Z_{it} Y_{it}^{*}) \quad (9)$$

Where $Z_{it}=(X_{it}-\bar{X}_i,\Delta X_{i,t-k},\ldots,\Delta X_{i,t+k})$ is 2(K+1)×1 vector of the regressor

Table 1: Panel unit root test

Variable	At level				At 1st difference			
	Without trend	P-value	With trend	P-value	Without trend	P-value	With trend	P-value
LLC								
$lgdp_t$	5.765	1.000	−0.310	0.378	−4.558	0.000	−3.104	0.001
EC_t	4.961	1.000	0.103	0.541	−4.296	0.000	−9.485	0.000
TC_t	−0.024	0.491	3.833	0.999	−6.746	0.000	−4.909	0.000
IPS								
$lgdp_t$	0.690	0.755	−0.847	0.199	−6.179	0.000	−5.335	0.000
EC_t	0.339	0.633	1.850	0.968	−5.749	0.000	−8.048	0.000
TC_t	−0.039	0.485	−0.905	0.183	−5.858	0.000	−4.849	0.000

$lgdp_t$ is the gross domestic product while EC_t and TC_t are the energy consumption and trade openness, respectively. P-value <0.10,<0.05,<0.01 indicate the rejection of null hypothesis of no cointegration at 10%, 5%, and 1% levels of significance, respectively

Table 2: Pedroni (1999) and Kao (1999) panel co-integration tests

Test	Panel v-statistic	Panel rho-statistic	Panel PP-statistic	Panel ADF-statistic	Group rho-statistic	Group PP-statistic	Group ADF-statistic	Kao Test
Statistic	0.108	−6.739	−7.242	−6.010	−4.702	−7.662	−6.094	−1.534
	(0.919)	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***

P-values are shown in parentheses. All reported values are asymptotically normally distributed. Probability statistics are shown within parentheses. *, **, *** indicate the rejection of the null hypothesis of no co-integration at 10%, 5%, and 1% levels of significance, respectively

Table 3: FMOLS and DOLS panel

Variable	FMOLS		DOLS	
	Coefficient	P-value	Coefficient	P-value
EC_t	0.186	0.00	0.196	0.00
TC_t	0.491	0.00	0.477	0.00

Gross domestic product is treated as the independent variable. EC_t and TC_t are energy consumption and trade openness, respectively. P-value <0.10,<0.05,<0.01indicate the rejection of null hypothesis of no cointegration at 10%, 5%, and 1% levels of significance, respectively

According to Kao and Chiang (2000), DOLS estimator is promising for small samples and performs well in general for co-integrated panels. The benefit of using the FMOLS method is that its value of estimation is reliable for small sample sizes. Additionally, the FMOLS method provides and checks for the robustness of results. The method was originally introduced and developed by Philips and Hansen (1990) to estimate single co-integrating relationships that have a combination of I(1). According to Nasreen and Anwar (2014), the difference between the two approaches was not very apparent in terms of sign and statistical significance value.

4. EMPIRICAL RESULTS AND DISCUSSION

Before the model estimation, the unit root test was one of the methods to identify whether a time series variable is non-stationary and possesses a unit root. Based on the panel unit root test, as presented in Table 1, it is concluded that all of the variables contain unit root at level and stationary at the first difference. The results were based on the three-panel unit root tests by Lin and Chu (2002) or LLC and Im, Pesaran and Shin (1997) or IPS for each selected variable with and without a trend.

This condition permits the use of Pedroni (1999) and Kao (1999) panel co-integration tests. The current paper then applied seven Pedroni and Kao tests of panel co-integration. The test results proved that the hypothesis of no co-integration between the variables as presented in Table 2. According to Hdom and Fuinhas (2020), if a co-integrating relationship between the series is found, the next step is to estimate the long-run parameters.

The FMOLS and DOLS results at the group level are presented in Table 3. The findings suggest the existence of a long run co-integrating relationship between energy consumption, trade openness and economic growth. The analysis showed that all coefficients were significant and worked according to economic theory. Both models also present similar results in terms of the value of the coefficients and level of significance. Hdom and Fuinhas (2020) the advantages employ FMOLS and DOLS for panel data; the estimator is free of endogeneity problems due to sampling size.

The results for FMOLS indicated that a 10% increase in energy consumption gave an impact to the economic growth, measured by the real gross domestic product of the BIMP-EAGA, by about 1.8%, while an increase of 10% in trade openness may lead to the economic growth by 4.9% of the region. Based on the DOLS model, a rise in energy consumption by 10% contribute to the expansion of the economy by 1.96% while similar movement on the trade openness explains 4.7%. The analysis also showed that all variables shared positive relationships with each other.

5. CONCLUSION

The purpose of the present study is to identify issue energy consumption, trade openness and economic growth among the BIMP-EAGA. This association was developed to increase trade, economic growth among team members towards sustainability growth. One of the unique factors of this association is that it is also developed to attract investors by offering a much more investor-friendly platform in terms of labor and policy. According to Kasim et al. (2012), the region considers well-planned connectivity between major cities within the region as one of the prime movers and major key instruments towards the success of the region. To achieve the objective of the study, an analysis in this study was conducted based on the objective using the fully modified ordinary least square (FMOLS) and parametric dynamic panel OLS (DOLS) approaches.

The empirical results revealed that all of the time series were integrated in order of I(1). The FMOLS and DOLS estimations showed positive and significance in the relationship between energy consumption, trade openness and economic growth. This is similar to the findings of previous researchers. According to Bildirici (2013), for example, a positive relationship between income and electricity demand is associated with normal goods. This may suggest that the positive association between energy consumption and economic growth as presented in the current paper may imply that the demand for normal goods increases in the region. However, in terms of trade openness, Balassa (1989) identified that financial liberalization would help the economy to grow, especially if the real interest rate is high enough to draw international financial intermediaries to invest into the local market.

Our empirical insight has major policy recommendations based on our findings. The result based on the analysis reflects the importance of having a good infrastructure, particularly in terms of steady-state and sufficient electricity production. Additionally, technological innovation in the energy sector can be promoted as an upcoming industry in the association area as well. Sound policy and commitment between countries to foster trade openness are also vital, and the current paper recommends that the BIMP-EAGA continue to build its economic strategy as it will bring economic benefits to the region.

REFERENCES

Apergis, N., Payne, J. (2009), Energy consumption and economic growth in Central America: Evidence from a panel cointegration and error correction model. Energy Economic, 31, 211-216.

Balassa, B. (1989), Financial Liberalization in Developing Countries. The World Bank Policy, Planning and Research Working Paper No.55.

Beaudreau, B.C. (1995), The impact of electric power on productivity: The case of US manufacturing 1958-1984. Energy Economics, 22, 615-625.

Bildirici, M.E. (2013), The analysis of relationship between economic growh and electricity consumption in africa by ardl method. Energy Economics Letters, 1(1), 1-14.

Erol, U., Yu, E.S.H. (1987), On the relationship between electricity and income for industrialized countries. Journal of Electricity and Employment, 13, 113-122.

Ghani, G.M. (2012), Does trade liberalization effect energy consumption? Energy Policy, 43, 285-290.

Hdom, H.A.D., Fuinhas, J.A. (2020), Energy production and trade openness: Assessing economic growth, CO_2 emissions and the applicability of the cointegration analysis. Energy Strategy Reviews, 30, 100488.

Hossain, S. (2012), Multivariate Granger causality between economic growth, electricity consumption, exports and remittances for the panel of three SAARC countries. Global Journal Management Business Research, 12, 41-54.

Im, K.S., Pesaran, M.H., Shin, Y. (2003), Testing for unit roots in heterogeneous panels. Journal of Econometrics, 115(1), 53-74.

Jena, P.R., Grote, U. (2008), Growth-trade environment nexus in India. In: Proceedings of the German Development Economics Conference, Zurich 2008. Berlin: Verein Für Socialpolitik, Research Committee Development Economics.

Jie, T., Wei, W., Jiang, L. (2020), A sustainability-oriented optimal allocation strategy of sharing bicycles: Evidence from ofo usage in Shanghai. Resources, Conservation and Recycling, 153, 104510.

Kao, C., Chiang, M.H. (2000), On the estimation and inference of a cointegrated regression in panel data. Advances in Econometrics, 15, 179-222.

Kao, C.D. (1999), Spurious regression and residual-based tests for cointegration in panel data. Journal of Econometrics, 90, 1-44.

Kasim, M. (2009), Investing in BIMP-EAGA For Sustainable Growth: The Future Dynamics of Sub-Regional Development. BIMP-EAGA International Conference At: Kota Kinabalu Saba.

Kasim, M., Remali, Y., Arsiah, B., Janie, L.T., Awangku, H.B.P., Rasid, M., Dullah, M., Razali, D.E.D., Kamarul, M.M., Rozilee, A., Safri, S.M., Andy, L.C.H., Hajar, S.S. (2012), A study on developing a monitoring system for the BIMP-EAGA region. BIMP-EAGA Journal for Sustainable Tourism Development, 1(1), 70-80.

Kunst, R., Nell, C., Zimmermann, S. (2011), Summary Based on Chapter 12 of Baltagi: Panel Unit Root Tests. Available from: https://www.homepage.univie.ac.at/robert.kunst/pan2011_pres_nell.pdf.

Marinaș, M.C., Dinu, M., Socol, A.G., Socol, C. (2018), Renewable energy consumption and economic growth. Causality relationship in Central and Eastern European countries. PLoS One, 13(10), e0202951.

Muhammad, S., Long, X., Salman, M., Dauda, L. (2020), Effect of urbanization and international trade on CO_2 emissions across 65 belt and road initiative countries. Energy, 196, 117102.

Murad, M.W., Alam, M.M., Noman, A.H., Ozturk, I. (2018), Dynamics of technological innovation, energy consumption, energy price and economic growth in denmark. Environmental Progress and Sustainable Energy, 1, 1-8.

Narayan, P.K., Smyth, R. (2009), Multivariate granger causality between electricity consumption, exports and GDP: Evidence from a panel of Middle Eastern countries. Energy Policy, 37(1), 229-236.

Nasreen, S., Anwar, S. (2014), Causal relationship between trade openness, economic growth and energy consumption: A panel data analysis of Asian countries. Energy Policy, 69, 82-91.

Ozturk, I., Acaravci, A. (2010), CO_2 emissions, energy consumption and economic growth in Turkey. Renewable and Sustainable Energy Reviews, 14, 3220-3225.

Pedroni, P. (1999), Critical values for cointegration tests in heterogeneous panels with multiple regressors. Oxford Bulletin of Economics and Statistics, 61, 653-700.

Rafindadi, A.A., Ozturk, I. (2015), Natural gas consumption and economic growth nexus: Is the 10th Malaysian plan attainable within the limits of its resource? Renewable and Sustainable Energy Reviews, 49, 1221-1232.

Rafiq, I. (2016), Trade openness in malaysia: Evidence from trade with ASEAN and Australasian countries. Scholars Journal of Economics, Business and Management, 3(12), 669-679.

Shaari, M.S., Hussain, N.E., Ismail, M.S. (2013), Relationship between energy consumption and economic growth: Empirical evidence for Malaysia. Business Systems Review, 2(1), 17-28.

Shahbaz, M., Hye, Q.M.A., Tiwari, A.K., Leitão, N.C. (2013), Economic growth, energy consumption, financial development, international trade and CO_2 emissions in Indonesia. Renewable and Sustainable Energy Reviews, 25, 109-121.

Shairilizwan, T., Remali, Y. (2014), Telecommunications infrastructure consequence to economic growth in Malaysia: Time series analysis. International Journal of Computer Trends and Technology, 18(5), 175-179.

Siddiqui, A.H., Iqbal, B. (2005), Impact of Trade Openness on Output Growth for Pakistan: An Empirical Investigation, Munich Personal REPEC Archive. Available from: https://www.mpra.ub.unimuenchen.de/23757/1/impact_of_trade_openness_on_output_growth_for_pakistan_an_empirical_investigation.pdf.

Soylu, O.B. (2018), The poverty, growth and inequality in Canada. International Journal of Current Research, 9(10), 74326-74332.

Soytas, U., Sari, R., Ewing, B.T. (2007), Energy consumption, income and carbon emissions in the United States. Ecological Economics, 62, 482-489.

Tiba, S., Frikha, M. (2018), Income, trade openness and energy interactions: Evidence from simultaneous equation modeling. Energy, 147, 799-811.

Wang, Q., Zhang, F. (2021), The effects of trade openness on decoupling carbon emissions from economic growth-evidence from 182 countries. Journal of Cleaner Production, 279, 123838.

Wei, W., Cai, W., Guo, Y., Bai, C., Yang, L. (2020), Decoupling relationship between energy consumption and economic growth in China's provinces from the perspective of resource security. Resources Policy, 68, 101693.

Zhang, C., Zhou, K., Yang, S., Shao, Z. (2017), On electricity consumption and economic growth in China. Renewable and Sustainable Energy Reviews, 76, 353-368.