Global Business and Management Research: An International Journal
Vol. 12, No. 4 (2020)

Does Government Expenditure Contribute to Malaysia Environmental Sustainability? A Dynamic Analysis

Nor Salwati binti Othman *
College of Business and Accounting
Universiti Tenaga Nasional
Email: norsalwati@uniten.edu.my

Hussain Ali Bekhet
Jordan

Ts. En. Steve Anthony Lojuntin
SEDA, Malaysia

* *Corresponding Author*

Abstract
Purpose: This paper investigates the impact of government expenditures (GSE) on the environmental quality proxy by carbon dioxide (CO_2) emissions in Malaysia over the 1971–2019 period.
Design/methodology/approach: The stochastic impacts by regression on population, affluence, and technology (STIRPAT) model in the Environmental Kuznet Curve (EKC) framework is utilized. The F-bound test is applied to assess the existence of the co-integration relationship, and the Autoregressive Distributed Lags (ARDL) model is used to measure the short-run and long-run environmental elasticities.
Findings: Empirical results show the existence of co-integration relationship among CO_2 emissions, Gross Domestic Product (GDP) and Malaysia's GSE. The findings provide strong support for the presence of the EKC in the case of Malaysia, but the GSE did not directly contribute to the reduction in CO_2 emissions.
Research limitations/implications: Even the role of GSE on environmental sustainability can be tested in many approaches; this study focuses on assessing the direct impact of GSE. In the future, this study can be extended by measuring the role of GSE with a moderating role.
Practical implications: These results highlight understanding that Malaysia is currently in the process towards environment sustainability due to the existence of the EKC hypothesis in Malaysia. However, the GSE is not directly contributed to environmental sustainability. As one of major component of GSE, this finding indicates that the government spending on education, and R&D did not function well in stimulating the level of productivity
Originality/value: This study investigates the role of GSE by utilizing the STIRPAT and EKC framework, which is still in the infant stage for Malaysia. The uniqueness of this study holds due to dynamic analysis by assuming that the effect of GSE on CO_2 emissions is not instantaneous.

Keywords: Environmental Sustainability, Carbon Emissions, Government Spending, Co-integration, ARDL

Introduction

The sustainable development goal (SDG) has created renewed attention in the study of the relationship between the growth of economic activities and environmental quality. As defined by many scholars in this area, the sustainable development is a kind of development of the economy and societies that meet the need of the current and future generation (Juraschek et al., 2018; Jalil, 2010). One of the possible ways to achieve sustainable development goals is by making sure the development of a country is moving towards green. Precisely, by guaranteeing the Gross Domestic Product (GDP) to scale up and scale down the environmental pollution simultaneously. However, the time trend of Malaysia's economy activities and the status of environmental quality represented by CO_2 emissions are pictured in Figure 1.

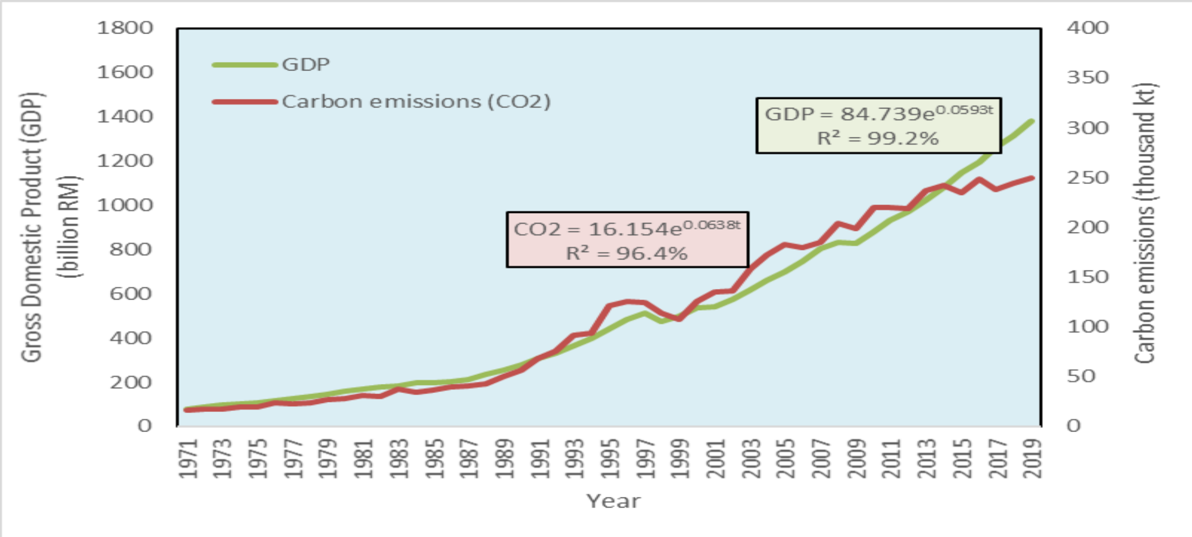

Figure 1: The trend of GDP and Carbon Dioxide Emission for 1971-2019 period
Source: World Development Indicator (2020)

Figure 1 clearly shows the GDP and carbon dioxide (CO_2) emissions growth by 5.9 % and 6.3 % respectively for 1971-2019 period. For instance, the improvement in GDP is not associated with the improvement in environment quality represented by CO_2 emissions that affirmed the issue of sustainable development remains unsolved. At present, a plethora of studies investigated the relationship between GDP and environmental pollutions. For example Bekhet & Othman (2017), Begum et al. (2015), Bekhet & Yasmin (2013), Al-Mulali et al. (2015), Ozturk & Al-Mulali (2015) investigate the trade-off between carbon dioxide emissions and GDP in the Environmental Kuznet Curve (EKC) framework, Sadorsky (2014), Martinez-Zarzosa & Maruotti (2011), He et al. (2017), Ozturk & Al-Mulali (2015), Bekhet & Othman (2017) taking into account the role of urbanization in determining the interaction between carbon emission and GDP, Shahzad et al. (2017), Mrabet & Alsamara (2017), Dogan & Ozturk (2017) considered the role of energy consumption, and many more.

On the other hand, fiscal policy plays a crucial role in the accumulation and allocation of an economy's resources (López et al., 2010). In Malaysia, GSE comprises about 9.76 % – 19.25 % of the GDP (see Figure 2). The GSE includes all current government expenditures for purchases of goods and services (including compensation of employees), education, R&D and also on national defence and security (Ministry of Finance, 2020). The GSE may affect environmental pollution in several ways (Hua et al., 2018; Islam & Lopez, 2013; Lopez et al., 2011). First, spending on education tends to raise the share of cleaner human capital. Second, the GSE on R & D can result in a higher adoption rate of cleaner technology and third, the increase on GSE for operating services such as compensation and salary of civil servants could lead to higher demand for environmentally product and services. Even recently, the government has pump-up their allocation on GSE (RM20 billion stimulus package) in order to stabilize the economic activities and to support the welfare of the societies as a result of COVID-19 pandemic[1] (www.isis.org.my). There are many studies that successfully verified the function of GSE on GDP (economic activities), but the function of GSE to improve the environmental quality is still limited, mainly for cases in Malaysia. Against this backdrop, this study fills this gap in this area by linking the effect of GSE on CO_2 emissions in Malaysia.

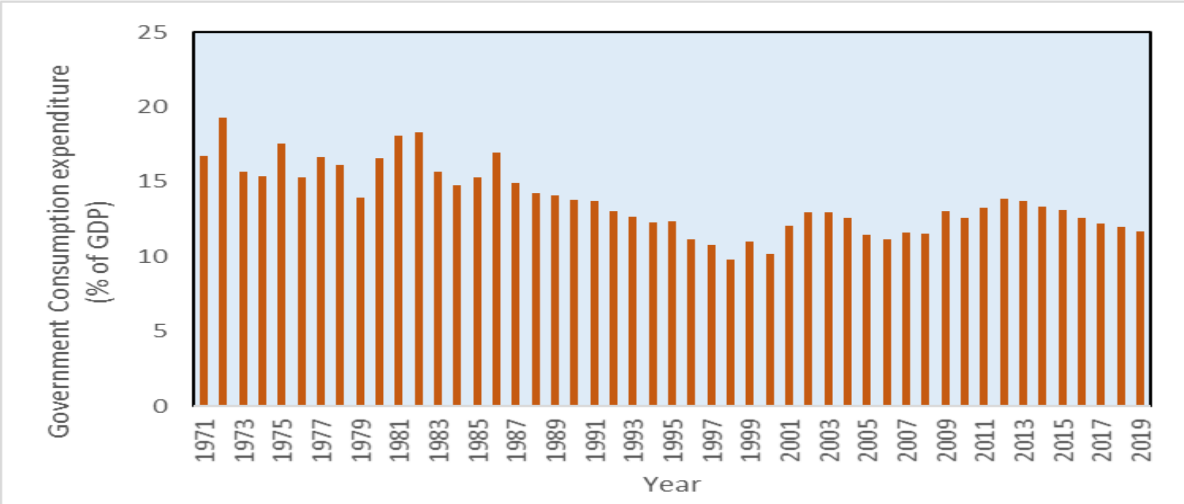

Figure 2: Government Consumption Expenditure in Malaysia for 1971-2019 period
Source: World Development Indicator (2020)

Since the effect of human capital accumulation, clean technology adoption is not instantaneous, and it is time-consuming; this study will utilize the dynamic analysis rather than level analysis. To do so, first and foremost, the existence of the dynamic relationship between the named variables need to be confirmed. Then, the impact of GSE on CO_2 emissions is assessed. This study inclines to clarify the extent the GSE influences CO_2 emissions. Also, it contributes to the growing literature on fiscal policy and environmental quality, mainly for cases in Malaysia. The results have significant practical policy implications precisely at the time Malaysia aims for a sustainable development goal.
The rest of this study is structured as follows: section 2 reviews the related theory and past related literature, section 3 discusses the data and methodology steps, section 4 presents and confer the empirical results, and finally, section 5 concludes the study with policy implications.

Theoretical background and Existing Literatures

Generally, the Malaysia GSE was allocated for two significant purposes, namely, operation purposes and development purposes (Bekhet & Othman, 2012). The rationale for allocating the budget for operation purposes is to upgrade and improve productivity as well as to impede long term economic growth potential. In the 2020 budget, a total of RM297 billion or 18.4 % of GDP was allocated, of which RM241 billion or 81.1 % was for operating expenditure while

[1] The COVID-19 intensely damaging effects the Malaysia macroeconomy and economic welfare of the societies. The government of Malaysia imposed the PRIHATIN package purposely to support income during the moving control order (MCO) and to kick-start the economy after the restriction are lighted (www.isis.org.my).

the balance RM56 billion was for development expenditure (Ministry of Finance, 2020). The largest components of operating expenditure are emoluments, subsidies, supplies and services. The factor contributing to higher allocation for emoluments is due to annual salary increment. Supply and services are second top operation expenditure due to higher outlays for repairs and maintenance as well as an allocation for professional services. On the other hand, the development expenditure was channeled to promote economic development, upgrade basic rural infrastructure and to enhance the standard of living.

Theoretically, government expenditure is able to affect environmental pollution in several ways (Lopez et al., 2011; Lopez & Islam, 2008). First is through scale effect. The scale effect is a condition when the increase in government spending generate more economic activities and creates more pollution. Second is through composition effect. The composition effect is the consequences of better education level and skill that raise the share of cleaner human capital-intensive activities relative to the share of dirtier physical capital-intensive activities. Third, more fiscal spending on R & D can result in a higher adoption rate of cleaner technology by firms that reduces the pollution-output ratio (a technique effect). Finally, private income raised by public-good expenditures leads to higher demand for a cleaner environment and more stringent regulations (an income effect).

Existing empirical studies on the effect of GSE on environmental quality/pollution is still limited. Lopez & Palacios (2010) examine whether GSE makes the environmental quality cleaner in Europe. The results conclude that total government expenditure has a negative relationship with air pollution. Then, Lopez et al. (2011) specify the purpose of GSE, which is the reallocation of GSE towards social and public goods and revealed both allocations significantly reduce the sulfur dioxide (SO_2) emissions. However, increasing the total government size without changing its orientation has a non-positive impact on environmental quality. Halkos & Paizanos (2013) investigate how GSE effected a different kind of pollution and revealed the GSE have a negative direct effect on SO_2 and a non-linear relationship between government expenditure and CO_2 emissions. Precisely, at the low-income level, the increase in GSE scale down the CO_2 emissions and scale up at a high-income level. Similar to Halkos & Paizanos (2013), Zhang et al. (2017) investigate the impact of GSE on emissions of three typical pollutants in China. They found that the total effect of GSE on SO_2, soot, and chemical oxygen demand (COD) are different. The effect on SO_2 is negative, while the effect on soot and COD are inverted U-shaped and U-shaped, respectively. Also, the proportion of GSE does not have a significant effect on pollution emissions. Huang (2018) pays attention to SO_2 emissions and measure the change in these emissions as a result of the changes in China's government spending. The main findings of this study are that SO_2 emissions can be effectively reduced by government spending on environmental protection. Xie & Wang (2019) evaluate the efficacy of government spending on air pollution control in Beijing, China and found the government expenditure has a noticeable influence on the improvement of air quality. Based on the above review, this study can conclude that the interaction between GSE is different according to the types of pollution.

Furthermore, Adewuyi (2016) examined the impact of GSE on aggregate and sectoral CO_2 emissions in world economies during the 1990–2015 period and found the rise in GSE raised the CO_2 emission. Halkos & Paizanos (2016) analysed the effect of fiscal policy on CO_2 emissions in the USA and discovered the increase in GSE reduces emissions from production and consumption. Hua et al. (2018) investigated if education spending affects air pollution in China. The regional analysis demonstrates that the effects of education spending are relatively pervasive, while the effects of R & D spending are scarcely identified. Environmental return of education spending appears to be the highest in the eastern cities and diminishes as we move towards the inland area. Insofar, most of the studies mentioned above were tested in China, Europe, and the USA. While in Malaysia, the relationship study between these two variables is still at the infant stage. Due to that, this study intends to contribute to the existing literature by first investigating the existing dynamic relationship between CO_2 emissions (proxy to environment quality) and GSE. The uniqueness of this study holds due to dynamic analysis by assuming that the effect of GSE on CO_2 emissions is not instantaneous. So, it needs time lags to influence CO_2 emissions.

Hypothesis Development

Based on the background theory, past studies and to get to the bottom of the aim of this study, the following hypotheses are formulated:

H_{11}: Significant co-integration relationship exists between CO_2 Emissions and its determinants in Malaysia.
H_{12}: CO_2 Emissions has a significant relationship with GSE in Malaysia.

Data, Empirical model, and methodology

Data

The assessing of the interaction between the CO_2 Emissions and GSE, the yearly data of the CO_2 Emissions (EQ), government consumption expenditure (GSE), GDP (Y) and population (POP) are employed. All data are obtained from World Development Indicator (WDI)", issued by the "World Bank" which covers the years from 1971 to 2019.

Empirical Model and Methodology

In order to explore the effect of socio-economic activities on pollution emissions, Enlich and Holdren (1971) were first introduced to the IPAT model. Then, Dietz and Rosa (1994, 1997) modified the model into a stochastic form known as the STIRPAT (Stochastic Estimation of Impact by Regression on Population, Affluence, and Technology) in order to allow for random errors in the parameter estimation. Then, equation one is used:

$$I = \alpha 1\ P^{\alpha 2}\ A^{\alpha 3}\ T^{\alpha 4} \qquad [1]$$

where I denote environment impact, P, A, T refer to population, affluence and technology respectively. In this study, the environmental impact indicator (CO_2 Emissions), population (number of populations), affluence (GDP) and technology (GSE), are applied. In this case, the GSE is used to represent the technology, due to its ability to upgrade and improve productivity, impede the long-term growth and enhancing the standard of living. Likewise, the α_is [i=1,2,3,4] are coefficients. In order to measure the objectives and assess the importance of each impact factor, the STIRPAT model is transformed to linear form by applying a logarithm technique (Zhang & Zhao, 2019) as per equation [2]:

$$\ln I_t = \ln\alpha_1 + \alpha_2 \ln P_t + \alpha_3 \ln A_t + \alpha_4 \ln T_t + \varepsilon \qquad [2]$$

where the α_i [i=1,2,3,4] are the elasticities of the explaining variables that also indicate a positive impact on the environmental quality, and vice versa. The larger the elasticity coefficient, the larger the impact on CO_2 Emissions (Xu et al., 2020). For further investigating and following the EKC hypothesis, this study adds a quadratic form of A on equation [2] as shown in equation [3]:

$$\ln I_t = \ln\alpha_1 + \alpha_2 \ln P_t + \alpha_3 \ln A_t + \alpha_5 \ln A^2_t + \alpha_4 \ln T_t + \varepsilon \qquad [3]$$

The EKC hypothesis applies if the inverted U-shaped relationship exists between environmental quality and GDP ($\alpha_3 > 0$; $\alpha_5 < 0$). Conversely, if $\alpha_3 < 0$; $\alpha_5 > 0$, a U-shaped relationship between environmental quality and GDP exists. Figure 3 has summarized the econometric procedures used to test the hypotheses and to achieve the objectives of this study (for detail, see Bekhet & Othman, 2017, 2018).

Findings:
ADF test is utilized to measure the integrated degree, and the results are presented in Table 1. It shows that all variables are substantially stationary [*I*(1)] at 1% except for lnP. These results are consistent with most of the previous studies that employed financial and macroeconomics variables (Bekhet & Othman, 2011; Bekhet & Othman, 2018).

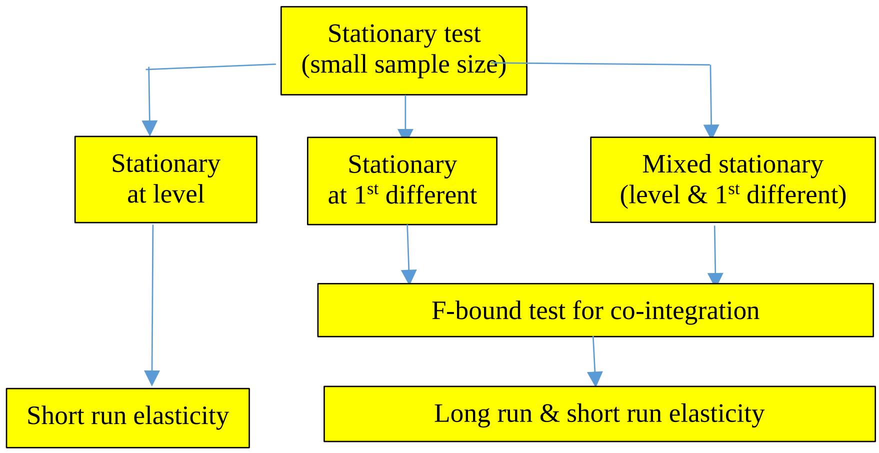

Figure 3. Estimation Procedure

Table 1: Result of stationary test

Variable	Level	ADF statistic	Critical value 1%	Critical value 5%	Critical value 10%	Decision
lnI	*I*(0)	-1.44	-3.57	-2.92	-2.59	I(1)
	I(1)	-7.67***				
lnP	*I*(0)	-2.92**				I(0)
	I(1)	-2.31				
lnA	*I*(0)	-2.03				I(1)
	I(1)	-5.17***				
lnT	*I*(0)	-0.94				I(1)
	I(1)	-3.79***				

"Note: ***, **, and * indicate 1%, 5%, and 10% level of significant respectively. Type of test= ADF statistic".
"Source: Output of EVIEWS package version 10".

Due to the combination of *I*(0) and *I*(1) level of stationarity and the sample size being relatively small (n=49), the most appropriate method to measure co-integration relationship is the F-bounds assessment. Nevertheless, before proceeding with the co-integration assessment, it is

essential to ascertain the optimum lag extent to be applied in the F-bounds assessment (Sugiawan & Managi, 2016). Utilizing the "Akaike information criterion (AIC)", the optimum lag extent for the current paper is 4 (refer to the appendix for details).
Table 2 presents the results of F-Bound test. The empirical findings show the presence of long-run relationships between variables for all models at 5% significant level over the 1971–2019 period. This is because the calculated F-statistic for each model is higher than the upper bound critical value at 5 % level of significance.

Table 2: Results of F − Bounds test

Model	F-Stat.	Critical Value			Decision
		Level	I(0)	I(1)	
Model 1: lnI/ lnP,lnA,lnA^2,lnT	4.677***	10%	2.538	3.398	Co-integrated
Model 2: lnP/ lnI,lnA,lnA^2,lnT	7.781***	5%	3.048	4.002	Co-integrated
Model 3: lnA/ lnI,lnP,lnA^2,lnT	10.956***	1%	4.188	5.328	Co-integrated
Model 4: lnT/ lnI,lnP,lnA^2,lnA	3.768**				Co-integrated

"Note: ***, **, and * indicate 1%, 5%, and 10% level of significant respectively. Type of test= F-bound test".
"Source: Output of EVIEWS package version 10".

Concerning the above findings, the error correction model has been formulated to measure the long-run elasticities between CO_2 Emissions, GDP, population and GSE. The estimated results are demonstrated in Table 3. It shows that lnA and quadratic form of lnA have a significant positive and a negative impact on lnI, respectively. This means that the long-run relationship between lnA and lnI is not linear, which confirms the existence of EKC theory. This result could be attributed with Grossman and Krueger (1991), where they found a non-linear relation between CO_2 Emissions and economic growth which is an inverted U-shaped relationship.
On the other hand, the role of GSE and population is found insignificant in influencing the GDP and CO_2 Emissions relationship in the long-run. As regards the short-run scenario, none of the variables has a significant impact on lnI. So, it indicates that EKC does not exist in the short run. A negative sign of ECM coefficient indicates that 52.7 % of adjustment takes place towards the long-run equilibrium over the years. This finding is consistent with many scholars in this area where the EKC is a long run phenomenon.

Table 3: Long-run and Short-run Elasticities

Variables	Level Equation Case 2: Restricted Constant and No Trend		
	Coefficient	**t-Statistic**	**Prob.**
Long -Run			
lnA	3.681	2.307	0.030
lnA^2	-0.269	-1.777	0.088
lnT	-0.621	-1.207	0.239
lnP	2.648	1.447	0.161
C	-11.790	-2.265	0.033
Short-run			
ΔlnA	3.395	0.620	0.540
ΔlnA^2	-1.621	-0.318	0.752
ΔlnT	-22.284	-1.106	0.298
ΔlnP	24.42	1.153	0.260
ECT(-1)	-0.527	-5.845	0.000

$ECT = lnI - (3.6816*lnA \ -0.2699*lnA^2 \ -0.6212*lnT + 2.6488*lnP \ -11.7907)$

The robustness of the model has been confirmed by several diagnostic tests presented in Table 4. All tests demonstrated that the model has the desired econometric properties, namely the residuals are normally distributed, serially uncorrelated, homoscedastic, and it has a correct functional form (Law, 2008).

Table 4: Residual Diagnostic Checking via Reliability Test

Test	**F-Stat/ Probability**	**Decision**
Normality test	0.942 (0.624)	H_0: Normal distributed
Breusch-Godfrey Serial Correlation test	2.281 (0.126)	H_0: No serial correlation
ARCH-Heteroscedasticity test	0.363 (0.549)	H_0: No Heteroscedasticity
Ramsey RESET test	0.002 (0.957)	H_0: Model have a correct functional form.

Furthermore, the stability tests of the coefficients were examined by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). Figure 4 reports that CUSUM and CUSUMSQ curves remain within the critical boundaries of the 5 % significance level. These statistics properties specify the stability of both the long-run and short-run coefficients in the error correction model.

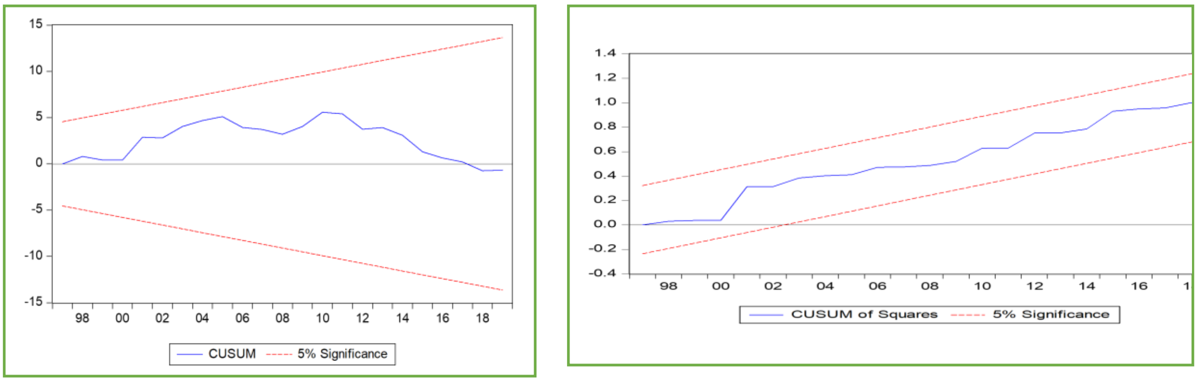

Figure 4: Stability test

Conclusion and Policy Implication

This study focused on observing the impact of government expenditures on environmental quality in Malaysia for 1971-2019 period. To do so, the stochastic impacts by regression on population, affluence, and technology (STIRPAT) model in the EKC framework is utilized. In terms of methodology, this study employed the ARDL F-bound test to assess the existence of the co-integration relationship, the short-run, and long-run impact, respectively.

Empirical results show the existence of co-integration relationship among CO_2 emissions, GDP and Malaysia's government expenditure (GSE). Furthermore, in the long run, the results confirmed the significant inverted U-shaped relationship between CO_2 emissions and GDP. However, the GSE did not directly contribute to the reduction in carbon emissions. These results highlight the understanding that Malaysia is currently in the process towards environment sustainability due to the existence of the EKC hypothesis in Malaysia. However, the GSE is not directly contributed to environmental sustainability. As one of major component of GSE, this finding indicates that the government spending on education, and R&D did not function well in stimulating the level of productivity.

Therefore, the government of Malaysia should formulate a clear direction of its operation and development expenditure. For instance, rather than supporting the welfare of the societies, the government of Malaysia should consider on how the allocation of money (e.g., emoluments, supplies and services, education/training, housing and health) benefited the quality of the environment via improving Malaysian attitude, behavior, and awareness on environmental issues. The education fund should be allocated more to the school management which has successfully proven that it can build student awareness and positive attitude towards green purchasing, energy efficiency, energy saving, and green technology. Also, the government of Malaysia should increase the allocation for R & D in energy efficiency and renewable energy product, and the green technologies accessible to all citizens no matter where they are located in rural and urban area.

Acknowledgments [if any]

The authors would like to acknowledge **IRMC UNITEN** for awarding **BOLD grant** (*RJO 10517844/029*) for funding this research.

References

Adewuyi, A. O. (2016). Effects of public and private expenditures on environmental pollution: A dynamic heterogeneous panel data analysis. Renewable and Sustainable Energy Reviews. 65, 489-506.

Al-Mulali, U., Saboori, B., & Ozturk, I. (2015). Investigating the Environmental Kuznets Curve Hypothesis in Vietnam. *Energy Policy*, 76, 123–131.

Law, S.H. (2008). Does a country's Openness to Trade and Capital Accounts Lead to Financial Development: Evidence from Malaysia. Asian Economic Journal. 22(2), 161-177.

Bekhet, H.A., & Othman, N.S. (2018). The Role of Renewable Energy to Validate Dynamic Interaction Between CO_2 Emissions and GDP Toward Sustainable Development in Malaysia. *Energy Economics*. 72, 47–61.

Bekhet, H.A., & Othman, N.S. (2017). Impact of Urbanization Growth on Malaysia CO_2 emissions: Evidence from the Dynamic Relationship. *Journal of Cleaner Production*. 154, 374-388.

Bekhet, H.A., & Othman, N.S. (2012). Examining the Role of Fiscal Policy in Malaysian Stock Market. International Business Research; 5(12), 59-67.

Bekhet, H.A., & Latif, N.W.A. (2018). The impact of technological innovation and governance institution quality on Malaysia's sustainable growth: Evidence from a dynamic relationship. *Technology in Society*. xxx, 1-14. (in press)

Bekhet, H.A., & Othman, N.S. (2011). Assessing the Elasticities of Electricity Consumption for Rural and Urban Areas in Malaysia: A Non-linear Approach *International Journal of Economics and Finance*, 3(1), 208-217.

Bekhet, H. A., & Yasmin, T. (2013). Disclosing the Relationship among CO_2 Emissions, Energy Consumption, Economic Growth and Bilateral Trade between Singapore and Malaysia: An Econometric Analysis. *World Academy of Science, Engineering and Technology, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, *7*(9), 2529-2534.

Begum, R.A., Sohag, K., Abdullah, S.M.S., & Jaafar, M. (2015). CO_2 Emissions, Energy Consumption, Economic and Population Growth in Malaysia. *Renewable and Sustainable Energy Reviews*. 41, 594–601.

Clemens, J., & Veuger, S. (2020). *Implications of the COVID-19 Pandemic for State Government Tax Revenues* (No. w27426). National Bureau of Economic Research.

Dietz, T., & Rosa, E. A. (1994). Rethinking the environmental impacts of population, affluence and technology. *Human ecology review*, *1*(2), 277-300.

Dietz, T., & Rosa, E. A. (1997). Effects of Population and Affluence on CO2 Emissions. Natl. Acad. Sci. U.S.A, 94, 175-179.

Dogan, E., & Ozturk, I. (2017). The influence of renewable and non-renewable energy consumption and real income on CO 2 emissions in the USA: evidence from structural break tests. *Environmental Science and Pollution Research. 24*(11), 10846-10854.

Ehrlich, P.R., & Holdren, J.P. (1971). Impact of Population Growth. Science 171, 1212-1217.

Grossman, G.M., & Krueger, A.B. (1991). Environmental Impacts of a North American Free Trade Agreement. *NBER working paper* (Vol. 3914).

Halkos, G., & Paizanos, E. (2013). The effect of government expenditure on the environment: an empirical investigation. Ecol. Econ. 91, 48–56.

He, Z., Xu, S., Shen, W., Long, R., & Chen, H. (2017). Impact of Urbanization on Energy related CO_2 Emissions at Different Development Levels: Regional difference in China based on Panel Estimation. *Journal of Cleaner Production*. 140, 1719-1730.

Hua, Y., Xie, R., & Su, Y. (2018). Fiscal spending and air pollution in Chinese cities: Identifying composition and technique effects. China Economic Review, 47, 156-169.

Huang, J-T. (2018). Sulfur dioxide (SO2) emissions and government spending on environmental protection in China - Evidence from spatial econometric analysis. Journal of Cleaner Production. 175, 431-441.

Islam, A. M., & López, R. E. (2013). *Government spending and air pollution in the US* (No. 1667-2016-136314).

Jalil, M.A. (2010). Sustainable Development in Malaysia: A Case Study on Household Waste Management, *Journal of Sustainable Development*, 3, 91-102.

Juraschek, M., Bucherer, M., Schnabel, F., Hoffschröer, H., Vossen, B., Kreuz, F., ... & Herrmann, C. (2018). Urban factories and their potential contribution to the sustainable development of cities. *Procedia Cirp*, *69*, 72-77.

Lopez, R., Galinato., G., & Islam, A. (2011). Fiscal Spending and the Environment: Theories and Empirics. Journal of Environmental Economic and Management, 62, 180-198.

Lopez, R. E., & Palacios, A. (2010). *Have government spending and energy tax policies contributed to make Europe environmentally cleaner?* (No. 1667-2016-136345).

López, R.E., Thomas, V., & Wang, Y. (2010). The effect of fiscal policies on the quality of growth. Evaluation Brief 9. Independent Evaluation Group, The World Bank, Washington, D.C., U.S.A

Lopez, R., & Islam, A. (2008). Whwn Government Spending Serve the Elites. Consequences for Economic Growth In the Context of Market Imperfection. University of Marryland at College Park. Working Paper. 8-11.

Martinez-Zarzoso, I., & Maruotti. (2011). The Impact of Urbanization on CO_2 Emissions: Evidence from Developing Countries, *Ecological Economics*, 70, 1344-1353.

Ministry of Finance (2020). Fiscal Updates 2019. https://www.treasury.gov.my/index.php/en/fiscal-economy/fiscal-updates.html

Mrabet, Z., & Alsamara, M. (2017). Testing the Kuznets Curve Hypothesis for Qatar: A Comparison between Carbon Dioxide and Ecological Footprint. *Renewable and Sustainable Energy Reviews*, 70, 1366–1375.

Ozturk, I. & Al-Mulali,U. (2015). Investigating the Validity of the Environment Kuznets Curve Hypothesis in Cambodia. *Ecological Indicator*, 57, 324-330.

Shahzad, S.J.H., Kumar, R.R., Zakaria, M., & Hurrh, M. (2017). Carbon Emission, Energy Consumption, Trade Openness and Financial Development in Pakistan: A Revisit. *Renewable and Sustainable Energy Reviews*. 70, 185–192.

Sugiawan, Y., & Managi, S. (2016). The Environmental Kuznets Curve in Indonesia: Exploring the Potential of Renewable Energy. *Energy Policy*. 98, 187–198.

Sadorsky, P. (2014). The Effect of Urbanization On CO_2 Emissions in Emerging Economies, *Energy Economics*, 41, 147-153.

World Bank (2020). World Development Indicators. Retrieved from https://data.worldbank.org/indicator. (Accessed on 16th September, 2020).

Ministry of Finance (2020). Fiscal Updates 2019. Retrieves from https://www.treasury.gov.my/?lang=en. (Accessed ob 16th September, 2020).

Xie, X., & Wang, Y. (2019). Evaluating the Efficacy of Government Spending on Air Pollution Control: A Case Study from Beijing. *International journal of environmental research and public health*, *16*(1), 45.

Xu, F., Huang, Q., Yue, H., He, C., Wang, C., & Zhang, H. (2020). Reexamining the Relationship between Urbanization and Pollutant Emissions in China based on the STIRPAT Model. Journal of Environmental Management. 273, 111134.

Zhang, Q., Zhang, S., Ding, Z., & Hao, Y. (2017). Does government expenditure affect environmental quality? Empirical evidence using Chinese city-level data. *Journal of cleaner production*, *161*, 143-152.

Zhang, S., & Zhao, T. (2019). Identifying Major Influencing Factors of CO_2 Emissions in China: Regional Disparities Analysis Based on STIRPAT Model from 1996-2015. Atmospheric Environment. 207, 136-147.

Appendix

VAR Lag Order Selection Criteria
Endogenous variables: LC LPOP LG LY LY2
Exogenous variables: C
Date: 09/19/20 Time: 11:29
Sample: 1971 2019
Included observations: 45

Lag	LogL	LR	FPE	AIC	SC	HQ
0	114.6988	NA	5.25e-09	-4.875500	-4.674760	-4.800666
1	552.7877	759.3542	5.63e-17	-23.23501	-22.03057*	-22.78601
2	589.1495	54.94673	3.54e-17	-23.73998	-21.53184	-22.91680
3	629.8634	52.47564*	1.97e-17	-24.43837	-21.22653	-23.24103*
4	661.0525	33.26846	1.88e-17*	-24.71345*	-20.49790	-23.14193

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion