Low-Carbon-Emissions Sustainable Development in Malaysia – A Myth or a Reality?

Saranya Sree Subramaniam and Goh Han-Hwa(✉)

Faculty of Management, Multimedia University, Persiaran Multimedia, 63100 Cyberjaya, Selangor Darul Ehsan, Malaysia
1181303597@student.mmu.edu.my, hhgoh@mmu.edu.my

Abstract. Will the aspirations of Malaysia to become a carbon-neutral country by 2050 be a myth or a reality? This paper is therefore timely to examine both short-run dynamics and long-run relationship between carbon emissions, renewable energy consumption, economic growth and foreign direct investment inflows in Malaysia from 1990 to 2018. Our empirical results denote that there is a negative association between renewable energy consumption and carbon emissions in Malaysia in the long run. However, economic growth and foreign direct investment inflows in Malaysia are found to be significantly affecting the carbon emissions positively in the long run. Besides, there is evidence of unidirectional short-run causalities between carbon emissions and renewable energy consumption along with renewable energy consumption and economic growth in Malaysia. In short, the empirical results of this paper support Malaysia's goal of becoming a carbon-neutral country where the use of renewable energy can significantly reduce the carbon emissions in Malaysia in the long run while promoting sustainable economic growth in the short run.

Keywords: Carbon emissions · renewable energy · sustainable economic growth · foreign direct investment inflows · Malaysia

1 Introduction

The Intergovernmental Panel on Climate Change (IPCC) (2021) showed that the global climate crisis is getting worse if human-caused greenhouse gas emissions do not decrease quickly. In a latest study by Liu et al. (2022), more costly and aggressive emission reduction actions are needed to curb the emissions growth trend and contribute to the achievement of the 1.5 degrees Celsius, or at least 2 degrees Celsius, Paris Agreement goals. As such, reducing carbon emissions and developing a low-carbon economy are essential concerns for governments. A study by Zhu et al. (2016) argued that environmental degradation is exacerbated by economic expansion and increased energy use. According to United Nations Development Programme (UNDP, 2019), 80 percent of Malaysia's total carbon emissions come from the energy sector, including electricity and transportation. In Malaysia, most of the Carbon emissions originate from the consumption of fossil fuels used to power most transport machines and industries motor

S. K. Bhar and H. Rahmat (Eds.): CLESS 2022, ASSEHR 704, pp. 275–286, 2023.
https://doi.org/10.2991/978-2-494069-61-9_26

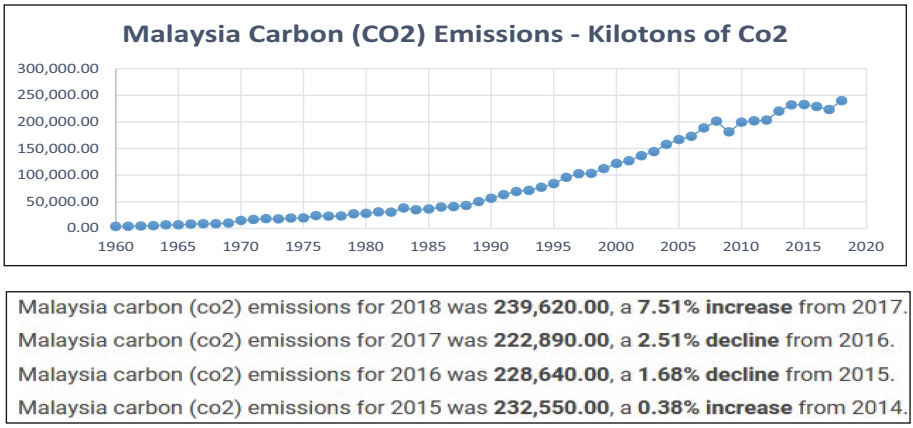

Fig. 1. Malaysia Carbon (CO_2) Emissions 1960–2018 (World Bank, 2021)

mobiles. Fossil fuel use in many sectors, such as in the home and the industrial sector, is a significant contributor to the rising CO_2 emissions (Farabi & Abdullah, 2020).

According to the World Bank, Malaysia's CO_2 emissions have been on the uptrend for the previous approximately six decades to reach 239.6 million tonnes in 2018, a dramatic increase of 7.51% from 2017, as shown in the Fig. 1. CO_2 emission is the largest source of greenhouse gas emission that constitutes about 65% of the total emission. Following the United Nations Framework Convention on Climate Change (UNFCCC) COP 26 which was held in 2021, Malaysia hopes to reduce the intensity of greenhouse gas (GHG) emission across the economy by 45% based on the Gross Domestic Product (GDP) in 2030 and aspires to achieve net-zero GHG emissions as early as 2050 (The Star, 2021a; 2021b).

In the 12th Malaysia Plan (12MP) 2021–2025, the Malaysia government has given green technology agenda a national priority to spur sustainability (The Star, 2021a; 2021b). Energy is critical to Malaysia's economic development, and any disruption in energy supply would have a significant negative impact on the country's economic progress. As exhibited in Fig. 2, the renewable energy consumption (% of total final energy consumption), starting from 1990, showed a continued decline until 2010 when the government started taking into serious consideration of the factor of climate change by implementing different approaches besides enacting policies to reduce carbon emissions due to the use of harmful non-renewable sources. At this juncture Malaysia aims to raise the renewable energy share in its installed capacity under power generation plan to 31% in 2025 and 40% in 2035 (MIDA, 2021). The aspirations of Malaysia to become a carbon-neutral country by 2050 as proposed by the present prime minister Datuk Seri Ismael Sabri Yaakob (The Star, 2021a; 2021b) that would eventually turn out to be a myth or a reality deserve an empirical examination. In other words, this paper aims to fill the gap by studying the causality between renewable energy consumption and CO_2 emissions (as the proxy for the level of pollution) in Malaysia using multivariate models.

Spurred by an acceleration of foreign direct investments (FDIs), Malaysia has sustained a swift economic growth ever since the 1990s. The FDIs nurture the capability of

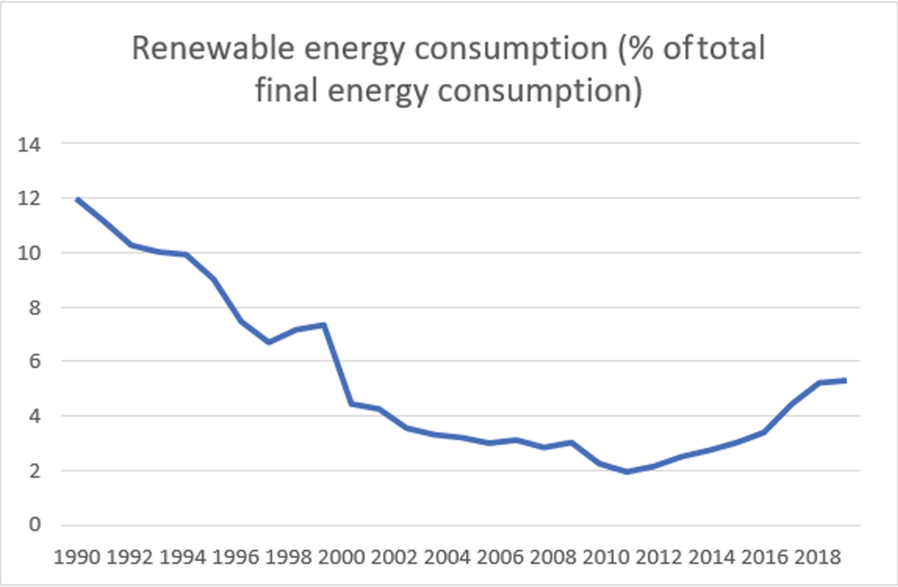

Fig. 2. Renewable energy consumption (World Bank, 2021)

export in the host country and this causes an increase in profit gains in foreign exchange by developing nations mostly. Also, FDIs are able to raise the provision of funds for domestic investments, create new job opportunities as well as reinforce the transfers of technology, and thus stimulating the economy (Dritsaki and Stiakakis, 2014). Despite the ongoing Covid-19, FDIs in Malaysia surged 223.1% year-on-year in the first half of 2021. A total of RM107.5 billion of FDIs and domestic direct investments was approved by the government in the manufacturing, service, and primary sectors during the first half of 2021, an increase of 70% over the same period in 2020 (New Straits Time, 2021). No doubt, FDIs have been playing a significant part in growing the Malaysia economy. As such, FDIs is included in this paper as one of the control variables. Nevertheless, the findings of prior researches on FDIs on CO2 emissions and environmental degradation are rather contradictory. While some researchers found that FDIs harm environment by contributing to the CO_2 emissions (Bukhari, Shahzadi & Ahmad, 2014; Fauzel, 2016; Blanco, Gonzalez & Ruiz, 2013; Bakhsh et al., 2017), others showed empirical evidence that FDIs promote environmental welfare via efficient technology for production which can subsequently help improve the country's pollution level (Pan et al., 2017; Khan et al., 2019). Given that FDI and economic growth (represented by real gross domestic product) act as the control variables in this paper, it is timely for us to investigate whether Malaysia is on the right track of advancing sustainable economic growth with low carbon emissions via the use of renewable energy to materialise its Shared Prosperity Vision to emerge as a developed country with high income by 2030.

The remainder of the paper proceeds as follows. Section 2 offers a brief discussion of related theoretical and empirical literature. Following that, Sect. 3 outlines the data

and methodology applied in this research. Section 4 demonstrates the empirical results. Finally, Sect. 5 provides concluding remarks.

2 Literature Review

In the past few decades, researchers have investigated the correlation association between sustainable growth, CO_2 emission, energy use and FDI. Saboori, Sulaiman and Saidatulakmal (2012), using granger causality test based on VECM methodology, examined the correlation between GDP and CO_2 emissions in Malaysia between 1980 and 2009 and found that CO_2 emissions and GDP had an inverted-U shape relationship. Besides, there was no causation between CO_2 emissions and GDP in the short run, but in the long run, there was unidirectional causality from GDP to CO_2 emissions. Odhiambo (2017) who employed the error-correction model (ECM)-based panel causality to assess the link between carbon emissions and GDP for 10 sub-Saharan African (SSA) countries from 1986 to 2013 discovered a negative relationship between GDP and CO_2 emissions in the long run but a positive association in the short run. The author argued that while a swift increase in the production in the short run may be accompanied by more intense energy usage by the existing technology, new low-carbon technologies were being developed which allowed for the long-term production with decreased CO_2 emissions. Mikayilov, Galeotti and Hasanov (2018) conducted a cointegration study using annual data from 1992 to 2013 in in Azerbaijan to examine the correlation between GDP and carbon emissions. Their empirical findings revealed that GDP and CO_2 emissions had a linear positive relation in the long run.

Jian et al. (2019) applied the Johansen cointegration test and the VECM to study the impact of energy utilisation on China's carbon dioxide emissions over the period of 1982 to 2017. They discovered that there was a two-way causal relationship between CO_2 emissions and energy consumption. In another study by Sasana and Putri (2018), they used multiple linear regression analysis to examine the effect of renewable energy consumption on CO_2 emissions in Indonesia from 1990 to 2014 and found out that renewable energy consumption had a negative and significant impact on CO_2 emissions in the long run. Sinha and Shahbaz (2018) conducted another study to inspect the role of renewable energy in the estimation of an environmental Kuznets curve for CO_2 emissions in India. The authors employed ARDL approach for the period of 1971 and 2015 and uncovered that renewable energy had significant negative effect on CO2 emissions in both short and long terms. Similarly, Zafar et al. (2019) used cross-sectional dependence test, second-generation panel unit root test and panel cointegration tests as well as VECM to examine the association between energy consumption and CO_2 emissions using the framework of environment Kuznets curve (EKC) for Emerging economies between 1990 and 2015. Their findings revealed that renewable energy consumption had a negative effect on CO_2 emissions. In addition, renewable energy consumption was found to Granger cause CO_2 emissions in the long run while there was a short-run causality between renewable energy and economic growth.

Blanco, Gonzalez and Ruiz (2013) employed the panel granger causality test to investigate the influence of FDI and GDP on carbon emissions in 18 Latin American countries over the sample period of 1980 to 2007. Their empirical study revealed that

FDI in the dirty sector has granger causality with the increase in carbon emissions per capita and per unit of economic development. A study by Bakhsh et al. (2017) who used the simultaneous equation model on the annual data to examine the effect of FDI on CO2 emissions in Pakistan from 1980 to 2014 found out that FDI was positively related to pollution. Besides, Bukhari, Shahzadi and Ahmad (2014) who carried out empirical research employing the Autoregressive Distributed Lag model to study the long- term consequences of FDI and capital formation on the environment in Pakistan between 1974 and 2010 argued that if the host developing economies had fewer environmental laws and regulations, the FDI enterprises from developed countries tend to be less concerned about environmental restrictions. To explore the dynamic impact of FDI on China's CO_2 emissions, Pan et al. (2017) used the Markov-Switching VECM over monthly data between January 1997 and December 2013. Surprisingly, they discovered that FDI had an inhibiting impact on China's CO_2 emissions. Another study by Khan et al. (2019) who employed ARDL model to investigate the effects of FDI, globalisation, energy utilisation on CO_2 emissions in Pakistan from 1971 to 2016. They found out that while FDI positively influenced carbon emissions in the long run, it had a negative impact on CO2 emissions in the short run. As such, they recommended that Pakistan authorities should pass the laws and regulations to encourage foreign investors to engage in green energy projects for the sake of conserving the environment while enhancing the long-term GDP.

3 Data and Methodology

The conceptual framework of regression model for this paper is shown as below:

$$CO_{2t} = f\ (RNEW_t,\ RGDP_t,\ FDI_t) \tag{1}$$

where CO_{2t} is the carbon dioxide emissions in Malaysia (dependent variable), while, renewable energy consumption of Malaysia ($RNEW_t$), real gross domestic product of Malaysia which proxies Malaysian economic growth ($RGDP_t$) and foreign direct investment inflows of Malaysia (FDI_t) are the independent variables.

All variables are expressed in the natural logarithms and the logarithmic form of functional regression model is written as follows:

$$LCO_{2t} = \beta_0 + \beta_1 LRNEW_t + \beta_2 LRGDP_t + \beta_3 LFDI_t + \mu \tag{2}$$

For this paper, we used annual data of time series from 1990 to 2018. The summary of data description is presented in Table 1.

3.1 Empirical Model

For the sake of ensuring all the time series variables are stationary either in levels or first differences, we performed the Augmented Dickey-Fuller (ADF) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root tests which are a prerequisite for conducting the cointegration test. Cointegration exists when the variables are integrated of the same order and there is a stationary linear combination of them.

Table 1. Variable definitions and source

Variable Name	Definition	Source
CO_2	CO_2 emissions (kt)	World Bank
RNEW	Renewable energy consumption (% of total final energy consumption)	World Bank
RGDP	Real gross domestic product (Constant US$)	World Bank
FDI	Foreign direct investment, net inflows (BoP, current US$)	World Bank

3.1.1 Johansen and Juselius Multivariate Cointegration Test

For this paper, we adopted the Johansen and Juselius (1990) Multivariate cointegration test to investigate whether there is a long-run relationship between the dependent variable (LCO2) and independent variables (LRNEW, LRGDP and LFDI) using trace and maximum eigenvalue statistics. This technique is superior to the bivariate cointegration test because it can be applied to multiple variables and can fully capture the underlying time series data in the equation.

3.1.2 Granger-Causality Test Within Vectors Error-Correction Modelling (VECM)

VECM is conducted if there is a long run relationship between the variables involved in the study. The long-term relationship can be determined by the Johansen and Juselius cointegration test above. The next step from here is to proceed with the test of Granger causality within VECM in order to examine the causal links among the variables in this paper. Below is the Granger Causality test within VECM:

$$\Delta LCO2_t = \alpha_1 + \gamma_1 \varepsilon_{t-1} + \sum_{i=1}^{P} \theta_{1i} \Delta LCO2_{t-i} + \sum_{i=1}^{P} \varphi_{1i} \Delta LRNEW_{t-i} + \sum_{i=1}^{P} \beta_{1i} \Delta LRGDP_{t-i} + \sum_{i=1}^{P} \delta_{1i} \Delta LFDI_{t-i} + \mu_{1t} \tag{3}$$

$$\Delta LRNEW_t = \alpha_2 + \gamma_2 \varepsilon_{t-1} + \sum_{i=1}^{P} \theta_{2i} \Delta LCO2_{t-i} + \sum_{i=1}^{P} \varphi_{2i} \Delta LRNEW_{t-i} + \sum_{i=1}^{P} \beta_{2i} \Delta LRGDP_{t-i} + \sum_{i=1}^{P} \delta_{2i} \Delta LFDI_{t-i} + \mu_{2t} \tag{4}$$

$$\Delta LRGDP_t = \alpha_3 + \gamma_3 \varepsilon_{t-1} + \sum_{i=1}^{P} \theta_{3i} \Delta LCO2_{t-i} + \sum_{i=1}^{P} \varphi_{3i} \Delta LRNEW_{t-i} + \sum_{i=1}^{P} \beta_{3i} \Delta LRGDP_{t-i} + \sum_{i=1}^{P} \delta_{3i} \Delta LFDI_{t-i} + \mu_{3t} \tag{5}$$

$$\Delta LFDI_t = \alpha_4 + \gamma_4 \varepsilon_{t-1} + \sum_{i=1}^{P} \theta_{4i} \Delta LCO2_{t-i} + \sum_{i=1}^{P} \varphi_{4i} \Delta LRNEW_{t-i} + \sum_{i=1}^{P} \beta_{4i} \Delta LRGDP_{t-i} + \sum_{i=1}^{P} \delta_{4i} \Delta LFDI_{t-i} + \mu_{4t} \tag{6}$$

where $LCO2_t$ is the logarithmic form of carbon dioxide emissions in Malaysia at time t, $LRNEW_t$ is the logarithmic form of renewable energy consumption of Malaysia at time t, $LRGDP_t$, is the logarithmic form of real gross domestic product of Malaysia (a proxy of Malaysian economic growth) at time t, $LFDI_t$ is the logarithmic form of foreign direct investment inflows of Malaysia at time t, α is the intercept, θ, φ, β and δ are the coefficients of the independent variables of the regression, γ is the error correction coefficient, ε_{t-1} is the error correction term and μ is an error term of the regression.

Table 2. Result of Unit Root Tests

ADF Test				
	Level		**First Difference**	
	Intercept	**Trend & Intercept**	**Intercept**	**Trend & Intercept**
LCO2	−2.6059 (6)	−1.7871 (0)	−4.7469 (0)***	−5.5094 (1)***
LRNEW	−1.8200 (0)	−0.4465 (0)	−3.7607 (0)***	−4.6093 (0)***
LRGDP	−2.5786 (2)	−2.1202 (0)	−3.0710 (1)**	−3.9559 (1)**
LFDI	−2.5990 (2)	−3.1817 (2)	−6.4422 (1)***	−6.3227 (1)***
KPSS Test				
	Level		**First Difference**	
	Intercept	**Trend & Intercept**	**Intercept**	**Trend & Intercept**
LCO2	0.7132 (4)**	0.2004 (4)**	0.3898 (14)	0.0311 (0)
LRNEW	0.4860 (4)**	0.1672 (4)**	0.3374 (8)	0.1320 (5)
LRGDP	0.7667 (4)***	0.1521 (4)**	0.4181 (8)	0.0771 (0)
LFDI	0.5518 (2)**	0.1507 (12)**	0.0248 (0)	0.0211 (0)

Notes: Figures in () are the lag lengths. Asterisks (*), (**) and (***) denote significance at 10%, 5% and 1% levels, respectively.

4 Empirical Results

First of all, unit root test has been conducted to check the stationary of all variables. This study conducted ADF and KPSS Unit Root Test to check the stationary between variables at levels and first differences.

Based on the results shown in Table 1, both Augmented Dickey-Fuller (ADF) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests indicate that all the time series variables for the paper are non-stationary at their levels but stationary at their first difference, or I(1) variables. Since all the time series variables are integrated in the same order of 1, I(1), the study proceeds to analyse the cointegration between the variables using Johansen and Julius Cointegration Test.

The Johansen and Juselius (1990) cointegration test as shown in Table 2 via trace and maximum eigenvalue tests validated that there is only one cointegrated relationship among the time series variables in the model. In other words, there is a long-run linear equilibrium between carbon dioxide emissions in Malaysia (LCO2) and renewable energy consumption of Malaysia (LRNEW), real gross domestic product of Malaysia (a proxy of Malaysian economic growth) (LRGDP) as well as foreign direct investment inflows of Malaysia (LFDI).

$$\begin{gathered} \mathrm{LCO2_t} = -16.0089 - 0.2413\mathrm{LRNEW_t} + 0.4680\mathrm{LRGDP_t} + 0.7227\mathrm{LFDI_t} \\ t - stat\ [-1.650]* [1.865]* [8.151] * ** \end{gathered} \tag{7}$$

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

Table 3. Result of Johansen and Juselius Cointegration Test

Trace Test: LCO2, LRNEW, LRGDP, LFDI (k = 2, r = 1)			
H_0	H_1	λ-trace	95% CV
r = 0	r ≥ 1	60.13744**	47.85613
r ≤ 1	r ≥ 2	19.19745	29.79707
r ≤ 2	r ≥ 3	6.829658	15.49471
r ≤ 3	r ≥ 4	0.437957	3.841465
Maximum Eigenvalue Test: LCO2, LRNEW, LRGDP, LFDI (k = 2, r = 1)			
H_0	H_1	λ-max	95% CV
r = 0	r = 1	40.94000**	27.58434
r ≤ 1	r = 2	12.36779	21.13162
r ≤ 2	r = 3	6.391702	14.26460
r ≤ 3	r = 4	0.437957	3.841465

Notes: Asterisk (**) denotes significant at 5% level, k is the number of lag and r is the number of cointegration vector. The null hypothesis of r = 0 is rejected at 5% significant level against its alternative r = 1, However, the hypothesis of r < 1 cannot be rejected at the same level of significance.

The long-run estimates are shown in Eq. (7). The independent variables of LRGDP and LFDI are found to be significantly positively related to while LRNEW negatively related to the dependent variable, LCO2. For every 1% increase in the renewable energy consumption of Malaysia (LRNEW), carbon dioxide emissions in Malaysia (LCO2) will reduce by 0.2413%. Meanwhile, for every 1% growth in the real gross domestic product of Malaysia (LRGDP), the carbon dioxide emissions in Malaysia (LCO2) will go up by 0.4680%. With regard to the foreign direct investment inflows of Malaysia (LFDI), for every 1% growth in the LFDI, the carbon dioxide emissions in Malaysia (LCO2) will increase by 0.7227%.

Our empirical results showed that the renewable energy consumption of Malaysia (LRNEW) significantly influenced carbon dioxide emissions in Malaysia (LCO2) negatively in the long run. This result is consistent with prior researches (Sasana & Putri, 2018; Sinha & Shahbaz, 2018; Zafar et al., 2019) who discovered that renewable energy use has a negative long-term association with carbon emissions. Besides, one of the empirical findings of this paper revealed that the real gross domestic product of Malaysia (LRGDP) and carbon dioxide emissions in Malaysia (LCO2) has a linear positive relation in the long run is supported by a study of Mikayilov, Galeotti and Hasanov (2018). Finally, the result of a positive long-run association between foreign direct investment inflows of Malaysia (LFDI) and carbon dioxide emissions in Malaysia (LCO2) is also consistent with the similar outcomes of previous studies, such as Bakhsh et al. (2017), Bukhari, Shahzadi and Ahmad (2014), Khan et al. (2019) (Table 4).

Table 3 shows the Granger causality results based on the Vectors Error Correction Modeling (VECM). We found that the error-correction coefficients (ECT) for LCO2

Table 4. Granger Causality Tests Results

Dependent Variables	χ^2-statistic (p-value)				ECTs	
	ΔLCO2	**ΔLRNEW**	**ΔLRGDP**	**ΔLFDI**	**Coefficient**	**t-statistic**
ΔLCO2	–	0.031 (0.859)	0.495 (0.481)	0.039 (0.841)	−0.046	−1.665*
ΔLRNEW	6.5793 (0.010)**	–	1.585 (0.207)	0.022 (0.879)	−0.237	−3.068***
ΔLRGDP	0.113 (0.736)	2.833 (0.092)*	–	0.616 (0.432)	0.040	1.790*
ΔLFDI	1.861 (0.172)	0.901 (0.342)	0.942 (0.331)	–	1.914	3.066***

Notes: Asterisks (*), (**) and (***) denote significant at 10%, 5% and 1% levels, respectively. Δ is the first difference operator.

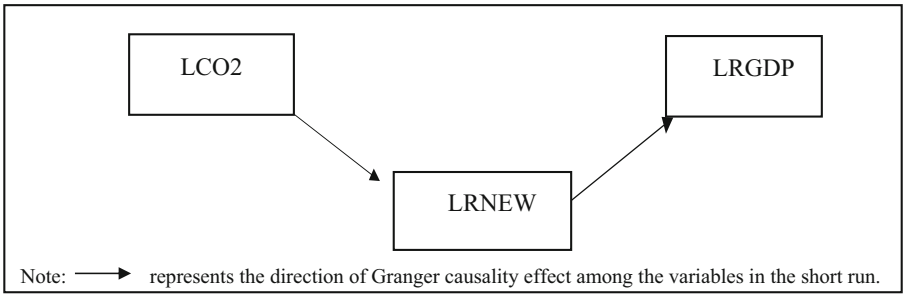

Fig. 3. The Short-run Granger Causality Effect

is statistically significant at 10% with a negative value, indicating the correct sign as expected. The ECT value of −0.046 implies that about 4.6% of the short run deviations in the LCO2 would be adjusted in annual basis in order to reach the long run equilibrium state. In other word, there is a relatively slow adjustment to correct disequilibrium among the factors affecting CO_2 emissions in Malaysia. The results demonstrate that there are short-run unidirectional granger causalities running from the carbon dioxide emissions in Malaysia (LCO2) to the renewable energy consumption of Malaysia (LRNEW), and from the renewable energy consumption of Malaysia (LRNEW) to the real gross domestic product of Malaysia (LRGDP), which is exhibited in the Fig. 3. The short-run causal relationship between renewable energy consumption and CO_2 emissions is consistent with the studies of Jian et al. (2019) and Sinha and Shahbaz (2018). Besides, the finding of the short-run causality link between renewable energy consumption and economic growth is also supported by the study of Odhiambo (2017).

5 Conclusion

The present paper used multivariate cointegration approach and Granger causality methodology to examine the association between carbon emissions, renewable energy consumption, economic growth and foreign direct investment inflows in Malaysia from 1990 to 2018. The empirical findings based on these tests demonstrate that the renewable energy consumption is negatively related to the Malaysia's carbon emissions where an increase in the use of renewable energy will result in a reduction in carbon emissions, while economic growth and foreign direct investment inflows have significantly positive effects on the carbon emissions in Malaysia in the long run. Besides, there is a unidirectional short-run causality between carbon emissions and renewable energy consumption along with renewable energy consumption and economic growth in Malaysia.

The policy implications are clear. Understanding the relationship and direction of causality between carbon emissions, renewable energy consumption, economic growth and foreign direct investment for both short term and long term is crucial for designing appropriate and comprehensive national energy policy that is able to give a long-term strategic direction supporting Malaysia's goal of becoming a carbon-neutral country. From this paper, the findings exhibit that the use of renewable energy can significantly reduce the carbon emissions in Malaysia in the long run while promoting sustainable economic growth in the short run. Therefore, the government should speed up the transition to green connection by enhancing the usage of renewable energy, such as floating solar, large-scale hydro and waste-to-energy projects which are common and increasingly popular in developed nations to help their countries fulfil the renewable energy goals. Furthermore, policymakers should also enhance funding for renewable energy sources and increase spending on research and development of greener technologies to boost the motivation of creating and innovating ecofriendly tools.

Additionally, the findings of the paper also showed that foreign direct investment has a positive impact on CO_2 emission in the long run. Hence, the government needs to implement relevant policies to reduce CO2 emissions resulting from foreign direct investment. For instance, while the government may encourage local firms to invest in environmentally friendly technologies via tax exemptions, the tax exclusions can also be made valid for foreign investors looking to set up subsidiaries or factories in Malaysia, with the condition that they bring in green technology that would be less harmful to the environment.

In a nutshell, the empirical results of this paper suggest that the aspirations of Malaysia to become a carbon-neutral country by 2050 would be a reality and not a myth provided that the policymakers are determined to design some policies and adopt proactive approaches as mentioned above to intensify energy efficiency via the use of renewable energy for the sake of promoting a low-carbon emission sustainable economic development in Malaysia.

References

Bakhsh, K., Rose, S., Ali, M. F., Ahmad, N., & Shahbaz, M. (2017). Economic growth, CO2 emissions, renewable waste and FDI relation in Pakistan: New evidences from 3SLS. *Journal of environmental management*, *196*, 627-632. https://doi.org/10.1016/j.jenvman.2017.03.029

Blanco, L., Gonzalez, F., & Ruiz, I. (2013). The impact of FDI on CO2 emissions in Latin America. *Oxford Development Studies*, *41*(1), 104-121. https://doi.org/10.1080/13600818.2012.732055

Bukhari, N., Shahzadi, K., & Ahmad, M. S. (2014). Consequence of FDI on CO2 emissions in case of Pakistan. *Middle-East Journal of Scientific Research*, *20*(9), 1183-1189. https://doi.org/10.5829/idosi.mejsr.2014.20.09.13595

Dritsaki, C., & Stiakakis, E. (2014). Foreign direct investments, exports, and economic growth in Croatia: A time series analysis. *Procedia Economics and Finance*, *14*, 181-190.

Farabi, A., & Abdullah, A. (2020). Environmental Degradation in Indonesia and Malaysia: The Effect of Energy Consumption, Economic Growth, Population, and Foreign Direct Investment (FDI). *Jurnal Manajemen Teori dan Terapan*, *13*(2), 160–177.https://doi.org/10.20473/jmtt.v13i2.19483

Fauzel, S. (2016). Modeling the relationship between FDI and financial development in small island economies: A PVAR approach. *Theoretical Economics Letters*, *6*(3), 367–375. https://doi.org/10.4236/tel.2016.63041

Intergovernmental Panel on Climate Change Climate Change (2021, August 9). *Widespread, Rapid, And Intensifying*. IPCC. https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/

Jian, J., Fan, X., He, P., Xiong, H., & Shen, H. (2019). The effects of energy consumption, economic growth and financial development on CO2 emissions in China: A VECM approach. *Sustainability*, *11*(18), 4850. https://doi.org/10.3390/su11184850

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and statistics*, *52*(2), 169-210.

Khan, M. K., Teng, J. Z., Khan, M. I., & Khan, M. O. (2019). Impact of globalization, economic factors and energy consumption on CO2 emissions in Pakistan. *Science of the total environment*, *688*, 424–436.https://doi.org/10.1016/j.scitotenv.2019.06.065

Liu, Z., Deng, Z., Davis, S. J., Giron, C., & Ciais, P. (2022). Monitoring global carbon emissions in 2021. *Nature Reviews Earth & Environment*, 1–3.

MIDA, 2021. Malaysia aims 31% RE capacity by 2025. Retrieved on March 18, 2022 from https://www.mida.gov.my/mida-news/malaysia-aims-31-re-capacity-by-2025/

Mikayilov, J. I., Galeotti, M., & Hasanov, F. J. (2018). The impact of economic growth on CO2 emissions in Azerbaijan. *Journal of cleaner production*, *197*, 1558-1572. https://doi.org/10.1016/j.jclepro.2018.06.269

New Straits Time, 2021. Malaysia's FDI surges 223pct in first six months: Azmin Ali. Retrieved on March 18, 2022 from https://www.nst.com.my/business/2021/10/736524/malaysias-fdi-surges-223pct-first-six-months-azmin-ali

Odhiambo, N. M. (2017). CO2 emissions and economic growth in sub-Saharan African countries: A panel data analysis. *International Area Studies Review*, *20*(3), 264-272. https://doi.org/10.1177/2233865917715943

Pan, X., Zhang, J., Li, C., Quan, R., & Li, B. (2018). Exploring dynamic impact of foreign direct investment on China's CO_2 emissions using markov-switching vector error correction model. *Computational Economics*, *52*(4), 1139-1151. https://doi.org/10.1007/s10614-017-9745-x

Saboori, B., Sulaiman, J., & Mohd, S. (2012). Economic growth and CO2 emissions in Malaysia: a cointegration analysis of the environmental Kuznets curve. *Energy policy*, *51*, 184-191. https://doi.org/10.1016/j.enpol.2012.08.065

Sinha, A., & Shahbaz, M. (2018). Estimation of environmental Kuznets curve for CO2 emission: role of renewable energy generation in India. *Renewable energy*, *119*, 703-711. https://doi.org/10.1016/j.renene.2017.12.058

Sasana, H., & Putri, A. E. (2018). The increase of energy consumption and carbon dioxide (CO2) emission in Indonesia. In *E3S web of conferences* (Vol. 31, p. 01008). EDP Sciences. The Star, September 27, 2021. Government remains committed to carbon neutral Malaysia by 2050 target. Retrieved on March 18, 2022 from https://www.thestar.com.my/business/business-news/2021/09/27/govt-remains-committed-to-carbon-neutral-malaysia-by-2050-target

The Star, September 27, 2021. Government remains committed to carbon neutral Malaysia by 2050 target. Retrieved on March 18, 2022 from https://www.thestar.com.my/business/business-news/2021/09/27/govt-remains-committed-to-carbon-neutral-malaysia-by-2050-target

The Star, October 11, 2021. PM: Malaysia plans to reduce greenhouse gas emission by 45%. Retrieved on March 18, 2022 from https://www.thestar.com.my/news/nation/2021/10/11/pm-malaysia-plans-to-reduce-greenhouse-gas-emission-by-45

UNDP, 2019. Low carbon cities - Malaysia's response to global climate emergency. Retrieved on March 18, 2022 from https://www.my.undp.org/content/malaysia/en/home/news-centre/articles/2019/lowcarboncity.html

Zafar, M. W., Mirza, F. M., Zaidi, S. A. H., & Hou, F. (2019). The nexus of renewable and non-renewable energy consumption, trade openness, and CO2 emissions in the framework of EKC: evidence from emerging economies. *Environmental Science and Pollution Research*, *26*(15), 15162-15173. https://doi.org/10.1007/s11356-019-04912-w

Zhu, H., Duan, L., Guo, Y., & Yu, K. (2016). The effects of FDI, economic growth and energy consumption on carbon emissions in ASEAN-5: evidence from panel quantile regression. *Economic Modelling*, *58*, 237-248. https://doi.org/10.1016/j.econmod.2016.05.003