The Impacts of Energy Use, Tourism and Foreign Workers on CO₂ Emissions in Malaysia

Arifur Rahman Atiqur Rahman 1, Mohd Shahidan Shaari 1,2, Faiz Masnan 1 and Miguel Angel Esquivias 2,∗

1 Faculty of Applied and Human Sciences, Universiti Malaysia Perlis, Arau 02660, Malaysia; arifrahman2717@gmail.com (A.R.A.R.); shahidanshaari@unimap.edu.my (M.S.S.); faizmasnan@unimap.edu.my (F.M.)
2 Faculty of Economics and Business, Airlangga University, Surabaya 60286, Indonesia

∗ Correspondence: miguel@feb.unair.ac.id

Abstract: Previous studies have investigated various determinants of CO₂ emissions, such as energy use, economic expansion and population growth. However, foreign workers have not been treated as a potential determinant. Therefore, this research embarks on an investigation into the impacts of energy use, foreign workers and tourist arrivals on CO₂ emissions in Malaysia from 1982 to 2018. An ARDL approach was employed, and the findings showed that natural gas and electricity use insignificantly influence CO₂ emissions. Tourist arrivals, coal use and oil use were found to positively influence CO₂ emissions, while foreign workers and population growth insignificantly influence CO₂ emissions. It was found that in the early stages of development, higher GDP negatively influences CO₂ emissions, but in the final stages, higher GDP positively influences CO₂ emissions. These findings are important for formulating policies to reduce environmental degradation stemming from higher CO₂ emissions. Malaysia should use more renewable energy sources, and a carbon tax could be imposed to reduce environmental degradation.

Keywords: energy use; foreign workers; tourist arrivals; CO₂ emissions

1. Introduction

Carbon emissions are responsible for ozone depletion, having an unfavourable impact on the environment. An inexorable increase in carbon emissions can lead to higher global temperatures [1]. Compared with other gas emissions, such as CH₄, N₂O and F-gases, CO₂ is the primary catalyst for global climate change, contributing 65% of the total greenhouse gas emissions. What sets alarm bells ringing regarding whether global climate change is taking place, is that it may lead to natural disasters, such as hurricanes, great fires, serious droughts and deadly heatwaves. The global temperature is rising, influencing agricultural yields and natural wildlife habitats. According to Dava [2], the average temperature in Malaysia has increased by about 1.2 °C in the last 50 years. If no prompt action is taken to control CO₂ emissions, the temperature may continue to rise until 2030. This will cause rice yields to drop by about 12% to 31.3%.

Due to the environmental issue, it is vital to reduce CO₂ emissions urgently. Therefore, factors such as energy use, economic growth, tourism, etc., that can contribute to CO₂ emissions, must be investigated to formulate the right policies [3–5]. Most previous studies used the IPAT model to examine how population growth, energy use and economic growth influence the environment. The model that has been introduced by Ehrlich and Holdren [6] provides a theoretical framework that emphasises three determinants of the environment (I): population (P), affluence (A) and technology (T). Energy use represents technology (T) in the model. Technology, such as machines, computers and vehicles, consumes energy, and this can have undesirable impacts on CO₂ emissions [7,8]. The burning of fossil energy, such as coal, oil and natural gas, can release CO₂ into the air, thus harming the environment. Some studies examined the impacts of energy use by type, especially non-renewable energy,
such as oil, gas and coal, on CO₂ emissions [9]. They found that these types of energy may lead to CO₂ emissions.

Besides technology, economic expansion representing affluence (A) can also cause CO₂ emissions to rise [10]. Figure 1 shows total GDP at constant prices in Malaysia from 2009 to 2019. Based on the figure, it can be observed that GDP in the country exhibited an upward trend, with the highest GDP recorded in 2019 at RM1.424 trillion.

![Figure 1. Gross domestic product (GDP) at constant prices (RM trillion).](image1)

According to the IPAT model, population growth can also harm the environment. Over decades, a rapid escalation in the population can enhance CO₂ emissions [11]. The world has experienced a rapid increase in the total global population over the last three centuries. We must bear in mind that environmental issues, such as growing CO₂ emissions in the atmosphere, may emerge. As the global population grows, the demand for energy, such as oil, gas, coal, etc., also increases. As a result, CO₂ will be released into the atmosphere when energy is burned. China has the biggest population in the world, and it is the biggest emitter of CO₂. The country contributes the largest share of the total global CO₂ emissions at 28%. This suggests that its large population may be detrimental to the environment.
Considering the local population as a determinant of CO\textsubscript{2} emissions is not adequate without also considering foreigners. An increase in foreigners, including tourists and foreign workers, may potentially harm the environment. Zaman et al. [12] found that tourist arrivals can also adversely influence the environment despite its favourable contribution to economic growth. The tourism industry acts as a catalyst for economic expansion in developing countries [13,14]. However, boosting the sector entails extensive energy use, which may release CO\textsubscript{2}. Peeters et al. [15] supported the negative effect of tourism on CO\textsubscript{2} emissions, as fuel is consumed in transportation for tourists. Tourists who travel inevitably use aeroplanes, vehicles, trains, boats and even hot air balloons, significantly impacting the environment. Transportation in the tourism industry can contribute to greenhouse gas emissions. Aircraft and cars emit the highest CO\textsubscript{2} per passenger, followed by buses, ferries and trains. Due to transportation development, tourism has increased dramatically. Hence, greater CO\textsubscript{2} emissions have ensued. Tourism is still one of the most important industries in Malaysia; it contributed 13.3% of GDP in 2020. Figure 3 shows tourism receipts in Malaysia from 2009 to 2019. Tourism receipts in the country showed an upward trend during this period. Malaysia received RM53.4 billion in 2009, and this figure increased by 61.23% to RM86.1 billion in 2019.

Previous studies did not include foreign workers, although this variable can also potentially harm the environment. Foreign workers have been perceived to play a pivotal role in boosting economic growth. They do not necessarily compete with local workers who prefer to work in critical sectors, such as agriculture, mining, quarrying and construction, because jobs in these sectors are deemed not to be sufficiently lucrative. Most jobs require workers to spend time outdoors under the sun, which many local workers are unwilling to do. Hence, in Malaysia, the number of foreign workers increased by 2.44%, from 2,183,400 in 2018 to 2,236,600 in 2019 [16]. Malaysia receives foreign workers from various nations, such as Indonesia, India, Nepal, Bangladesh, etc., to contribute to various economic sectors. According to the Department of Statistics, the manufacturing sector employed the largest share of total foreign workers at 36.58% in 2018, followed by the construction sector (18.8%), the plantation sector (15.07%), the services sector (13.63%), and the agriculture sector (8.8%). More foreign workers are needed to work in these sectors and this implies that more CO\textsubscript{2} will be released, with environmental degradation ensuing as a result.

2. Literature Review

This section explains the theoretical framework and previous empirical studies on the determinants of environmental degradation.
2.1. Theoretical Framework

The IPAT model was introduced by Ehrlich and Holdren [6] to explain the impacts of population growth (P), affluence (A) and technology (T) on the environment (E). The model provides a theoretical framework that can serve as a building block for this study. It is expected that the use of technology can result in higher environmental degradation. Environmental degradation can also stem from population growth. Besides, increasing affluence can also contribute to environmental degradation. Besides the IPAT model, the environmental Kuznets curve (EKC) is also used to explain environmental degradation. Grossman and Krueger [17] proposed an EKC that represents a non-linear connection between GDP per capita and environmental degradation. The curve suggests that in the early stages of development, environmental degradation deteriorates and then reaches a turning point. The stages are connected to developing countries that focus on boosting their industrial output by relying only on non-renewable energy. In the following stages, environmental degradation is believed to fall, and these stages are related to developed countries that have a high awareness of the environment. They have advanced technology to reduce environmental degradation. Furthermore, their economy is driven by the service sector, which does not produce much pollution.

2.2. Empirical Studies on the Nexus of CO2 Emissions, Energy Consumption, and Economic Growth

Innumerable past studies have examined the influences of energy consumption, population growth and economic expansion on environmental degradation, such as Shikwambana et al. [18], Sulaiman and Abdul-Rahim [19] and Antonakakis et al. [20]. However, their findings are mixed, and thus it remains complex to formulate the right policies. Various methods have been employed to analyse data. Sulaiman and Abdul-Rahim [19] employed the autoregressive distributed lag (ARDL) technique to evaluate whether population growth, GDP and energy use affect CO2 emissions in Nigeria. The influences were observed for the following three time periods: 1971–2000, 1971–2005 and 1971–2010. The VECM Granger causality approach was also employed to investigate the association between the variables in the short and long run. The results showed that greater CO2 emissions are primarily due to economic expansion. Population growth and energy use were discovered to be minor contributors to CO2. Economic development, population growth and energy use were also discovered to influence CO2 emissions in the short run.

The nexus between energy and environmental degradation has also been examined in a large number of countries. Employing the PVAR and impulse response methods for a sample of 106 countries, Antonakakis et al. [20] found evidence on the environmental Kuznets curve (EKC) hypothesis. The study demonstrated that continuous economic expansion exacerbates greenhouse gas emissions. The findings cast doubt on current government policies to promote renewable energy use as a measure of achieving long-term growth. In a study covering 68 emerging countries, including the Middle East and North Africa, Muhammad [21] employed Seemingly Unrelated Regressions (SUR) and System Generalised Method of Moments (SGMM). The empirical results find that the economy escalates in both developed and emerging countries as energy consumption rises. Energy use rises as CO2 emissions increase, and the economy also grows. Dong et al. [22], using unbalanced panel data for 128 nations from 1990 to 2014, found that population and economic growth positively and significantly impact CO2 emissions. Dong et al. [22] pointed out that increasing renewable energy use can reduce CO2 emissions in six nations. The impacts in Latin America, Europe and Eurasia are much higher than in other regions.

Previous studies also investigated the relationships between CO2 emissions, energy use, population growth and economic expansion in the Association of Southeast Asian region (ASEAN). Chontanawat [23] employed co-integration and causality methods and found a significant long-run nexus between energy use, CO2 emissions and economic expansion in the ASEAN. The findings suggested that policies to reduce energy use, whether through improving energy efficiency or exploring new energy sources, should
be considered because they could reduce environmental degradation while having no negative influences on economic growth. Meanwhile, Vo et al. [24] supported the EKC hypothesis in the long run for the ASEAN-5 countries. Using data from 1971 to 2014, the findings showed a significant nexus between the variables in Indonesia, Myanmar and Malaysia. In Indonesia and Malaysia, the EKC hypothesis was confirmed. However, the causal relationship between the variables differs greatly across the nations, suggesting single-country studies. There is no causal relationship between emissions and renewable energy use in Malaysia, the Philippines and Thailand.

The nexus between energy consumption, economic growth and emissions in the ASEAN has also been examined in single-country studies. Shaari et al. [25] explored whether national output and electricity use can affect CO$_2$ emissions in Malaysia from 1971 to 2013. Employing the ARDL approach, both electricity use and national output impact CO$_2$ emissions in the long run. The findings also demonstrated that Malaysia’s energy use and national output have no short-run impacts on CO$_2$ emissions. Sasana and Putri [26] explored whether CO$_2$ emissions are influenced by fossil fuel use, population growth and renewable energy use. Annual data from 1990 to 2014 were analysed employing the Ordinary Least Squares (OLS) approach. The results revealed that Indonesia’s fossil fuels and a higher population might harm the environment. However, the use of renewable energy may help to lessen environmental degradation.

Single-country studies outside the ASEAN have also been carried out to examine the Kuznets curve (EKC) hypothesis. Shikwambana et al. [18] delved into factors in various emissions, such as CO$_2$, BC, SO$_2$ and CO in South Africa, and applied the sequential Mann-Kendall (SQMK) method. The correlation coefficient suggests a positive linear relationship between GDP and CO$_2$ emissions, but there is no significant linear relationship between GDP and other emission variables (e.g., CO). Shikwambana et al. [18] found an N-shaped EKC for SO$_2$ and CO, concluding that emissions are linked to economic growth. Khan, Hou and Le [27] studied the influences of natural resource use, energy use and population growth on the United States’ (US’s) footprint and CO$_2$ emissions from 1971 to 2016. The Generalised Method of Moments (GMM), Generalized Linear Model (GLM) and Ordinary Least Squares (OLS) methods were employed. The results showed that natural resource use and renewable energy sources enhance the quality of the environment over time, while population growth and the use of non-renewable energy sources, on the other hand, worsen the quality of the environment.

2.3. The Effects of Energy Use, Tourism and Foreign Workers on Carbon Dioxide Emissions

A few studies, such as Kocak et al. [28], Jebli et al. [29] and Paramati et al. [30], included tourism as a determinant of CO$_2$ emissions. They concluded that tourism could influence CO$_2$ emissions. Jebli et al. [29] examined the causal relationships among CO$_2$ emissions, international tourism from energy use, transportation and real GDP in the top ten international tourism destinations from 1995 to 2013, the VECM and the Granger causality tests procedure were employed. The findings showed that CO$_2$ emissions can cause economic growth without feedback. Economic expansion can affect energy use without feedback. There is also a bidirectional relationship between economic growth, international tourism and energy use. Kocak et al. [28] explored how CO$_2$ emissions, the essential driver of global warming and environmental change, react to tourism development. From 1995 to 2014, the influence of tourism development on environmental degradation in the most visited nations was examined by employing Continuously Updated and Fully Modified (CUP-FM) and Continuously Updated Bias-Corrected (CUP-BC) estimators. The findings revealed that tourist arrivals might increasingly influence CO$_2$ emission, while tourism receipts decreasingly influence CO$_2$ emissions.

Based on the previous literature, there are various factors that can influence CO$_2$ emissions, such as population growth, tourism, economic expansion and energy use. However, none of the prior literature investigated the impact of foreign workers on CO$_2$ emissions. The use of more foreign workers can potentially result in CO$_2$ emissions
escalating. Many companies prefer to employ foreign workers because of low wages, which can increase output, leading to an increase in CO₂ emissions.

3. Materials and Methods

This research uses time-series data from 1982 to 2018 on electricity use, oil use, natural gas use and coal use from Malaysia Energy Hub, real GDP per capita and CO₂ emissions from country.economy. The model specification in this study is derived from a combination of two economic models, namely, the environmental Kuznets curve (EKC) and IPAT. The EKC model is used in this study to investigate the inverted U-shaped EKC. The model is described as follows:

\[
\ln E_t = \varphi \ln GDP_t + \varnothing \ln GDP^2_t + v_t
\]  

(1)

where \( E \) is environmental degradation, \( GDP \) is GDP per capita in the early stages of development, \( GDP^2 \) is GDP per capita in the final stages of development, \( v \) is the error term, and \( \varphi \) and \( \varnothing \) are parameters, such that \( \varphi > 0 \) and \( \varnothing < 0 \). Besides the EKC model, this research also uses the IPAT model, and the model is as follows:

\[
I = f (P, A, T)
\]

(2)

Many previous studies have investigated the impacts of energy use and economic expansion on CO₂ emissions using the IPAT and EKC models. Therefore, this study also uses the same proxies whereby CO₂ emissions are a proxy for environmental degradation, GDP per capita is a proxy for affluence, population growth is a proxy for population and energy consumption is a catalyst for technology. This study divides energy into several types, particularly electricity, natural gas, oil, and coal. Therefore, our model specification is as follows:

\[
\ln CO_{2t} = \partial_0 + \partial_1 \ln GDP_t + \partial_2 \ln GDP^2_t + \partial_3 \ln POP + \partial_4 \ln TA + \partial_5 \ln FW + \partial_6 \ln E + \partial_7 \ln C + \partial_8 \ln O + \partial_9 \ln NG + \nu_t
\]

(3)

where \( \ln CO₂ \) represents the log of CO₂ emissions, and \( \ln GDP \) is the log of GDP per capita. \( \ln POP \) is the log of population growth, \( \ln TA \) is the log of tourist arrivals, \( \ln FW \) is the log of foreign workers, \( \ln E \) is the log of electricity use, \( \ln C \) is the log of coal use, \( \ln O \) is the log of oil use and \( \ln NG \) is the log of gas use. The variables used in this study are described in Table 1.

| Variable                  | Description                        | Source                                          | Symbols |
|---------------------------|------------------------------------|                                                |         |
| CO₂ Emissions             | CO₂ emissions metric tonne         | Country.economy                                | CO₂     |
| Coal Use                  | Final Coal Use (ktoe)              | Malaysia Energy Information Hub                | C       |
| Oil Use                   | Final Oil Use (ktoe)               | Malaysia Energy Information Hub                | O       |
| Foreign employment        | Increase in foreign employment     | Department of Statistics                        | FW      |
| Population                | Population growth                  | Department of Statistics                        | POP     |
| Gas Use                   | Final Gas Use (ktoe)               | Malaysia Energy Information Hub                | NG      |
| Tourist Arrivals          | Tourist arrival in country         | Department of Statistics                        | TA      |
| Electricity use           | Final Electricity Use (ktoe)       | Malaysia Energy Information Hub                | E       |
| Economic expansion        | Constant LCU                      | Country.economy                                | GDP     |
This study examines the long-run and short-run relationships between tourist arrivals, foreign workers, population growth, energy use (oil, electricity, gas and coal), economic expansion and CO\textsubscript{2} emissions using the ARDL approach introduced by Pesaran et al. [31]. ARDL models are ordinary least squares regressions, with lags of the dependent variable and independent variables as regressors. The method can be used to examine the co-integrating relationship between the variables. The employment of the ARDL method provides more advantages in comparison with the Johansen approach and Engle-Granger methods. One of the advantages is that the model can be estimated regardless of whether the variables are integrated of order I (0), I (1), or mixed order I (0) and I (1). Therefore, it is important to conduct a unit root test to ensure that the order of integration is not I (2). Hence, the Augmented Dickey-Fuller (ADF) test is employed to check the existence of a unit root in the time-series data analysis as follows:

\[ \Delta Z_t = a_0 + a_1 Z_{t-1} - Z_{t-1} + \epsilon_t \]  

(4)

where \( \Delta \) is the first differential operator, \( \epsilon_t \) is the white noise and \( X_t \) is a time-series variable. The hypotheses that need to be tested are the null hypothesis (\( H_0 \)) which means the existence of a unit root (non-stationary), and the alternative hypothesis (\( H_1 \)), which indicates that the time-series variable is stationary. If the null hypothesis is rejected, the time-series variable \( X_t \) is stationary.

Next, to estimate the ARDL model, three steps must be followed. The first step is to estimate the long-run relationships (co-integration) among the time-series variables. Therefore, the equation can be written as follows:

\[
\begin{align*}
\Delta \text{LNCO}_t &= \beta_0 + \sum_{i=1}^{j} \beta_i \Delta \text{LNCO}_{2t-i} + \sum_{i=0}^{k} \gamma_i \Delta + \text{LN}\text{GDP}_{1t-i} + \sum_{i=0}^{l} \delta_i \Delta \text{LN}\text{GDP}^2_{1t-i} + \sum_{i=0}^{m} \lambda_i \Delta \text{LNPOP}_{1t-i} \\
&+ \sum_{i=0}^{n} \omega_i \Delta \text{LN}\text{T}\text{A}_{1t-i} + \sum_{i=0}^{p} \mu_i \Delta \text{LN}\text{FW}_{1t-i} + \sum_{i=0}^{q} \varphi_i \Delta \text{LN}\text{POP}_{1t-i} + \sum_{i=0}^{r} \psi_i \Delta \text{LN}\text{NO}_{1t-i} \\
&+ \sum_{i=0}^{s} \tau_i \Delta \text{LN}\text{NG}_{1t-i} + \sum_{i=0}^{t} \nu_i \Delta \text{LNPOP}_{1t-i} + \sum_{i=0}^{u} \text{LN}\text{GDP}_{2t-i} + \sum_{i=0}^{v} \text{LN}\text{POP}_{1t-i} + \sum_{i=0}^{w} \text{LN}\text{POP}_{1t-i} + \sum_{i=0}^{x} \text{LN}\text{NO}_{1t-i} + \nu_t
\end{align*}
\]  

(5)

where \( \Delta \) is the first differential operator, \( \{j, k, l, m, o, p, q, r, s, t, u, v, w, x\} \) is the optimum lag and \( \nu_t \) refers to the error term. The null and alternative hypotheses are tested using the F-statistic to examine the existence of a long-run relationship among the variables as follows:

\[ H_0: \forall \beta_0 = \forall \gamma_3 = \forall \delta_5 = \forall o_6 = \forall \beta_7 = \forall \beta_8 = \forall \beta_9 = 0 \text{ (Long – run relationship does not exist)} \]

\[ H_1: \forall \beta_0 \neq \forall \gamma_3 \neq \forall \delta_5 \neq \forall o_6 \neq \forall \beta_7 \neq \forall \beta_8 \neq \forall \beta_9 \neq 0 \text{ (Long – run relationship exists)} \]

The null hypothesis must be rejected if the estimated value of the F-statistic exceeds the upper bound critical value, which explains the existence of a long-run relationship (co-integration) among the time-series variables. In contrast, if the estimated value of the F statistic is less than the lower bound critical value, the null hypothesis is not rejected. However, if the estimated value of the F-statistic falls between the upper and lower bound critical values, the results remain inconclusive. Thus, it is impossible to determine whether there is a co-integration. After establishing the existence of the co-integration, the next step is to estimate the long-run ARDL model, and the equation is as follows:

\[
\begin{align*}
\text{CO}_2 &= \alpha_0 + \sum_{i=1}^{j} \alpha_i \text{LNCO}_{2t-i} + \sum_{i=0}^{k} \alpha_2 \text{LN}\text{GDP}_{1t-i} + \sum_{i=0}^{l} \alpha_3 \text{LN}\text{GDP}^2_{1t-i} + \sum_{i=0}^{m} \alpha_4 \text{LN}\text{POP}_{1t-i} + \sum_{i=0}^{n} \alpha_5 \text{LN}\text{T}\text{A}_{1t-i} \\
&+ \sum_{i=0}^{o} \alpha_6 \text{LN}\text{FW}_{1t-i} + \sum_{i=0}^{p} \alpha_7 \text{LN}\text{POP}_{1t-i} + \sum_{i=0}^{q} \alpha_8 \text{LN}\text{NO}_{1t-i} + \sum_{i=0}^{r} \alpha_9 \text{LN}\text{NG}_{1t-i} + \nu_t
\end{align*}
\]  

(6)
In the final step, the short-run ARDL model must be estimated by taking the error correction term (ECT) into account, and it is derived from the long-run estimated ARDL model. The error correction model (ECM) can be expressed in the following equation:

$$\Delta LNCO_2 = \gamma_0 + \sum_{j=1}^{k} \gamma_1 \Delta LNCO_{2t-j} + \sum_{i=0}^{p} \gamma_2 \Delta LNGDP_{t-i} + \sum_{i=0}^{m} \gamma_3 \Delta LNGDP^2_{t-i} + \sum_{i=0}^{r} \gamma_4 \Delta LNP_{t-i} + \sum_{i=0}^{s} \gamma_5 \Delta LNPOP_{t-i} + \sum_{i=0}^{o} \gamma_6 \Delta LNT_{t-i} + \sum_{i=0}^{p} \gamma_7 \Delta LNE_{t-i} + \sum_{i=0}^{q} \gamma_8 \Delta LNG_{t-i} + \sum_{i=0}^{r} \gamma_9 \Delta LNO_{t-i} + \sum_{i=0}^{s} \gamma_{10} \Delta LNN_{t-i} + \varphi_1 + \varphi_2 + ECT_{t-1} + \mu_t$$

(7)

The coefficient value of the ECT can explain two results. First, it can describe the speed of adjustment towards the long-run equilibrium (time taken by the explanatory variables to converge towards the long-run equilibrium). Second, it can confirm the existence of a long-run connection between the variables (tourist arrival, foreign employment, population, energy use (oil, electricity, gas and coal), economic expansion and CO$_2$.

4. Results

Table 2 indicates the results of the descriptive statistics for all variables used in this investigation. The table shows the maximum, minimum, mean and standard deviation values for LNCO$_2$, LNC, LNO, LNT, LNG, LNP, LNT, LNGDP, LNGDP$^2$ and LNE. Based on the table, there is a significant difference in the variation of each variable. LNGDP$^2$ has the highest mean at 101.5998, while LNP has the lowest mean at 0.7796. LNT has the biggest disparity between the highest and lowest values, with a difference of 2.2916. LNP shows the smallest difference between the maximum and minimum values. The difference stands at 0.9178.

| Variables | Mean | Median | Max. | Min. | Std. Dev. | Observations |
|-----------|------|--------|------|------|-----------|--------------|
| LNCO$_2$  | 4.7214 | 4.8867 | 5.5515 | 3.4430 | 0.7034 | 37 |
| LNC       | 6.6970 | 6.8845 | 7.5099 | 4.5325 | 0.7585 | 37 |
| LNO       | 9.7029 | 9.8823 | 10.3489 | 8.7368 | 0.5308 | 37 |
| LNF       | 13.4678 | 13.7593 | 14.6238 | 11.8226 | 0.8781 | 37 |
| LNG       | 7.9033 | 8.2589 | 9.8443 | 3.8067 | 1.4624 | 37 |
| LNP       | 0.7796 | 0.8990 | 1.0340 | 0.1162 | 0.2510 | 37 |
| LNT       | 16.1297 | 16.1400 | 17.1274 | 14.8358 | 0.7794 | 37 |
| LNGDP     | 10.0729 | 10.1252 | 10.6742 | 9.4547 | 0.3756 | 37 |
| LNGDP$^2$ | 101.5998 | 102.5213 | 113.9382 | 89.3918 | 7.5359 | 37 |
| LNE       | 10.7822 | 11.0076 | 11.8961 | 9.2595 | 0.8353 | 37 |

Note: LNCO$_2$ is the log of CO$_2$ emissions, LNC is the log of coal use, LNO is the log of oil use, LNF is the log of the number of foreign workers, LNG is the log of gas use, LNP is the log of population growth, LNT is the log of tourist arrivals, LNGDP is the log of GDP per capita, and LNGDP$^2$ is the log of GDP per capita.

Table 3 demonstrates the results of the unit root test. All the variables are not stationary at the level with no trend, while only LNC and LNG are stationary at the level with a trend. The results also reveal that all the variables are stationary at 1% at the first difference without any trend. With a trend, the findings show that all the variables are stationary at 1% except for LNCO$_2$, which is significant at 5%.

The bound test was performed before estimating the long-run coefficients. Table 4 shows the outcomes of the bound test. The R-squared value is 0.9985 and the adjusted R-squared value is 0.9977. The F-statistic value is 4.7270, higher than the critical value at the 5% significance level. It exceeds both the lower and upper bounds of $-1.95$ and $-4.61$, respectively. The null hypothesis is rejected, meaning the variables used in this study are co-integrated. The impacts of energy use, foreign workers, tourism arrivals, GDP, GDP$^2$ and electric use on CO$_2$ emissions can be investigated using the ARDL approach.
Table 3. Unit root test results.

| Variable | Intercept | First Difference | Intercept and Trend |
|----------|-----------|------------------|---------------------|
|          | Level     |                | Level               |                |
|          | (Intercept) | (Intercept and Trend) |
| LNCO₂    | -2.5425   | -4.4152 ***     | -0.0274             | -3.8660 **     |
|          | (0.1143)  | (0.0013)        | (0.9943)            | (0.0249)       |
| LNC      | -21.527   | -10.7204 ***    | -5.7540 ***         | -10.9009 ***   |
|          | (0.2363)  | (0.0000)        | (0.0002)            | (0.0000)       |
| LNO      | -2.1572   | -4.6135 ***     | -0.4566             | -5.0810 ***    |
|          | (0.2247)  | (0.0007)        | (0.9812)            | (0.0012)       |
| LNF      | -1.5283   | -5.5926 ***     | -1.7605             | -5.6132 ***    |
|          | (0.5081)  | (0.0000)        | (0.7028)            | (0.0003)       |
| LNG      | -2.2878   | -7.3232 ***     | -4.0150 **          | -7.2485 ***    |
|          | (0.1815)  | (0.0000)        | (0.0176)            | (0.0000)       |
| LNP      | 0.9003    | -8.1855 ***     | -2.5322             | -8.5740 ***    |
|          | (0.9943)  | (0.0000)        | (0.3118)            | (0.0000)       |
| LNT      | -1.1758   | -6.5300 ***     | -2.3403             | -6.5520 ***    |
|          | (0.6742)  | (0.0000)        | (0.4029)            | (0.0000)       |
| LNGDP    | 0.4171    | -4.9905 ***     | -1.7633             | -4.9161 ***    |
|          | (0.8956)  | (0.0003)        | (0.7014)            | (0.0018)       |
| LNGDP²   | -0.2259   | -5.0626 ***     | -1.8826             | -4.9858 ***    |
|          | (0.9260)  | (0.0002)        | (0.6427)            | (0.0015)       |
| LNE      | -2.565    | -4.4028 ***     | -0.4121             | -5.0166 ***    |
|          | (0.1096)  | (0.0013)        | (0.9832)            | (0.0014)       |

Note: *** and ** indicate significance levels of 1% and 5%, respectively. LNCO₂ is the log of CO₂ emissions, LNC is the log of coal use, LNO is the log of oil use, LNF is the log of the number of foreign workers, LNG is the log of gas use, LNP is the log of population growth, LNT is the log of tourist arrivals, LNGDP is the log of GDP per capita, and LNGDP² is the log of GDP² per capita.

Table 4. Bound Test Results.

| F-statistic | 4.7270 ** |
| Lag Model:  | 1, 0, 0, 0, 0, 1, 1, 1, 0, 0 |
| R-squared:  | 0.9985 |
| Adjusted R-squared | 0.9977 |

| Critical Value | Lower Bound | Upper Bound |
|----------------|-------------|-------------|
| 10%            | -1.62       | -4.26       |
| 5%             | -1.95       | -4.61       |
| 1%             | -2.58       | -5.25       |

Note: ** indicate the significance level of 5%, respectively.

Table 5 shows the findings of the long-run impacts of coal use, oil use, gas use, electricity use, foreign workers, population growth, tourist arrivals, GDP and GDP² on CO₂ emissions using the ARDL approach. The findings also reveal that tourist arrivals can positively influence CO₂ emissions in the long run, which is significant at 1%. The coefficient value is 0.2298, suggesting that a 1% increase in tourist arrivals can cause a 0.2298% rise in CO₂ emissions in the long run. It is also discovered that natural gas use has no long-run nexus with CO₂ emissions. This demonstrates that increasing natural gas use has no long-run influence on CO₂ emissions. The coefficient of natural gas use is −0.0175. Population growth is found to have no long-run relationship with CO₂ emission. This shows that an increase in population growth does not influence CO₂ emissions in the long run in Malaysia. The coefficient of population growth is −0.1567. GDP has a significant connection with CO₂ emissions at 1%, and the coefficient value is −1.7458. Based on the coefficient value, a 1% rise in GDP can prompt a reduction of 1.7458% in CO₂ emissions in the early stages of development. In the final stages, GDP has a positive and significant connection with CO₂ emission, which is significant at 1%, and the coefficient value is 0.0488. Based on the coefficient value, a 1% increase in GDP² can increase CO₂
emissions by 0.0488% in the long run. Thus, the results show a U-shaped EKC in the long run. Foreign workers have no nexus with environmental degradation, as it is not significant. The coefficient value is 0.1536. This indicates that an increase in foreign workers does not change CO₂ emissions in the long run.

Table 5. Results of long-run effects using ARDL approach.

| Variable | Coefficient | Standard Error | Probability |
|----------|-------------|----------------|-------------|
| LNC      | 0.1893 **   | 0.0756 **      | 0.0198 **   |
| LNO      | 1.3863 ***  | 0.2547 ***     | 0.0000 ***  |
| LNF      | 0.1536      | 0.1231         | 0.2244      |
| LNG      | −0.0175     | 0.0238         | 0.4691      |
| LNP      | −0.1567     | 0.1666         | 0.3566      |
| LNT      | 0.2298 ***  | 0.0758 ***     | 0.0059 ***  |
| LNGDP    | −1.7458 *** | 0.2044 ***     | 0.0000 ***  |
| LNGDP²   | 0.0488 **   | 0.0207 **      | 0.0270 **   |
| LNE      | 0.2450      | 0.2466         | 0.3308      |

Note: *** and ** indicate significance levels of 1% and 5%, respectively. LNCO₂ is the log of CO₂ emissions, LNC is the log of coal use, LNO is the log of oil use, LNF is the log of the number of foreign workers, LNG is the log of gas use, LNP is the log of population growth, LNT is the log of tourist arrivals, LNGDP is the log of GDP per capita, and LNGDP² is the log of GDP² per capita.

Similarly, electricity consumption does not have any positive relationship with environmental degradation, as it is not significant. This shows that a rise in electricity use does not influence CO₂ emissions in the long run. The coefficient value for electricity use is 0.2450. Coal use is found to have a positive relationship with CO₂ emission, which is significant at 5%. The coefficient value is 0.1893, indicating that a 1% increase in coal use can result in a 0.1893% increase in the long run. Last but not least, crude oil use is found to have a positive relationship with CO₂ emission, which is significant at 1%. The coefficient value is 1.3863, indicating that a 1% increase in crude oil use can cause a rise of 1.3863% in the long run.

Table 6 shows the results of the error correction term (ECT) and the impacts of energy use, foreign workers, tourist arrivals, GDP and GDP² on CO₂ emissions in the short run using the ARDL approach. The coefficient of ECT is negative and significant at 1%. The value is −0.5192, implying that the long-run disequilibrium is adjusted by 51.92%. The findings also reveal that natural gas use has no significant connection with CO₂ emission, and the coefficient value is −0.0090. Electricity use has no significant connection with CO₂ emission. Therefore, a 1% increase in electricity use cannot cause any change in CO₂ emissions in the short run. Tourist arrivals can positively influence CO₂ emissions as the connection is significant at 5%. The coefficient value of tourist arrivals is 0.1193, suggesting that a 1% increase in tourist arrivals can cause a 0.1193% rise in CO₂ emissions in the short run. Crude oil use has a significant and positive connection with CO₂ emission at 5%. The coefficient value is 0.3223, suggesting that a 1% increase in crude oil use can contribute to a 0.3223% rise in environmental degradation in the short run.

Coal use is found to have a positive nexus with CO₂ emission, which is significant at 5%. The coefficient value is 0.0982, indicating that a 1% increase in coal use can cause a 0.0982% rise in the short run. Foreign workers are found to have no short-run relationship with CO₂ emission. This shows that any increase in foreign workers has no influence on CO₂ emissions in the short run. The coefficient of foreign workers is 0.0797, suggesting that an increase in foreign workers does not impact CO₂ emissions in the short run. In the early stages of development, GDP has a significant connection with CO₂ emission at 1%, and the coefficient value is −0.9064. Based on the coefficient value, a 1% rise in GDP can reduce environmental degradation by 0.9064% in the short run. However, in the final stages, GDP has a positive and significant connection with CO₂ emission at 1%. The coefficient value is 0.0572, suggesting that a 1% rise in GDP² can cause an increase of 0.0572% in CO₂ emissions in the short run. Lastly, population growth has no positive nexus with CO₂.
emission. Therefore, a rise in population growth will lead to no change in CO$_2$ emissions in the short run.

Table 6. Results of short-run effects using ARDL approach.

| Variable | Coefficient | Standard Error | Probability |
|----------|-------------|----------------|-------------|
| LNC      | 0.0982 **   | 0.0358 **      | 0.0116 **   |
| LNO      | 0.3223 *    | 0.1760 *       | 0.0801 *    |
| LNF      | 0.0797      | 0.0601         | 0.1978      |
| LNG      | −0.0090     | 0.0122         | 0.4677      |
| LNP      | 0.0019      | 0.0676         | 0.9775      |
| LNT      | 0.1193 **   | 0.0494 **      | 0.0243 **   |
| LNGDP    | −0.9064 *** | 0.2400 ***     | 0.0010 ***  |
| LNGDP$^2$| 0.0572 ***  | 0.0130 ***     | 0.0002 ***  |
| LNE      | −0.1272     | 0.1227         | 0.3106      |
| ECT      | −0.5192 *** | 0.1249 ***     | 0.0004 ***  |

Note: ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively. LNCO$_2$ is the log of CO$_2$ emissions, LNC is the log of coal use, LNO is the log of oil use, LNF is the log of the number of foreign workers, LNG is the log of gas use, LNP is the log of population growth, LNT is the log of tourist arrivals, LNGDP is the log of GDP per capita and LNGDP$^2$ is the log of GDP$^2$ per capita.

Table 7 summarises the findings of the diagnostic tests (Breusch-Godfrey Serial Correlation LM, Ramsey RESET stability and Heteroscedasticity). The outcomes reveal that the model is free of diagnostic issues, implying that it can explain the influences of energy use, foreign employment and tourist arrivals on CO$_2$ emissions. We used the Cumulative Sum of Recursive Residuals (CUSUM), and Cumulative of Squares of Recursive Residuals (CUSUMSQ) tests to determine whether the model is stable. Figure 4 depicts the plots of the CUSUM and CUSUMSQ graphs. The plots fall within the boundaries, indicating the appropriateness of the model.

Table 7. Results of diagnostic tests.

| Statistics                  | F-Statistic/Jarque-Bera | Probability |
|-----------------------------|-------------------------|-------------|
| Breusch-Godfrey Serial Correlation LM | 0.6728                  | 0.5209      |
| Ramsey RESET stability      | 0.0227                  | 0.8815      |
| Heteroscedasticity          | 0.4016                  | 0.5306      |
| Normality                   | 0.0188                  | 0.9907      |

Figure 4. Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Square of Recursive Residuals (CUSUMSQ).
5. Discussions

Although previous studies [32] argued that natural gas consumption can reduce CO₂ emissions, our results conclude that natural gas use has no significant effect on CO₂ emissions. Similarly, we find no evidence that electricity use can significantly affect CO₂ emissions. Our findings are similar to the results of Shaari et al. [21]. Our findings are likely related to the shift of energy policy in Malaysia, in which the use of natural gas has been increased so that the country is not enormously dependent on oil. The use of natural gas to generate electricity is the least harmful to the environment. By contrast, crude oil use and coal use have a significant and positive effect on CO₂ emission. Our findings are consistent with the findings of Shaari et al. [33], that there is evidence on the crude oil—CO₂ emissions nexus, and the findings of Pata and Kumar [34] that there is a significant nexus between coal and CO₂ emissions in China and India. The burning of both types of energy (oil and coal) can be harmful to the environment as it can release CO₂ emissions.

Furthermore, we find that tourist arrivals can positively influence CO₂ emissions. This suggests that tourist arrivals cause the tourism and transportation sectors to grow, and thus more energy is consumed. Our result is in line with evidence provided by Sharif et al. [35] for the case of Pakistan. By contrast, foreign workers are found to have no short-run effect on CO₂ emissions. This is because most foreign workers in Malaysia work in low-energy intensive sectors, such as agriculture and construction. The findings do not support the EKC hypothesis, as GDP has a significant connection with CO₂ emissions in the early stages of development. However, GDP has a positive and significant connection with CO₂ emission in the final stages. Our results exhibit a U-shaped EKC and are similar to the findings of Jiang et al. [36] for the southwest, central and northeast regions of China. Lastly, population growth has no positive effect on CO₂ emission, which is in line with Begum et al. [37], who found no connection between population growth and CO₂ emissions in Malaysia.

6. Conclusions

This research investigated the impacts of energy use, foreign workers and tourist arrivals on CO₂ emissions in Malaysia from 1982 to 2018. A unit root test was performed, and the results show that all the variables are stationary at the first differences but not at the level. The findings of the bound test show that the variables are co-integrated. Natural gas consumption, electricity use and population growth do not have any short-run or long-run impacts on environmental degradation. Tourist arrivals as well as coal and oil use contribute to an increase in CO₂ emissions in the long and short run. As tourist numbers increase, the tourism industry will grow. The transportation sector will also flourish, and thus more energy will be consumed. Foreign workers do not influence CO₂ emissions in the short run or long run. This is because most foreign workers are employed in sectors that do not contribute a large amount of CO₂ emissions, such as construction and agriculture. GDP negatively influences CO₂ emissions in the short and long run. Lastly, GDP² positively influences environmental degradation in the long run and short run. The results of this research do not support the inverted U-shaped EKC.

These findings are important for policymakers in formulating the right policies, as energy use can cause greater environmental degradation. Malaysia continues to rely on non-renewable energy sources. We can see that natural gas and diesel use exhibits a steady increase. The transportation sector consumes the biggest proportion of the total energy, followed by the industrial sector. Its pattern of energy use will determine the country’s future environment. Therefore, Malaysia should use more renewable energy sources, such as biodiesel, hydro and solar, instead of non-renewable energy. Malaysia’s use of renewable energy is still very low. Thus, policies on increasing renewable energy are of utmost importance to reduce environmental degradation. As a result, Malaysia can attract more tourists to visit the country without having any unfavourable impact on the environment. Aside from this, the findings also show that in the final stages of development, higher GDP per capita can increase CO₂ emissions. Therefore, a carbon tax should be imposed on firms that emit CO₂. Most economists strongly advocate a carbon price policy as a profitable
strategy to reduce CO₂ emissions. Firms have to pay higher taxes the more emissions they produce. This policy could discourage firms from producing more emissions. Additionally, Malaysia could utilise technology that can capture and store CO₂ deep underground to reduce environmental degradation.

Despite the fact that this study has successfully achieved its objective, there are several shortcomings that can be addressed in future research. This study only focuses on Malaysia, and thus future research may consider many countries, especially developing countries, in order to produce better results.

Author Contributions: A.R.A.R. carried out and wrote the experiment. M.S.S. provided guidance and edited the whole manuscript significantly. F.M. gave ideas and edited the introduction part. M.A.E. gave ideas and improved the manuscript, especially in the discussion part. All authors did revisions equally after receiving the comments from the reviewers. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Universitas Universitas Airlangga under the Program International Research Collaboration Tahun 2021. The APC was funded by Universitas Airlangga.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data that support the findings of this study are available from Malaysia Energy Information Hub, Department of Statistics Malaysia and country.economy.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Ritchie, H.; Roser, M. Ozone Layer. Available online: https://ourworldindata.org/ozone-layer (accessed on 1 December 2021).
2. Dava, E. Climate Change Experts Reiterate Concerns over Increasing Surface Temperatures in Malaysia. Available online: https://www.thesundaily.my/local/climate-change-experts-reiterate-concerns-over-increasing-surface-temperatures-in-malaysia-Y8313685 (accessed on 2 December 2021).
3. Dogan, E.; Aslan, A. Exploring the relationship among CO₂ emissions, real GDP, energy consumption and tourism in the EU and candidate countries: Evidence from panel models robust to heterogeneity and cross-sectional dependence. Renew. Sustain. Energy Rev. 2017, 77, 239–245. [CrossRef]
4. Zaman, K.; Moemen, M.A.; Islam, T. Dynamic linkages between tourism transportation expenditures, carbon dioxide emission, energy consumption and growth factors: Evidence from the transition economies. Curr. Issues Tour. 2017, 20, 1720–1735. [CrossRef]
5. Amin, S.B.; Al Kabir, F.; Khan, F. Tourism and Energy Nexus in Selected South Asian Countries: A Panel Study. Curr. Issues Tour. 2019, 23, 1963–1967. [CrossRef]
6. Ehrlich, P.R.; Holdren, J.P. Impact of population growth. Science 1971, 171, 1212–1217. [CrossRef]
7. Thao, N.T.N. Nonrenewable, Renewable Energy Consumption and Economic Performance in OECD Countries: A Stochastic Distance Function Approach. Master’s Thesis, University of Economics Ho Chi Minh City, Ho Chi Minh, Vietnam, 2015.
8. Shafiei, S.; Salim, R.A. Non-renewable and renewable energy consumption and CO₂ emissions in OECD countries: A comparative analysis. Energy Policy 2014, 66, 547–556. [CrossRef]
9. Khan, M.K.; Teng, J.-Z.; Khan, M.I. Effect of energy consumption and economic growth on carbon dioxide emissions in Pakistan with dynamic ARDL simulations approach. Environ. Sci. Pollut. Res. 2019, 26, 23480–23490. [CrossRef]
10. Heidari, H.; Katircioglu, S.; Saedpour, L. Economic growth, CO₂ emissions, and energy consumption in the five ASEAN countries. Int. J. Electr. Power Energy Syst. 2015, 64, 785–791. [CrossRef]
11. Liddle, B. What are the carbon emissions elasticities for income and population? Bridging STIRPAT and EKC via robust heterogeneous panel estimates. Glob. Environ. Change 2015, 31, 62–73. [CrossRef]
12. Zaman, K.; Shahbaz, M.; Loganathan, N.; Raza, S.A. Tourism development, energy consumption and Environmental Kuznets Curve: Trivariate analysis in the panel of developed and developing countries. Tour. Manag. 2016, 54, 275–283. [CrossRef]
13. Costa, J. How are companies and destinations “surfing the wave” of global tourism? Worldw. Hosp. Tour. Themes 2017, 9, 588–591. [CrossRef]
14. Mason, P. Tourism Impacts, Planning and Management, 3rd ed.; Routledge: London, UK, 2015. [CrossRef]
15. Peeters, P. Why space tourism will not be part of sustainable tourism. Tour. Recreat. Res. 2018, 43, 540–543. [CrossRef]
16. Shaari, M.S.; Rahman, A.R.A. Revisit policy concerning foreign workers. New Strait Times, 18 November 2021.
17. Grossman, G.M.; Krueger, A.B. Economic Growth and the Environment. Q. J. Econ. 1995, 110, 353–377. [CrossRef]
18. Shikwambana, L.; Mhangara, P.; Kganyago, M. Assessing the Relationship between Economic Growth and Emissions Levels in South Africa between 1994 and 2019. Sustainability 2021, 13, 2645. [CrossRef]
19. Sulaiman, C.; Abdul-Rahim, A.S. Population Growth and CO\textsubscript{2} Emission in Nigeria: A Recursive ARDL Approach. *SAGE Open* **2018**, *8*, 1–14. [CrossRef]
20. Antonakakis, N.; Chatziantoniou, I.; Filis, G. Energy consumption, CO\textsubscript{2} emissions, and economic growth: An ethical dilemma. *Renew. Sustain. Energy Rev.* **2017**, *68*, 808–824. [CrossRef]
21. Muhammad, B. Energy consumption, CO\textsubscript{2} emissions and economic growth in developed, emerging and Middle East and North Africa countries. *Energy* **2019**, *179*, 232–245. [CrossRef]
22. Dong, K.; Hochman, G.; Zhang, Y.; Sun, R.; Li, H.; Liao, H. CO\textsubscript{2} emissions, economic and population growth, and renewable energy: Empirical evidence across regions. *Energy Econ.* **2018**, *75*, 180–192. [CrossRef]
23. Chontanawat, J. Relationship between energy consumption, CO\textsubscript{2} emission and economic growth in ASEAN: Cointegration and causality model. *Energy Rep.* **2020**, *6*, 660–665. [CrossRef]
24. Vo, D.H.; Le, T.Q. CO\textsubscript{2} Emissions, Energy Consumption, and Economic Growth: New Evidence in the ASEAN Countries. *J. Risk Financ. Manag.* **2019**, *12*, 145. [CrossRef]
25. Shaari, M.S.; Razak, A.A.; Hasan Basri, B. International Journal of Energy Economics and Policy the Effects of Electricity Consumption and Economic Growth on Carbon Dioxide Emission. *Int. J. Energy Econ. Policy* **2017**, *7*, 287–290.
26. Sasana, H.; Putri, A.E. The Increase of Energy Consumption and Carbon Dioxide (CO\textsubscript{2}) Emission in Indonesia. *E3S Web Conf.* **2018**, *31*, 1008. [CrossRef]
27. Khan, I.; Hou, F.; Le, H.P. The impact of natural resources, energy consumption, and population growth on environmental quality: Fresh evidence from the United States of America. *Sci. Total Environ.* **2020**, *754*, 142222. [CrossRef] [PubMed]
28. Koçak, E.; Ulucak, R.; Ulucak, Z.Ş. The impact of tourism developments on CO\textsubscript{2} emissions: An advanced panel data estimation. *Tour. Manag. Perspect.* **2020**, *33*, 100611. [CrossRef]
29. Jebli, M.B.; Hadhri, W. The dynamic causal links between CO\textsubscript{2} emissions from transport, real GDP, energy use and international tourism. *Int. J. Sustain. Dev. World Ecol.* **2018**, *25*, 568–577. [CrossRef]
30. Paramati, S.R.; Alam, M.S.; Chen, C.F. The Effects of Tourism on Economic Growth and CO\textsubscript{2} Emissions: A Comparison between Developed and Developing Economies. *J. Travel Res.* **2016**, *56*, 712–724. [CrossRef]
31. Pesaran, M.H.; Shin, Y.; Smith, R.J. Bounds testing approaches to the analysis of level relationships. *J. Appl. Econom.* **2001**, *16*, 289–326. [CrossRef]
32. Dong, K.; Sun, R.; Hochman, G. Do natural gas and renewable energy consumption lead to less CO\textsubscript{2} emission? Empirical evidence from a panel of BRICS countries. *Energy* **2017**, *141*, 1466–1478. [CrossRef]
33. Shaari, M.S.; Karim, Z.A.; Abidin, N.Z. The effects of energy consumption and national output on CO\textsubscript{2} emissions: New evidence from OIC countries using a panel ARDL analysis. *Sustainability* **2020**, *12*, 3312. [CrossRef]
34. Pata, U.K.; Kumar, A. The influence of hydropower and coal consumption on greenhouse gas emissions: A comparison between China and India. *Water* **2021**, *13*, 1387. [CrossRef]
35. Sharif, A.; Afshan, S.; Nisha, N. Impact of tourism on CO\textsubscript{2} emission: Evidence from Pakistan. *Asia Pac. J. Tour. Res.* **2017**, *22*, 408–421. [CrossRef]
36. Jiang, M.; Kim, E.; Woo, Y. The relationship between economic growth and air pollution—A regional comparison between China and South Korea. *Int. J. Environ. Res. Public Health* **2020**, *17*, 2761. [CrossRef] [PubMed]
37. Begum, R.A.; Sohag, K.; Abdullah, S.M.S.; Jaafar, M. CO\textsubscript{2} emissions, energy consumption, economic and population growth in Malaysia. *Renew. Sustain. Energy Rev.* **2015**, *41*, 594–601. [CrossRef]