# HSOA Journal of Environmental Science Current Research

**Research Article**

# Does The Collaboration Between Clean Energy, Stock Market Development, And International Investment Abate CO2 Emission? Insight from Cyprus

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## Abstract

The study sought to determine whether the collaboration between clean energy, Stock market development, and international investment, abate CO2 emissions in Cyprus. Our study employed descriptive statistics and correlation to know the normality and multicollinearity of the variables. ADF validated the stationarity of the variables. Per the short-run ARDL model, rising foreign direct investment can decrease CO2 emissions as the economy experiences growth, CO2 emissions increase in the short term. Renewable energy consumption decreases CO2 emissions in the short run. The stock market positively relates to co2 emission in the short run. Per the Durbin Watson value, the model is free from serial correlation. Nevertheless, in the long run, ARDL revealed that foreign direct investment is negatively related to CO2 in the long run. Renewable energy negatively impacted CO2 emissions in the long run. The stock market positively influences CO2 emissions. The Error Correction Model revealed a 16.6% high speed of adjustment from the short run to the long run. The bound test validated a long-run equilibrium relationship between the dependent and the independent variables. The study prompted many policy directions for Cyprus.

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## Introduction

Global clean energy capacity growth in twenty-twenty exceeded previous expectations and records despite the economic downturn caused by Covid 19 epidemic. Per the international Clean Energy Agency-IRENA, the globe acquired more than two hundred and sixty-gigawatt clean energy last year, over fifty percent more than in 2019 [1]. Following specific figures worldwide, from 2009, total clean energy recorded 1135599GW, in 2010 clean energy increased to 122335, in 2011 it increased to 1329886, in 2012 clean energy increased to 11442763, in 2013 it increased to 1564390, in 2014, clean energy increased to 1694061GW, in 2015 it improved to 1847258, in 2016 clean energy production increased to 2010005, in 2017 it increased to 2180389, in 2018 clean energy increased to2358749, in 2019 clean energy increased to2538441 and in 2020 clean energy increased to 2799094. Worldwide clean energy production experienced remarkable growth per (Figure 1).
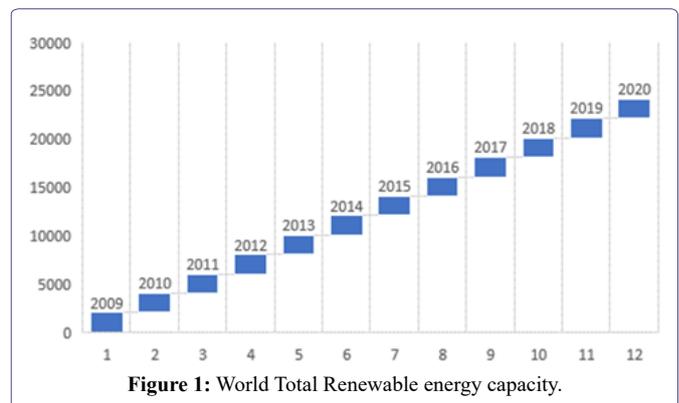


**Figure 1:** World Total Renewable energy capacity.

In Europe from 2009, total clean energy recorded 814713MW, in 2010 clean energy increased to 8898824, in 2011 it increased to 360883, in 2012 clean energy increased to 395154, in 2013 clean energy improved to 419914, in 2014 it increased to 440774, in 2015 clean energy increased to 465057, in 2016 it increased to 488578, in 2017 clean energy production increased to 512890, in 2018 it increased to 537570, in 2019 clean energy increased to 575167 and in 2020 clean energy augmented to 609499. In Europe, clean energy production experienced tremendous growth, per (Figure 2).

## Source: IRENA 2022

Cyprus, the treasure of the eastern Mediterranean, is endowed with lush plains, endless sunshine, steep mountains, and magnificent beaches, and its stunning landscape begs to be preserved. Switching to clean energy sources is one of the effective methods to keep the environment secure (RES). The European policy target for twenty-twenty outlines Cyprus's issue. These encompass the growth of local resources, improved energy supply security, increased competitiveness,
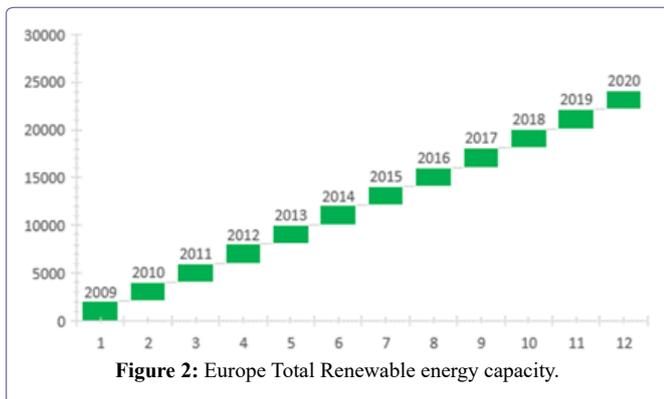
**Figure 2:** Europe Total Renewable energy capacity.

and environmental security. Cyprus must achieve a clean energy share of thirteen percent (13%) in its total final energy utilization in this project.

Since 2019 Cyprus increased total clean energy to 12MW. In 2010, clean energy increased to 97; in 2011, it increased to 153; in 2012, clean energy increased to 173. In 2013, clean energy improved to 192. In 2014, it increased to 221. In 2015 clean energy increased to 244. In 2016 it increased to 252; in 2017, clean energy production increased to 289. In 2018 it increased to 322; in 2019, clean energy increased to 322; and in 2020, clean energy augmented to 371. In Cyprus, clean energy production recorded incredible growth per (Figure 1).

Cyprus-Energy-Regulatory-Authority (CERA) came into action focusing on comprehensive energy market reforms, which was completed in twenty-twenty-one. The goal is to give customers a supplier choice and urge the private sector to generate clean energy for commercial uses. In this regard, in 2017, a revised scheme was launched, which was later updated in 2018 purposely to encourage the installation of P.V. systems up to eight M.W., wind systems up to seventeen point five M.W., and biomass usage systems up to five M.W.

Due to the European Union's clean energy directives binding requirements, a shortfall of thirteen percent in clean energy output might result in hefty fines assessed daily. Even though the daily punishment is determined, the European Commission has proposed a fine of EUR11, 404.80 a day until the required percentage of clean energy is achieved. Cyprus appears to recognize the directive's legal force since the administration declared that a total of EUR59 has been allocated to energy subsidies in the 2019 budget, with roughly EUR30 million going directly to clean energy generation.

Despite all these attempts, Cyprus is the most reliant on fossil fuels among European Union countries, posing a significant challenge. Presently, imported conventional energy provides just under ninety percent of the country's energy needs, accounting for up to eight percent of total economic growth. The novelty of this study is that it is one of its kind. No topic of this nature has been done in Cyprus. Similar to this study is [2]. This study follows the current methodology by adding a new approach such as the ARDL approach contrarily to [2]. The only research highlights much on the stock market's pertinent international investment and clean energy ensuring environmental quality in Cyprus. The above background necessitated the study to find the answer is to ''Does the collaboration between Clean energy, Stock market development, and international investment abate $CO_2$ emission in Cyprus?'. The study is organized into five parts the

introduction section, the methodology section, data presentation, analysis-discussion, conclusion, and policy directions.

## Brief Literature Review

The literature is divided into three sections. Thus the connection between renewable energy and CO2 emissions, Stock market development and CO2 emissions, international investment, and CO2 emissions.

## Renewable Energy and $CO_2$ Emissions

[3] Study the interrelationship between clean and non-renewable energy use, $CO_2$ emission, and growth in twenty-six European nations. The information was gathered from WDI and covered the period from 1990 to 2018. The outcome granger causality shows a long-term connection between clean, non-renewable energy, $co_2$, and economic expansion. The findings from this study contradict the findings of others, although they suggest a unidirectional causation relation between renewable energy and $co_2$. The result indicates that clean energy and non-renewable energy sources are interdependent and interchangeable. At the same time, [4] study aims to examine the STIROAT model's applicability in assessing carbon dioxide emissions from OECD nations from 1980 to 2011. According to the empirical findings, renewable energy usage correlates with decreased $co_2$ emissions. At the same time, [5] study outcome indicated that renewable energy contributes significantly to $CO_2$ emissions in the SSEA regions. Furthermore, the empirical results indicate that middle-income nations are experiencing a substantial increase in clean energy/fossil fuel energy consumption, resulting in greenhouse emissions in the SSEA regions. Also, [6] also examines the interplay between renewable energy uses, economic growth, and $co_2$ emissions. In other to carry out the analysis, the author has utilized the structural VAR method. A unit root test of the variables in question shows that they are non-stationary at their level and stationary in the first difference form. The study findings show that as clean energy use is bolstered, GDP rises, and $co_2$ emissions fall. The variance decomposition highlights the importance of using clean energy sources in reducing the forecast error variance of economic growth and carbon dioxide emissions. Correspondingly, [7], utilizing the ARDL bound testing approach, explored the lonk of $co_2$ emission on population growth, foreign investment, and clean energy in Pakistan. Causal relation was checked with the aid of the pairwise Granger causality method. Findings expressed that $co_2$ emission has an adverse link with clean energy. Adding more, [8] examine the impact of renewable energy and non-renewable energy consumption real income on $CO_2$ emissions evidence from structural breaks test. The studied variable became stationary at the first difference, according to the Zivot-Andrews unit rot test with structural breaks. $Co_2$ and renewable energy are cointegrated according to the Gregory-Hansen cointegration test with structural breaks. Improvement in renewable energy usage alleviates environmental according to the ARDL model's long-run projection.

## International Investment and $CO_2$ emission

[9] Looked at how economic policy uncertainty and FDI direct investment impacted $CO_2$ emissions in 24 industrialized and developing nations from 2001 to 2019. Following cross-section dependency and cointegration check, Granger causality approaches as dynamic seemingly unrelated regression and panel vector error correction model are employed for long-run estimates and validate the causal relationship between variables. Conversely, a one percent rise in international

investment is related to a decrease in $CO_2$ emissions. Likewise, [7] utilizing the ARDL bound testing approach and Granger causality approach, analyzed the dynamic interaction of $co_2$ emission on population growth, foreign investment, and renewable energy in Pakistan. The result exposed that FDI and population growth has significant positive interactions with $co_2$ emission, which means that a stringent benchmark is needed from the government of Pakistan to improve the economy's growth via the demonization of carbon dioxide emission. [10] Selected a panel of belt and road initiative nations from 1990 to 2017 to investigate the role of FDI and globalization on $co_2$ via the channel of energy usage. According to the dynamic seemingly unrelated regression, FDI does not predict co2 in the long run. This means that international investment lessens environmental repercussions with reduced $co_2$ emissions. [11] Examine the nexus between Turkey's foreign trade and CO2 emissions. The study employed linear and nonlinear ARDL models and identified significant asymmetric effects of import, export, and FDI on $CO_2$. Nevertheless, FDI has no significant effect in the long run. A decrease in export reduces $CO_2$ emissions in the long term, and an increase in export does not affect $CO_2$. In the long run, increases in imports raise $CO_2$ emissions. On the other hand, a decrease in export has no effect in the long run. Export and import were affected positively by urbanization and financial development. The study found that an increase in real GDP per capita led to the minimization of CO2 for the most current decades. For two of the four domains, changes in the overall emissions of $CO_2$ and the country's export and import numbers are reflected in different ways in the sectorial carbon dioxide emission share. In these cases, export leads to lower carbon dioxide shares while imports lead to higher $co_2$ share. Equally, [12] examine the link between FDI, renewable energy, non-renewable energy, GDP, and $co_2$ in 26 European countries. The study employed unbalanced panel data in its analysis. Granger causality indicated that there is significant long-run causality running from FDI to $co_2$ emissions. Since FDI-led growth does not appear to apply to both the E.U. countries and the five new member states, FDI-led growth does not appear to be a viable option. On the other hand, the short-term effect of FDI inflows on $co_2$ emissions in the 1st-4[the] enlargement nations is negligible, but in the long-term, this effect is lost.

Again, Lee (2005) studied the relationship between FDI and pollution in Malaysia. Depending on the level of development of the host country, findings revealed different causation correlations between the two factors. Carbon dioxide emissions Granger cause FDI inflows.

## Stock Market and Environmental Quality

[13] Study on stock market development and low-carbon economy in E.U. countries from 1980- to 2016 and found that the stock market fosters a low carbon economy. [14] Study concentrated on finding the asymmetric link between stock market development, energy efficiency, and environmental quality via a nonlinear analysis. The finding from the study indicates that positive and negative shocks on stock market indicators minimize environmental quality by deepening environmental pollution. [15] Concentrated on how environmental degradation reacts to stock market development in developing countries spanning from 1990- to 2014 in a panel of sixty developing countries. From disclosure stock market decreases environmental degradation in the short and long run. [16] Study tackled stock market and financial institution development on co2 emissions with the merit of clean energy usage and international investment in G20 economies from 1981-2017 via the CCEMG model. Findings indicate that the stock market improves the quality of the environment in advanced

countries, whiles the stock market decreases, environmental quality is minimized in developing economies. [2] Examined the impact of the stock market, clean energy usage, and urbanization on co2 emissions in BRICS economies from 1993-to 2018. The study revealed that stock market capitalization impacts co2 emissions in China, India, Russia, and South Africa. In the same study stock market positively related to environmental pollution in Brazil. [17] Examined stock market development and carbon intensity from south Asian countries spanning from 1990-to 2016 via the CS-ARDL approach. Findings from the study indicate that stock market development invigorates carbon intensity.

## Methodology

### Data description

To examine the impact of clean energy, international investment, and the stock market in mitigating $CO_2$ emissions in Cyprus. Our study tried to briefly describe variables as indicated in (Table 1). A detailed description of the variable is presented in (Table 6 in the Appendix) section.

| Variable(s) | Acronym | Proxy | Source |
|---|---|---|---|
| Clean energy | C.E. | Clean energy consumption (% of total final energy consumption) | WDI |
| Stock market capitalization | SMC | The market capitalization of listed domestic companies (current US$) | WDI |
| International investment | II | Foreign direct investment, net (BoP, current US$) | WDI |
| Co2 emissions | CO2 | CO2 emissions (metric tons per capita) | WDI |

**Table 1:** Variable Acronym, proxy, and sources.

### Model specification

To analyze the relationship among $CO_2$ emissions, stock market development, international investment, and clean energy consumption in Cyprus from 1990 to 2018, we used the ARDL model, [16] utilized in a related study. The generalized ARDL model is specified as:

$$Y_t = Y_{0i} + \sum_{i=1}^{p} \delta_i Y_{t-i} + \sum_{i=o}^{q} \beta'_i X_{t-i} + \varepsilon_{it} \qquad \text{Eq. 1}$$

Where Y't is a vector and the variable in (X't) are allowed to be purely I(0) or I(1) or co-integrated:$\boldsymbol{\beta}$ and δ are coefficients: Y is the constant: I =1,....,k;p,q are optimal lag orders; $_{it}$ is a vector of the error terms- unobservable zero-mean white noise vector process(serially uncorrelated or independent).

To perform the bounds test for cointegration, the conditional ARDL with four variables are specified as:

$$\Delta lnCO_{2t} = a_{01} + b_{11}\,lnCO_{2t-I} + b_{21}lnSMC_{t-i} + b_{31}FDI_{t-I} + b_{41}REC_{t-I} + \sum_{i=1}^{p}\alpha^1_i\Delta lnCO_{2t-i} + \sum_{i=1}^{q}a_{2i}\Delta lnSMC_{t-i} + \sum_{i=1}^{p}a_{3i}\Delta lnFDI_{t-i} + \sum_{i=1}^{p}a_{4i}\Delta lnREC_{t-i} + e_{1t}$$
Eq. 2

$$\Delta lnSMC_t = a_{02} + b_{12}\,lnCO_{2t-I} + b_{22}lnSMC_{t-i} + b_{32}lnFDI_{t-I} + b_{41}REC_t + \sum_{i=1}^{p}\alpha^1_i\Delta lnCO_{2t-i} + \sum_{i=1}^{q}a_{2i}\Delta lnSMC_{t-i} + \sum_{i=1}^{p}a_{3i}\Delta lnFDI_{t-i} + \sum_{i=1}^{p}a_{4i}\Delta lnREC_{t-i} + e_{2t}$$
Eq.3

$$\Delta lnFDI_t = \alpha_{03} + b_{13}\ lnCO2_{t-1} + b_{23}lnSMC_{t-1} + b_{33}lnFDI_{t-1} + b_{4i}\square REC_t + \sum_{i=1}^{p}\alpha_{1i}\Delta lnCO2_t + \sum_{i=1}^{q}\alpha_{2i}\Delta lnSMC_{t\_i} + \sum_{i=1}^{p}\alpha_{3i}\Delta lnFDI_{t\_i} + \sum_{i=1}^{p}\alpha_{4i}\Delta lnREC_{t\_i} + e_{3t} \qquad \text{Eq. 4}$$

$$\Delta lnREC_t = \alpha_{01} + b_{11}\ lnCO2_{t-1} + b_{21}lnSMC_{t-1} + b_{31}lnFDI_{t-1} + b_{41}REC_{t-1} + \sum_{i=1}^{p}\alpha^{1}_{i}\Delta lnCO2_{t\_i} + \sum_{i=1}^{q}\alpha_{2i}\Delta lnSMC_{t\_i} + \sum_{i=1}^{p}\alpha_{3i}\Delta lnFDI_{t\_i} + \sum_{i=1}^{p}\alpha_{4i}\Delta lnREC_{t\_i} + e_{4t} \qquad \text{Eq. 5}$$

## Error correction model

The Error Correction Model (ECM) representation is specified as:

$$\Delta lnCO2_t = \alpha_0 + \sum_{i=1}^{\mu}\alpha_{1i}\Delta lnCO2_{t\_i} + \sum_{i=1}^{q}\alpha_{2i}\Delta lnSMC_{t\_i} + \sum_{i=1}^{\mu}\alpha_{3i}\Delta lnFDI_{t_i} + \sum_{i=1}^{p}\alpha_{4i}\Delta lnREC_{t\_i} + \lambda ECT_{t\_i} + e_t \qquad \text{Eq. 6}$$

Where $\lambda$=(1-, speed of adjustment parameter with a negative sign

ECT=($lnCO2 - \theta X_t$), the error correction term

$\theta$= is the long term parameter

$\alpha_{1i}$ $\alpha_{2i}$ $\alpha_{3i}$ are the short-run dynamic coefficients of the models' adjustment long-run equilibrium

## Results and Discussion

### Descriptive statistics

This part displays the descriptive statistics of $CO_2$, REC, GDP, and FD1. Therefore, it is essential to run descriptive statistics to know what our data convey. Again, since our study is quantitative research, we must run descriptive statistics as indicated in (Table 2). We fail to reject the null hypothesis of a normal distribution with the probability statics values. We can say that REC, SMC, GDP, and $CO_2$ have a normal distribution contrary, FDI has no normal distribution because it has a significant statistical value. Therefore we reject a normal distribution for international investment because the distribution is clearly not normal.

| | REC | SMC | GDP | FDI | CO2 |
|---|---|---|---|---|---|
| **Mean** | 0.528676 | 4.333754 | 0.442941 | 2.3324941 | 0.836313 |
| **Median** | 0.5286760 | 0.0000000 | 0.570888 | 0.000000 | 0.846861 |
| **Maximum** | 1.084347 | 10.236882 | 0.973128 | 10.18425 | 0.893226 |
| **Minimum** | -0.475137 | 0.000000 | -0.396382 | 0.000000 | 0.746446 |
| **Std.Dev** | 0.465187 | 4.897775 | 0.381399 | 4.214042 | 0.043400 |
| **Skewness** | -1.026349 | 0.214001 | -0.589624 | 7.476732 | -0.506508 |
| **Kurtosis** | 3.122611 | 4.797202 | 2.785450 | 0.023793 | 2.026176 |
| **Jacque-Be-ra** | 5.109564 | 4.797202 | 2.785450 | 7.476732 | 2.385898 |
| **Probability** | 0.077709 | 0.0908450 | 0.248397 | 0.023793 | 0.303325 |
| **Sum** | 15.33160 | 125.6789 | 12.84529 | 67.64234 | 24.25309 |
| **Sum Sq, Dev.** | 6.059159 | 671.6697 | 4.073028 | 497.2283 | 0.052741 |

**Table 2:** Descriptive statistics.

Moreover, it is imperative to check for data stationarity using panel data series. Therefore, our study utilizes the ADF standard unit root test for stationarity checks. All the variables are integrated at $I(1)$ and $I(0)$ per (Tables 3 & 4). presents the short-run ARDL estimations. $CO_2$ itself, the lagged period, positively influences the current period.

At lag 1, foreign direct investment negatively influences $CO_2$ emissions but is not significant in the short term. The rising foreign direct investment can decrease $CO_2$ emissions. This section of our finding is consistent with [12]. In the case of GPD, GDP has a positive impact on $CO_2$, but the impact is not significant. This implies that as the economy experiences growth, $CO_2$ emissions increase. This is consistent with [7].

| Method | Level | | First-difference | |
|---|---|---|---|---|
| | **Constant** | **Constant &Trend** | **Constant** | **Constant &Trend** |
| LnCO2 | -1.3064 | -2.2468 | -4.1532*** | -4.2944** |
| LnREC | -2.3236 | -3.2996 | -3.7388** | -3.8332* |
| LnSMC | -0.9437 | -2.1011 | -5.1524*** | -5.0492*** |
| LnFDI | -4.5156** | -4.9507*** | -2.9063 | -2.38016 |
| LnGDP | -4.4721*** | -2.6851 | -4.1532** | -4.2944** |

**Table 3:** Unit root test (ADF).

| Variable | Coefficient | Std. Error | t. Statistic | Prob* |
|---|---|---|---|---|
| **LnCO2(-1)** | 0.833 | 0.0743 | 11.200 | 0.000 |
| **LnFDI** | -0.000 | 0.000 | -0.511 | 0.614 |
| **LnFDI(-1)** | -0.001 | 0.000 | -1.434 | 0.166 |
| **LnGDP** | 0.018 | 0.009 | 1.993 | 0.060 |
| **LnREC** | -0.035 | 0.020 | -1.674 | 0.109 |
| **LnREC(-1)** | 0.024 | 0.000 | 1.230 | 0.232 |
| **LnSMC** | 0.000 | 0.000 | 0.345 | 0.733 |
| **C** | 0.142 | 0.064 | 2.217 | 0.038 |
| **Adjusted R-squared** | 0.890 | | | |
| **F-statistic** | 32.441 | | | |
| **Prob(F-statistic)** | 0.000 | | | |

**Table 4:** ARDL short-run Estimations.

Renewable energy consumption negatively influences $CO_2$ emissions but is not significant, which means that renewable energy consumption decreases $CO_2$ emissions in the short run. These findings of our studies do not support the result of [6]. The stock market positively relates to co2 emission in the short run but is not significant. This means that the stock market can increase $CO_2$ emissions in the short run. This part of the findings is in line with [2] and [17]. The adjusted r-square is 89 percent value 32.44(p=0.00) is significant, and the Durbin Watson value is 2.4263, which proves that it is free from serial correlation.

(Table 4) presents the ARDL error correction model. Based on the error correction model, foreign direct investment is negatively related to $CO_2$ emissions but not significant. This means that foreign direct investment can decrease $CO_2$ emissions in the short run. Renewable energy hurts $CO_2$ emissions with a significant probability value. So in the short run, renewable energy can minimize $CO_2$ emissions in Cyprus. CointEq(-1)* value of -0.166 means a high speed of adjustment from the short run to the long run. If there is any disequilibrium, it takes an average speed of 16.6% to adjust back from the short run to the long run. (Table 5) presents the long-run ARDL form.

The lag period of $CO_2$ has a negative influence on the current period. Meaning $CO_2$ negatively impacts itself. Foreign direct investment is negatively related to $CO_2$ in the long run but not significant. This

| Variable | coefficient | Std Error | t-statistic | Prob. |
|---|---|---|---|---|
| C | 0.142 | 0.064 | 2.217 | 0.038 |
| LnCO2(-1)* | -0.166 | 0.074 | -2.241 | 0.036 |
| LnFDI(-1) | -0.001 | 0.001 | -1.817 | 0.084 |
| LnGDP** | 0.018 | 0.009 | 1.993 | 0.060 |
| LnREC(-1) | -0.010 | 0.008 | -1.226 | 0.234 |
| LnSMC** | 0.000 | 0.000 | 0.345 | 0.733 |

**Table 5:** ARDL long run Estimation.

suggests that foreign direct investment can decrease $CO_2$ emissions in the long term. This finding contrasts with Lee (2005) and [11]. GDP is positively related to $CO_2$ emissions in the long run but not significant. This implies that economic growth can increase $CO_2$ in the long run in Cyprus. Renewable energy negatively impacted $CO_2$ emissions but was not significant. This suggests that renewable energy can reduce $CO_2$ emissions in the long run. This part of our result is consistent with [4] and [5]. On the other hand, the stock market positively influences $CO_2$ emissions but is not significant. This in in contrast with [13] and [14]. (Table 6) presents the information on the Bounds test. The f-statistic value indicates a long-run equilibrium relationship between the dependent and the independent variables.

| Test Statistic | Value | Signif | I(0) | I(1) |
|---|---|---|---|---|
| F-statistics | 4.264 | 10% | 2.2 | 3.09 |
| K | 4 | 5% | 2.56 | 3.49 |
| | | 2.5% | 2.88 | 3.87 |
| | | 1% | 3.29 | 4.37 |

**Table 6:** F-Bounds Test.

This part of our result is consistent with [3]. The f-statistics value is higher than five, ten, and two percent lower bound and upper bound [18-54]. This means that our model passed the cointegration test.

## Conclusion and Policy Implication

The study sought to determine whether the collaboration between clean energy, Stock market development, and international investment, abate $CO_2$ emissions in Cyprus. Our study employed descriptive statistics and correlation to know the normality and multicollinearity of the variables. ADF validated the stationarity of the variables. Per the short-run ARDL model, rising foreign direct investment can decrease $CO_2$ emissions as the economy experiences growth, $CO_2$ emissions increase in the short term. Renewable energy consumption decreases $CO_2$ emissions in the short run. The stock market positively relates to co2 emission in the short run. Per the Durbin Watson value, the model is free from serial correlation.

Nevertheless, in the long run, ARDL revealed that foreign direct investment is negatively related to $CO_2$ in the long run. Renewable energy negatively impacted $CO_2$ emissions in the long run. The stock market positively influences $CO_2$ emissions. The Error Correction Model revealed sixteen point six percent the high speed of adjustment from the short run to the long run. The bound test validated a long-run equilibrium relationship between the dependent and the independent variables. The finding of the study triggered the following policy insight. Effective policies on international investment stock market development should be implemented to accelerate clean energy consumption while minimizing environmental degradation. The

findings suggest that stock market development positively relates to environmental quality, implying that Cyprus should invest more in stock market development.

Further, a shift in views towards stock market development is required, and officials in Cyprus should implement regulations that promote the sector's growth. The study also fills the lacuna in environmental repercussions caused by the energy commission's minimal coverage of environmental mitigation and restoration systems. As a result, there is a pressing need to focus on energy efficiency, improving the technical know-how of energy production and transmission, and substituting clean fuels for conventional fuels. This would aid in reversing the detrimental effect of energy production and its utilization on the environment. This research looked into the effect of clean energy, international investment, and stock market development on environmental quality in Cyprus alone; therefore, future research should look into Cyprus's institutional flaws, notably those that impede international investment and environmental law.

## Declaration

### Ethical Approval

Not applicable

### Consent to Participate

Not applicable

### Consent to Publish

Not applicable

### Author's Contribution

BAA wrote the introduction section, the methodology, analysed and interpreted the data regarding the subject under study. All author'(s) read and approved the final manuscript.

### Funding

### Competing interests

The authors declare that they have no competing interest

### Availability of Data and materials

The data used and/ or analyzed during the current study are available from the corresponding author on reasonable request.

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## Appendix

| Variable(s) | Acronym | Proxy | Definition | source |
|---|---|---|---|---|
| **Clean energy** | C.E. | Renewable energy consumption (% of total final energy consumption) | Clean energy consumption is the share of renewable energy in total final energy consumption. | WDI |
| **Stock market capitalization** | SMC | The market capitalization of listed domestic companies (current US$) | Stock market capitalization: Market capitalization (also known as market value) is the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies are excluded. Data are end-of-year values converted to U.S. dollars using corresponding year-end foreign exchange rates. | WDI |
| **International investment** | II | Foreign direct investment, net (BoP, current US$) | International investment: international investments are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than the investor. As shown in the balance of payments, it is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital. This series shows the total net FDI. In BPM6, financial account balances are calculated as the change in assets minus the liabilities. Net FDI outflows are assets, and net FDI inflows are liabilities. Data are in current U.S. dollars. | WDI |
| **$CO_2$ emissions** | $CO_2$ | $CO_2$ emissions (metric tons per capita) | Carbon dioxide emissions stem from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during solid, liquid, and gas fuels and gas flaring. | WDI |

**Table 6:** Detail description of variables.

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Advances In Microbiology Research | ISSN: 2689-694X

Archives Of Surgery And Surgical Education | ISSN: 2689-3126

Archives Of Urology

Archives Of Zoological Studies | ISSN: 2640-7779

Current Trends Medical And Biological Engineering

International Journal Of Case Reports And Therapeutic Studies | ISSN: 2689-310X

Journal Of Addiction & Addictive Disorders | ISSN: 2578-7276

Journal Of Agronomy & Agricultural Science | ISSN: 2689-8292

Journal Of AIDS Clinical Research & STDs | ISSN: 2572-7370

Journal Of Alcoholism Drug Abuse & Substance Dependence | ISSN: 2572-9594

Journal Of Allergy Disorders & Therapy | ISSN: 2470-749X

Journal Of Alternative Complementary & Integrative Medicine | ISSN: 2470-7562

Journal Of Alzheimers & Neurodegenerative Diseases | ISSN: 2572-9608

Journal Of Anesthesia & Clinical Care | ISSN: 2378-8879

Journal Of Angiology & Vascular Surgery | ISSN: 2572-7397

Journal Of Animal Research & Veterinary Science | ISSN: 2639-3751

Journal Of Aquaculture & Fisheries | ISSN: 2576-5523

Journal Of Atmospheric & Earth Sciences | ISSN: 2689-8780

Journal Of Biotech Research & Biochemistry

Journal Of Brain & Neuroscience Research

Journal Of Cancer Biology & Treatment | ISSN: 2470-7546

Journal Of Cardiology Study & Research | ISSN: 2640-768X

Journal Of Cell Biology & Cell Metabolism | ISSN: 2381-1943

Journal Of Clinical Dermatology & Therapy | ISSN: 2378-8771

Journal Of Clinical Immunology & Immunotherapy | ISSN: 2378-8844

Journal Of Clinical Studies & Medical Case Reports | ISSN: 2378-8801

Journal Of Community Medicine & Public Health Care | ISSN: 2381-1978

Journal Of Cytology & Tissue Biology | ISSN: 2378-9107

Journal Of Dairy Research & Technology | ISSN: 2688-9315

Journal Of Dentistry Oral Health & Cosmesis | ISSN: 2473-6783

Journal Of Diabetes & Metabolic Disorders | ISSN: 2381-201X

Journal Of Emergency Medicine Trauma & Surgical Care | ISSN: 2378-8798

Journal Of Environmental Science Current Research | ISSN: 2643-5020

Journal Of Food Science & Nutrition | ISSN: 2470-1076

Journal Of Forensic Legal & Investigative Sciences | ISSN: 2473-733X

Journal Of Gastroenterology & Hepatology Research | ISSN: 2574-2566

Journal Of Genetics & Genomic Sciences | ISSN: 2574-2485

Journal Of Gerontology & Geriatric Medicine | ISSN: 2381-8662

Journal Of Hematology Blood Transfusion & Disorders | ISSN: 2572-2999

Journal Of Hospice & Palliative Medical Care

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Journal Of Internal Medicine & Primary Healthcare | ISSN: 2574-2493

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Journal Of Neonatology & Clinical Pediatrics | ISSN: 2378-878X

Journal Of Nephrology & Renal Therapy | ISSN: 2473-7313

Journal Of Non Invasive Vascular Investigation | ISSN: 2572-7400

Journal Of Nuclear Medicine Radiology & Radiation Therapy | ISSN: 2572-7419

Journal Of Obesity & Weight Loss | ISSN: 2473-7372

Journal Of Ophthalmology & Clinical Research | ISSN: 2378-8887

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Journal Of Pharmacology Pharmaceutics & Pharmacovigilance | ISSN: 2639-5649

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