Does Globalization Asymmetrically Affect CO2 Emissions in Pakistan? A New Evidence through NARDL Approach

Fatima Farooq, Muhammad Faheem, Muhammad Zahid Usman

Assistant Professor, School of Economics Bahauddin Zakariya University, Multan, Pakistan
Email: fatimafarooq@bzu.edu.pk; http://orcid.org/0000-0002-7488-0579.
Lecturer, School of Economics Bahauddin Zakariya University, Multan Pakistan
Email: malik007.bzu@gmail.com
M. Phil Business Economics Scholar, School of Economics Bahauddin Zakariya University, Multan Pakistan
Email: zahidusman0121@gmail.com

ARTICLE DETAILS
History: Accepted 12 Dec 2020
Available Online 31 Dec 2020

Keywords: Globalization, Institutional Quality, ARDL and NARDL, Pakistan

JEL Classification: B15, R15

DOI: 10.47067/real.v3i3.96

The study examines the impact of globalization and institutional quality on environmental degradation in Pakistan. The study employs symmetric and asymmetric Autoregressive Distributed Lag Model (ARDL) at a time to check the linear and nonlinear effect of globalization on the environment over 1985 to 2017. The long-run findings of linear ARDL shows globalization affect positively to the environment and all other control variables FDI, GDP are significant with a positive sign while institutional quality and the interaction term of globalization and institutional quality is significant with a negative sign. The study also finds the marginal effect of interaction term and found that globalization has a different effect on the environment with different level of institutional quality. The linear ARDL model is not suitable to check the asymmetric behaviour of globalization on the environment. For this, the study applied a nonlinear ARDL estimation method. The findings of the nonlinear ARDL model showed the asymmetric behaviour of globalization on the environment. This study provides a new direction by proving the asymmetric relationship of globalization on environment quality that is more beneficial for policymakers and government officials.

© 2020 The authors. Published by SPCRD Global Publishing. This is an open access article under the Creative Commons Attribution-NonCommercial 4.0

Corresponding author’s email address: fatimafarooq@bzu.edu.pk

1. Introduction
In the past few decades, there is an indicator of climate change and global warming, which is increasing and contributing to the awareness of increasing environmental degradation (Majeed and Ozturk, 2020). Same as there is the economic activity which is affecting environmental degradation become the most popular topic for the researchers. In this aspect, there is the hypothesis of Kuznets curve and pollution hypothesis (Halo & Haven) on the environment is the many time surveyed
hypothesis that shows the relation of level of income as well as a foreign direct investment with the environment. Pollution haven hypothesis states that foreign direct investment degrades the environment, which is empirically proved in recent literature (Nathaniel et al., 2020; Nadeem et al., 2020). In pollution halo hypothesis opponents claimed that foreign direct investment cleans the environment that also proved in studies (Salehnia et al., 2020; Zhao et al., 2020).

Globalization can be stated as a modification from independent and secluded economies at the national level with trade and the barriers in investment, rules and regulation, and merge a cultural difference, depending on each other in the global economy (Hill-2008). The overall social, economic, political globalization shows positive as well as adverse effect on the environment from the recent decades between the nations (Lv and Xu, 2018; Shahbaz et al., 2018; Bilgili et al., 2020; Saud et al., 2020; Suki et al., 2020). Globalization has some economic features which affect the environment by the trade and FDI networks. In this case, the investor from foreign shall hire the new and latest technology through initiating or for growing their business projects that will reduce the consumption of energy and will improve the quality of the environment (Assamoi et al., 2020). The cost of production will be decreased and also reduce the consumption resources by using the latest and advanced technology that will give the idea to businesses at domestically to use the latest technology. Despite this all, the environmental quality will decline, if the foreign companies depend on straight and out old dated technologies (Shahbaz et al-2016). The globalization effect on the environment by trade openness can be defined as scale, effective technique and composition. Globalization will increase the consumption of energy and emission by rapid growth in economic activities. Globalization combines effect carries the changes in the structure of the economy (Anwar et al., 2016).

Apart from the globalization other factors also affect the environment like economic growth, foreign direct investment and institutional quality which already proved in the previous empirical literature. There are many studies which define the relation of economic growth and institutional quality with environmental degradation as utilization of CO2 emission (Salahuddin et al., 2015; Ali et al., 2019; Chaudhry et al., 2020).

The study contributes to the literature in many ways: (1) this study uses the unique methodologies ARDL and NARDL at a time to show the linear and nonlinear effect of globalization on CO2 emission; (2) our study uses interaction term (globalization*Institutional quality) and also finds the marginal effect of interaction term that shows globalization has a different effect on the environment with different level of institutional quality; (3) Finally, the study provides the new direction by proving the asymmetric relationship of globalization on environment quality that is more beneficial for policymakers in the formulation of policy.

The rest of the paper structures as following: the next section provides the literature of previous studies. Section 3 and 4 gives information about data and methodology and discussion about results, respectively. The last section provides concluding remarks and policy recommendations.

2. Literature Review

Lv and Xu (2018) show a relationship which is negative between the CO2 emission and globalization by using the panel estimation techniques for the panel of 15 countries against the cross-sectional and heterogeneity dependence for the time period of 1970-2012. Same as You and Lv (2018) propose a negative relationship for 83 countries panel between the CO2 emission and globalization. According to the discussion, Twerefou et al. (2017) show the relationship between CO2 emission and the globalization by applying the technology named GMM for the panel of 36 economies of Africa. The
results reveal that in particular African countries environment degraded by the globalization. Same as Shahbaz et al. (2018) examine the consequences of CO2 emissions by globalization for the panel of developed 25 countries. The results disclose that there is a positive effect of globalization on the carbon dioxide emissions in the economies which are developed. Salahuddin et al. (2019) show that there are the 44 SSA countries in which the effect on Carbon Dioxide emission effected by the globalization by applying the techniques of panel estimation. The results reveal that there is no significant impact on carbon dioxide from the globalization and also there is a positive impact of the urbanization on the carbon dioxide emission. Suki et al. (2020) revealed the association of globalization and environment by using quantile ARDL method over quarterly date from 1970-2018 in Malaysia. The findings showed that globalization degrades the environment. Xu et al. (2018) claims no effect of globalization on the carbon dioxide emission in Saudi Arabia. By adding all, researcher analysis the impact of globalization on various environmental signs and the findings changes throughout the countries. Globalization has both effects as negative and positive on political, economic and social aspects. Many of the recent studies apply the panel data with non-conclusive results.

More recently, Nasir et al. (2019) found supporting results for PHH hypothesis by indicating that FDI enhances economic growth at the cost of CO2 emissions in ASEAN-5 countries(Singapore, Thailand, Malaysia, Philippines and Indonesia) by using the data covering the period 1982–2014. The study used quantitative techniques for panel data analysis which involved Fully Modified OLS (FMOLS) and Dynamic Ordinary Least Squares (DOLS) methods. Similarly, Hanif et al. (2019) confirmed the PHH hypothesis for 15 Asian countries, for the period 1990–2013. The study of Mohmmed et al., (2019) discovered the change in the carbon dioxide CO2 emission and its driving factors in the top 10 emitting economies. The method used for this study was The Logarithmic mean Divisia index (LDMI) which analysed that due to CO2 emissions, there is significant change in the per capita income, energy intensity, carbon intensity effects and population. The data used for these countries was from 1991 to 2014. The results show that due to the increased CO2 emission, there is a significant effect in these emitting countries, especially in China and the United States by income and population. Opoku and Boachie (2020) investigated the effect of foreign direct investment and industrialization environment. In this study were used data time period from 1980 to 2014. The investigation applied to 36 selected African countries. We examined Environmental proxies with a variety of variables, including carbon dioxide, nitrous oxide, methane, and complete and the Emissions of Greenhouse Gases. Pooled Mean Group technique was used to check the significance level of variables. The results showed that industrial environmental have a significant effect on foreign direct investment. Nadeem et al (2020) results showed that a positive long-term model is a positive relationship between the inflow of FDI and CO2 emissions, solid fuel CO2 emissions, and GHG and CO2 emissions. The long-term negative relationship between the inflow of FDI and emissions of SO2. Overall, we did not find any definitive proof of the life for Pakistan. Ali et al. (2019) estimates the effect of quality of institutions on the emission of carbon throughout the 47 countries which are developing. The results uncover that the quality of institutions issues for the environment.

3. Methodology

The finest and well-known sources of data are used to collect the data. These are data collection sources as “Statistical Review of World Energy” for CO2 emissions, International country risk guide (ICRG) for institutional quality and “World Development Indicators” for FDI and GDP. The study uses overall globalization and data sourced from KOF index of globalization. The study uses data that covers 1985-2017 on data availability.

The previous literature used different econometric methodologies to check the effect of
globalization on different macroeconomic indicators. This study uses Autoregressive distributed lag model (ARDL) to prove hypothesis on the behalf of stationary results. The mixed order of integration leads to apply the method of ARDL. Prior to this, this is necessary to identify the long run existence in the model. There ought to be the co-integration for this between the variables that will be perceived by F-test. Subsequent attaining these tests and the presence of long-run clearance, the following significant step is to exercise the technique of ARDL. By this, the technique of ECM is formulated on the model empirically to identify the impact of the short run to the long run and equilibrium stability. Toward the conclusion, diagnostic tests are experienced on the empirical model to detect the model is unrestricted from all problems with respect to hetero, normality, stability. The ARDL model is not sufficient to check asymmetric behaviour of globalization therefore, the study uses a nonlinear ARDL model, which was introduced by Shin, Yu, and Greenwood-Nimmo (2014).

This study examines the effect of globalization, gross domestic product, foreign direct investment, institutional quality and the interaction term of globalization and institutional quality on the degradation of the environment in Pakistan. Here,

$$ CO_2 = f (GLOB, GDP, FDI, INSQ, (GLOB*INSQ)) $$ (1)

The equation (1) defines that the carbon emission is the function of globalization, growth of the economy, foreign direct investment, institutional quality and the interaction term of (GLOB*INSQ). Following is the model specification based on the previous studies,

$$ CO_{2t} = \beta_0 + \beta_1 GLOB_t + \beta_2 GDP_t + \beta_3 FDI_t + \beta_4 INSQ_t + \beta_5 (GLOB \ast INSQ)_t + \mu_t $$

(2)

The ARDL formulation as follows:

$$ \Delta CO_{2t} = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta CO_{2t-i} + \sum_{i=0}^{q} \beta_i GLOB_{t-i} + \sum_{i=0}^{r} \alpha_i \Delta GDP_{t-i} + \sum_{i=0}^{s} \beta_i \Delta FDI_{t-i} + \sum_{i=0}^{t} \alpha_i \Delta INSQ_{t-i} +$$

$$ + \sum_{i=0}^{v} \alpha_i \Delta (GLOB \ast INSQ)_{t-i} + \beta_1 CO_{2t-i} + \beta_2 GLOB_{t-i} + \beta_3 GDP_{t-i} + \beta_4 FDI_{t-i} + \beta_5 INSQ_{t-i} + \beta_6 (GLOB \ast INSQ)_{t-i} + \mu_t $$

(3)

So, ECM model estimation as :

$$ \Delta CO_{2t} = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta CO_{2t-i} + \sum_{i=0}^{q} \beta_i GLOB_{t-i} + \sum_{i=0}^{r} \alpha_i \Delta GDP_{t-i} + \sum_{i=0}^{s} \beta_i \Delta FDI_{t-i} + \sum_{i=0}^{t} \alpha_i \Delta INSQ_{t-i} +$$

$$ + \sum_{i=0}^{v} \alpha_i \Delta (GLOB \ast INSQ)_{t-i} + \lambda ECT - 1 + v_t $$

(4)

$\lambda$ expresses the speed of adjustment parameter in equation (4) and the residuals from the model is denoted by ECT.

We take partial derivatives of equation (4) to confine the marginal effects of changes in the two variables with respect to the globalization, as follows:

$$ \delta CO_{2t} / \delta GLOB_t = \alpha_2 + \alpha_6 INSQ_t $$

(5)

In the partial derivative if ($\alpha_2$ and $\alpha_6$) are positive that shows a high level of globalization and
the high level of institutional quality would improve the environment. But if these two coefficients have different signs that indicate the threshold effect exists that environmental impact of globalization varies with the level of the institutional quality. So, there is compulsory to evaluate marginal effect within the sample. Similarly, this would be applied in the nonlinear model.

The above ARDL model can be written as NARDL (Shin, Yu, and Greenwood-Nimmo (2014)) formulation as follows:

\[
\Delta CO_2 = \alpha_0 + \sum_{i=1}^{p} \delta_i \Delta CO_2_{t-1} + \sum_{i=0}^{p} \alpha_i' GLOB_{t-1} + \sum_{i=0}^{p} \alpha_i FDI_{t-1} + \sum_{i=0}^{p} \alpha_i INSQ_{t-1} + \sum_{i=0}^{p} \alpha_i (GLOB_{t-1} \ast INSQ_{t-1}) + \beta_1 CO_{t-1} + \beta_2 GLOB_{t-1} + \beta_3 GDP_{t-1} + \beta_4 FDI_{t-1} + \beta_5 INSQ_{t-1} + \beta_6 (GLOB_{t-1} \ast INSQ_{t-1}) + \mu
\]

(6)

\[\beta_2^+ \text{ and } \beta_2^- , \alpha_2^+ \text{ and } \alpha_2^- \text{ measures asymmetry by taking following hypotheses in the long run and short run:}\]

\[H_0: \beta_2^+ = \beta_2^- = 0\]

\[H_1: \sum_{i=0}^{p} \alpha_2^+ = \sum_{i=0}^{p} \alpha_2^-\]

for all \(i=0, \ldots, p\).

4. Results and Discussion
4.1 Descriptive Statistics and Correlation Matrix

The result of descriptive statistics shows the mean value of CO2, Globalization, INSQ, FDI, GDP, (GLOB*INSQ) are 105.6861, 46.63502, -0.012951, 1.006286, 1.35E+11 and (GLOB*INSQ) 2.510603 respectively. The maximum value of CO2 195.7069, Globalization 55.34643, Institutional quality 2.754684, FDI 3.668323, GDP 2.54E+11 and (GLOB*INSQ) 122.1868 respectively. The minimum value of CO2 36.51237, Globalization 34.35223, Institutional quality -6.062273, FDI 0.178192, GDP 5.60E+10 and (GLOB*INSQ) -208.5540 respectively. The standard deviation value of CO2 44.96726, Globalization 7.403649, Institutional quality 1.393037, FDI 0.813576, GDP 5.57E+10 and (GLOB*INSQ) 55.52804 respectively. The correlation matrix shows the association between the variables. The high value of the coefficient of correlation shows the high association between the variables.
Table 4.1: Descriptive Statistics & Correlation Matrix

|        | CO2   | GLOB  | INSQ  | FDI   | GDP   | (GLOB*INSQ) |
|--------|-------|-------|-------|-------|-------|-------------|
| Mean   | 105.6861 | 46.63502 | -0.012951 | 1.006286 | 1.35E+11 | 2.510603   |
| Median | 98.88407  | 47.65687  | 0.084339  | 0.764443  | 1.20E+11 | 3.475800   |
| Maximum| 195.7069  | 55.34643  | 2.754684  | 3.668323  | 2.54E+11 | 122.1868   |
| Minimum| 36.51237  | 34.35223  | -6.062273 | 0.178192  | 5.60E+10 | -208.5540  |
| Std. Dev. | 44.96726 | 7.403649 | 1.393037 | 0.813576 | 5.57E+10 | 55.52804   |
| Skewness | 0.201170 | -0.339351 | -1.995431 | 2.065990 | 0.469302 | -1.104099  |
| Kurtosis | 1.977772 | 1.690547 | 11.72234 | 6.608571 | 2.141473 | 7.703930   |
| Jarque-Bera | 1.759959 | 3.172317 | 134.1758 | 43.88860 | 39.7951  |
| Probability | 0.414792 | 0.204710 | 0.000000 | 0.000000 | 0.307332 | 0.000000   |
| Sum | 3699.014 | 1632.226 | -0.453278 | 35.22001 | 4.71E+12 | 104834.4 |
| Sq. Dev. | 68749.86 | 1863.677 | 65.97882 | 22.50478 | 1.06E+12 | 87.87109   |

4.2 Unit Root Test

The findings of the unit root test express that all variables have a mixed order of integration. The variable CO2, globalization, GDP, FDI and (GLOB*INSQ) are non-stationary at the level, and it becomes stationary at first differences, while institutional quality and (GLOB*INSQ) is stationary at the level as well as at first difference.

Table 4.2: Unit Root Test

| Variable | ADF | PP |
|----------|-----|----|
|          | Level | First Difference | Level | First Difference |
| CO2 | 1.063 | -3.095*** | 1.009 | -3.095*** |
| GLOB | -1.848 | -4.435*** | -1.739 | -4.435*** |
| INSQ | -3.964*** | -2.272** | -5.576*** | -9.028*** |
| GDP | 3.533 | -4.176*** | 4.018 | -4.201*** |
| FDI | -2.823 | -3.867*** | -1.933 | -3.842*** |
| (GLOB*INSQ) | -3.920*** | -2.438** | -4.559*** | -7.274*** |

4.3 ARDL Bound Test

Table 4.3 shows the bound test a result which clearly indicates F-stat is equal to 6.5755 is higher than upper bounds that show the long-run association between the variables.

Table 4.3: Bound Test (ARDL)

|          | 1% | 5% | 10% |
|----------|----|----|-----|
| Lower Bound | 4.257 | 3.037 | 2.508 |
| Upper Bound | 6.040 | 4.443 | 3.763 |
| F-Stat | 6.5795 |    |    |
4.4 ARDL Short Run and Long Run Results

In table 4.4, diagnostic test results show our model is free from hetero problem, auto problem normal and stable. The value of R2 is 0.89, and the value of Durbin Watson is 2.073. The coefficient of globalization is 0.093 and 0.062, which is positively significant which means a 1% increase in globalization will degrade the environment by 0.09% and 0.062% in long run and short run. The variable FDI is significant with the positive sign which validates the pollution haven hypothesis (PHH). The variable GDP is significant with a positive sign in the short-run and long run. While institutional quality and the interaction term (GLOB*INSQ) is significant with a negative sign in the long run only. Error correction term ECM (-1) is significant with a negative sign that insures the long-run stability.

Table 4.4: ARDL RESULTS

| Long Run Results | Coefficient | Std. Error | t-stat |
|------------------|-------------|------------|--------|
| GLOB             | 0.093**     | 0.036      | 2.583  |
| INSQ             | -0.132*     | 0.077      | -1.722 |
| FDI              | 0.037*      | 0.019      | 1.939  |
| GDP              | 1.112***    | 0.205      | 5.430  |
| (GLOB*INSQ)      | -0.003*     | 0.002      | -1.815 |
| Constant         | -10.076***  | 1.957      | -5.148 |

| Short Run Results | Coefficient | Std. Error | t-stat |
|-------------------|-------------|------------|--------|
| D(GLOB)           | 0.062**     | 0.029      | 2.085  |
| D(INSQ)           | -0.034      | 0.023      | -1.481 |
| D(FDI)            | 0.012***    | 0.004      | 3.227  |
| D(GDP)            | 0.287***    | 0.075      | 3.821  |
| D(GLOB*INSQ)      | -0.0008     | 0.0005     | -1.60  |
| ECM(-1)           | -0.258***   | 0.093      | -2.779 |

| Diagnostic Test   | J.B Test    | LM Test    | R²       |
|-------------------|-------------|------------|----------|
|                   | 0.541 (0.763) | 0.298 (0.589) | 0.89 |
|                   | HETERO Test | RAMSEY Test|          |
|                   | 1.093 (0.391) | 2.272 (0.143) |          |

Note: *, **, *** shows significance level at 10%, 5% and 1%, respectively.

The following figures 4.1 and 4.2 represent the graph of CUSUM and CUSUMSQ for stability test.

Figure 4.1: CUSUM graph
It is necessary to compute the marginal effect within the sample by using the estimated coefficients of the ARDL model as the sign of the estimated coefficients are different as shown in table 4.4.

Table 4.5 shows the marginal effect at a different level of institutional quality.

\[ \delta CO_{2t} / \delta GLOB_t = 0.093 - 0.003INSQ_t \]

Moreover, the marginal effect of globalization on the environment is analyzed at minimum, the mean and maximum level of institutional quality is 0.111186, 0.093039 and 0.084735, respectively.

| Pakistan | Institutional Quality | Minimum   | Average   | Maximum   |
|----------|-----------------------|-----------|-----------|-----------|
|          |                       | -6.062273 | -0.012951 | 2.754684  |
|          | Marginal Effect       | 0.111186  | 0.093039  | 0.084735  |

The following graph expresses the marginal effect of globalization on different level institutional quality which shows the environment improve on a high level of institutional quality.
4.5 NARDL Bound Test

Table 4.6 shows the bound test results which clearly indicate F-stat is higher than upper bounds that validate the long-run association between variables.

|                  | 1%    | 5%    | 10%   |
|------------------|-------|-------|-------|
| **Lower Bound**  | 4.016 | 2.864 | 2.387 |
| **Upper Bound**  | 5.797 | 4.324 | 3.671 |
| **F-Stat**       | 9.23  |       |       |

4.6 NARDL Short Run and Long Run Results

In table 4.9, diagnostic test results show NARDL model is free from hetero problem, auto problem normal and stable. The value of R2 is 0.881, and the value of Durbin Watson is 2.036. In tables 4.7 and 4.8, coefficients of GLOB-POS and GLOB-NEG are 0.018, 0.006 and 0.050, 0.015 which is statistically significant in the long run and short run, respectively. It means that a 1% increase in positive globalization will increase CO2 emission by 0.018% and 0.006% in the long and short run. On the other hand, a 1% decrease in globalization will decrease in CO2 emission by 0.050% and 0.015% in the long and short run, respectively. Other control variables like FDI and GDP are significant with a positive sign while INSQ and interaction term are significant with a negative sign in long run. Error correction term ECM (-1) is significant with a negative sign that insures the long-run stability.

Table: 4.7 NARDL RESULTS

|                  | Coefficient | Std. Error | t-stat  |
|------------------|-------------|------------|---------|
| **GLOB-POS**     | 0.018*      | 0.009      | 1.898   |
| **GLOB-NEG**     | 0.050**     | 0.022      | 2.271   |
| **INSQ**         | -0.014**    | 0.006      | -2.339  |
| **FDI**          | 0.126**     | 0.056      | 2.251   |
| **GDP**          | 2.030***    | 0.498      | 4.079   |
| **(GLOB*INSQ)**  | -0.021***   | 0.005      | -3.822  |
| **Constant**     | -20.179***  | 5.361      | -3.764  |

Note: *,**,*** shows significance level at 10%, 5% and 1%, respectively.

Table: 4.8 NARDL RESULTS

|                  | Coefficient | Std. Error | t-stat  |
|------------------|-------------|------------|---------|
| **D(GLOB-POS)**  | 0.006**     | 0.002      | 2.537   |
| **D(GLOB-NEG)**  | 0.015**     | 0.007      | 2.225   |
| **D(INSQ)**      | -0.015      | 0.023      | -0.676  |
| **D(FDI)**       | 0.004       | 0.004      | 0.935   |
| **D(GDP)**       | 0.625***    | 0.155      | 4.027   |
| **D(GLOB*INSQ)** | -0.0004     | 0.0005     | -0.751  |
| **ECM(-1)**      | -0.308***   | 0.088      | -3.504  |

Note: **,*** shows significance level at 5% and 1%, respectively.
Table: 4.9 DAIGNOSTIC RESULTS

| Diagnostic Test | J.B Test     | HETERO Test | LM Test      | RAMSEY Test | R²     | D.W  | W_LR     | W_SR     |
|-----------------|--------------|-------------|--------------|-------------|--------|------|----------|----------|
|                 | 0.103 (0.949)| 0.681 (0.687)| 1.659 (0.209)| 1.392 (0.249)| 0.881  | 2.036| 3.386 (0.049)| 0.487 (0.038)|

$W_{LR}, W_{SR}$: Wald test for the null hypothesis of the long run and short run symmetry, respectively.

The study employed the Wald test for long-run ($W_{LR}$) and short-run ($W_{SR}$) to check the appropriateness of the nonlinear model, and results are presented in Table 4.9. The findings are in favour of asymmetry of globalization on the environment. The asymmetric behaviour of positive and negative changes of globalization on environment articulated by following the dynamic multiplier graph.

![Dynamic Multiplier Graph](image)

**Figure 4.4: Dynamic Multiplier Graph**

### 5. Concluding Remarks and Policy Suggestions

The study examines the impact of globalization and institutional quality on environmental degradation in Pakistan. The study employs symmetric and asymmetric Autoregressive Distributed Lag Model (ARDL) at a time to check the linear and nonlinear effect of globalization on the environment over 1985 to 2017. The long-run findings of linear ARDL, globalization affect positively to the environment and all other control variables FDI, GDP are significant with a positive sign while institutional quality and the interaction term of globalization and institutional quality is significant with a negative sign. The study also finds the marginal effect of interaction term and found that globalization has a different effect on the environment with different level of institutional quality. The linear ARDL model is not suitable to check the asymmetric behaviour of globalization on the environment. For this, the study applied a nonlinear ARDL estimation method. The findings of the nonlinear ARDL model showed the asymmetric behaviour of globalization on the environment. This study provides a new direction by proving the asymmetric relationship of globalization with environment quality that is more beneficial for policymakers in the formulation of policy.
References
Anwar, Y., Farooq, F., Ullah, S., & Faheem, M. (2016). Impact of Financial Globalization on Human Capital: Evidence from Pakistan. Pakistan Journal of Social Sciences (PJSS), 36(2).
Ali, H. S., Zeqiraj, V., Lin, W. L., Law, S. H., Yusop, Z., Bare, U. A. A., & Chin, L. (2019). Does quality institutions promote environmental quality?. Environmental Science and Pollution Research, 26(11), 10446-10456.
Assamoi, G. R., Wang, S., Liu, Y., & Gnangoin, Y. T. B. (2020). Investigating the pollution haven hypothesis in Cote d'Ivoire: evidence from autoregressive distributed lag (ARDL) approach with structural breaks. Environmental Science and Pollution Research, 1-14.
Bilgili, F., Ulucak, R., Koçak, E., & İkay, S. Ç. (2020). Does globalization matter for environmental sustainability? Empirical investigation for Turkey by Markov regime switching models. Environmental Science and Pollution Research, 27(1), 1087-1100.
Chaudhry, I. S., Azali, M., Faheem, M., & Ali, S. (2020). Asymmetric Dynamics of Oil Price and Environmental Degradation: Evidence from Pakistan. Review of Economics and Development Studies, 6(1), 1-12.
Figge, L., Oebels, K., & Offermans, A. (2017). The effects of globalization on Ecological Footprints: an empirical analysis. Environment, Development and Sustainability, 19(3), 863-876.
Hanif, I., Raza, S. M. F., Gago-de-Santos, P., & Abbas, Q. (2019). Fossil fuels, foreign direct investment, and economic growth have triggered CO2 emissions in emerging Asian economies: some empirical evidence. Energy, 171, 493-501.
Hill, H. (2008). Globalization, inequality, and local-level dynamics: Indonesia and the Philippines. Asian Economic Policy Review, 3(1), 42-61.
Lv, Z., & Xu, T. (2018). Is economic globalization good or bad for the environmental quality? New evidence from dynamic heterogeneous panel models. Technological Forecasting and Social Change, 137, 340-343.
Majeed, M. T., & Ozturk, I. (2020). Environmental degradation and population health outcomes: a global panel data analysis. Environmental Science and Pollution Research, 1-11.
Mohmmed, A., Li, Z., Arowolo, A. O., Su, H., Deng, X., Najmuadin, O., & Zhang, Y. (2019). Driving factors of CO2 emissions and nexus with economic growth, development and human health in the Top Ten emitting countries. Resources, Conservation and Recycling, 148, 157-169.
Nadeem, A. M., Ali, T., Khan, M. T., & Guo, Z. (2020). Relationship between inward FDI and environmental degradation for Pakistan: an exploration of pollution haven hypothesis through ARDL approach. Environmental Science and Pollution Research, 1-19.
Nasir, M. A., Huynh, T. L. D., & Tram, H. T. X. (2019). Role of financial development, economic growth & foreign direct investment in driving climate change: A case of emerging ASEAN. Journal of environmental management, 242, 131-141.
Nathaniel, S., Aguegboh, E., Iheonu, C., Sharma, G., & Shah, M. (2020). Energy consumption, FDI, and urbanization linkage in coastal Mediterranean countries: re-assessing the pollution haven hypothesis. Environmental Science and Pollution Research, 27(28), 35474-35487.
Opoku, E. E. O., & Boachie, M. K. (2020). The environmental impact of industrialization and foreign direct investment. Energy Policy, 137, 11178.
Salahuddin, M., Gow, J., & Ozturk, I. (2015). Is the long-run relationship between economic growth, electricity consumption, carbon dioxide emissions and financial development in Gulf Cooperation Council Countries robust?. Renewable and Sustainable Energy Reviews, 51, 317-326.
Salahuddin, M., Ali, M. I., Vink, N., & Gow, J. (2019). The effects of urbanization and globalization on CO 2 emissions: evidence from the Sub-Saharan Africa (SSA) countries. Environmental Science and Pollution Research, 26(3), 2699-2709.
Salehnia, N., Alavijeh, N. K., & Salehnia, N. (2020). Testing Porter and pollution haven hypothesis via economic variables and CO2 emissions: a cross-country review with panel quantile regression method. Environmental Science and Pollution Research, 1-16.

Saud, S., Chen, S., & Haseeb, A. (2020). The role of financial development and globalization in the environment: Accounting ecological footprint indicators for selected one-belt-one-road initiative countries. Journal of Cleaner Production, 250, 119518.

Shahbaz, M., Solarin, S. A., & Ozturk, I. (2016). Environmental Kuznets curve hypothesis and the role of globalization in selected African countries. Ecological Indicators, 67, 623-636.

Shahbaz, M., Shahzad, S. J. H., Mahalik, M. K., & Hammoudeh, S. (2018). Does globalisation worsen environmental quality in developed economies?. Environmental Modeling & Assessment, 23(2), 141-156.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In Festschrift in honor of Peter Schmidt (pp. 281-314). Springer, New York, NY.

Suki, N. M., Sharif, A., Afshan, S., & Suki, N. M. (2020). Revisiting the Environmental Kuznets Curve in Malaysia: The role of globalization in sustainable environment. Journal of Cleaner Production, 121669.

Twerefou, D. K., Danso-Mensah, K., & Bokpin, G. A. (2017). The environmental effects of economic growth and globalization in Sub-Saharan Africa: A panel general method of moments approach. Research in International Business and Finance, 42, 939-949.

Xu, Z., Baloch, M. A., Meng, F., Zhang, J., & Mahmood, Z. (2018). Nexus between financial development and CO2 emissions in Saudi Arabia: analyzing the role of globalization. Environmental Science and Pollution Research, 25(28), 28378-28390.

You, W., & Lv, Z. (2018). Spillover effects of economic globalization on CO2 emissions: a spatial panel approach. Energy Economics, 73, 248-257.

Zhao, X., Liu, C., Sun, C., & Yang, M. (2020). Does stringent environmental regulation lead to a carbon haven effect? Evidence from carbon-intensive industries in China. Energy Economics, 86, 104631.