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The Effects of Industrial Value Addition and Energy Consumption on Environmental Deterioration: New Evidence from Islamic Countries

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Abstract: The current research is aimed at finding out the effects of energy consumption and industrial value addition on environmental deterioration. Panel data for the years 2000-2017 was employed to explore the long- and short-term association of variables for the selected Islamic countries. Panel Unit Root Test was used to check the stationarity of the data. Moreover, Fisher panel Co-integration tests, PMG, Fully Modified Ordinary Least Square (FMOLS) and Dynamic Ordinary Least Square method (DOLS) were also applied to find out relationship between the variables. The study suggested that economic growth, industrial value addition and energy consumption positively affect the CO_2 emission. Moreover, high-energy consumption to meet the demands of energy in transportation and production sectors leads to increased environmental pollution. The coefficient of industrial value addition shows significant effect on environmental deterioration in long term. Our study suggests the use of cleaner technology in production system and replacing renewable energy by non-renewable energy sources.

Key words: Energy, consumption, industrial value addition, environment, deterioration.

Introduction

After the industrial revolution, majority of countries struggled for economic growth which caused environmental pollution. Industrialization and development damaged environment because of over exploitation of natural resources, emission of pollutants from industries, inefficient and poor technology, ignorance and lack of awareness. Many Islamic countries are vulnerable to environmental challenges due to their growing economies. Majority of them are struggling to improve economic conditions by industrial expansion and exports. The current study aims to investigate the relationship between industrial value addition, energy consumption on environmental deterioration in selected Islamic countries (Bangladesh, Bahrain, Egypt, Indonesia, Iran, Jordan, Kazakhstan, Malaysia, Morocco, Nigeria, Pakistan, Tanzania and Turkey). Jamel and Derbali (2016) highlighted the pivotal relationship between environmental deterioration and economic activities which show badly affect the ecosystem due to over industrialization. Cherniwchan (2012) used two sector models to examine the impact or changes of economic shift from agriculture to industrialization on environment quality (sulfur dioxide emission). The result revealed that industrialization is a significant factor for environmental problems as the economic growth from agriculture to industrialization and, increase in scale of production cause pollution.

Nnaji et al., (2013) studied the association among variables such as CO_2 emission and energy consumption with other determinant by taking the time period of 1971-2009 in Nigeria by using Bound test method. Results showed significant positive relationship between CO_2 emission and fossil fuel consumption. Jamel and Derbali (2016) conducted a study to observe the influence of energy use on environmental degradation over the period of 1991-2013 for eight Asian countries. The result revealed the significant effect of energy consumption on environmental pollution. CO_2 emission increases when energy consumption increases (Shahbaz, et al., 2011). A similar study was also conducted by Ali et al., (2015) supporting the long run relationship among variables, but rejected in short run relationship.

Islam et al., (2013) conducted a study in context of Bangladesh, which shows that major contributor of CO_2 emission is energy consumption. Tiwari (2011) suggested green growth for economic development by applying Engle-Granger approach in VECM framework. The result revealed that economic growth causes environmental degradation in the long run. Shafik and Bandopadhyay (1992) found a vital relationship between economic growth and several ecological value indicators. The quantity of sulphur dioxide, fecal coliform and suspended particulate matter is increased as income level increases and then decreased as income reaches a certain level. According to Suri and Chapman (1998) industrialization and energy consumption lead to environmental degradation. Acar and Tekce (2014) examined the effects of industrial value addition on CO_2 emission for Mediterranean countries.

Materials and Methods

For empirical investigation this study has initially used panel unit root tests to identify the order of the integration of the variables. In second stage, long run relationship has been explored by using Johansen

Cointegration test. Later Fully Modified Least Square (FMOLS) is used after confirming the long run association between the variables. This method looks into the endogeneity in regressors arises from existence of Cointegration (Ahmad, et al., 2013). In addition, this paper also utilizes DOLS to examine the effect of energy consumption and industrial value added on environmental loss. Finally, for robust analysis this paper uses PMG.

The proposed model of the study is given below.

ED= f (GDP, EG, IVA) ……..... (1)

Where ED is the environmental deterioration; and GDP, EG, IVA represent per capita economic growth, energy consumption and industrial value addition respectively. present study examined the influence of economic growth (GDP per capita) and energy consumption (EG) on environmental deterioration (CO_2 emission) by incorporating a new variable industrial value addition (IVA). Alternatively, equation (1) can be written as;

$CO_{2t} = \beta_o + \beta_1 GDP_{it} + \beta_2 EGit + \beta_3 IVA_{it} + \mu_{it}$ …… (2)

Where CO_2 represents carbon dioxide emissions per capita, GDP represents GDP per capita, EG represents energy consumption, IVA represent industrial value addition, ß$_o$ relates to the constant and µ denotes the error term.

Table 1 Variables description.

Variables	Description of the variables	Source of the data
CO_2	Carbon dioxide emission	World Development Indicators
EG	The proxy for energy consumption is energy use (kg of oil equivalent) per $ 1000 GDP (constant 2011 PP)	World Development Indicators
IVA	Industry value added (constant 2010 US $	World Development Indicators
GDP	GDP per capita in constant 2010 US $	World Development Indicators

This study acquired data from World Development Indicators (WDI) covering the time from 2000 to 2017 for the selected Islamic countries (Bangladesh, Bahrain, Egypt, Indonesia, Iran, Jordan, Kazakhstan, Malaysia, Morocco, Nigeria, Pakistan, Tanzania and Turkey) were used to carry out the study. The CO_2 emission is used as dependent variable for the study whereas energy consumption in production and in manufacturing process (metric tons per capita) are used as independent variables (World Bank, 2018). The independent variables are GDP per capita (constant 2010 US$), industry value added (constant 2010 US$) and energy consumption (kg of oil equivalent) per $1,000 GDP (Ali, 2015).

Results and Discussion

The result of panel unit root test indicates that all variables are non-stationary at level. However, at first difference all the variables are found to be stationary and thus, it was concluded that all variables, under consideration, are integrated to order one.

Table 2 Results of panel unit root tests.

Var.	LLC	IPS	ADF Fisher	PP Fisher
CO_2	-0.94417 (0.1725)	1.05560 (0.8544)	17.4257 (0.8957)	25.0960 (0.5135)
ΔCO_2	-3.45704 (0.0003)	-3.80211 (0.0001)	59.7765 (0.0002)	146.785 (0.0000)
IVA	-0.14057 (0.4441)	1.44445 (0.9257)	23.2626 (0.6180)	62.4149 (0.0001)
Δ IVA	-3.78423 (0.0001)	3.20131 (0.0007)	51.3354 (0.0022)	89.0199 (0.0000)
EG	0.04015 (0.5160)	2.44440 (0.9927)	8.84569 (0.9993)	16.5190 (0.9229)
ΔEG	-5.46398 (0.0000)	-4.91188 (0.0000)	71.2938 (0.0000)	161.223 (0.0000)
GDP	1.73430 (0.9586)	3.27880 (0.9995)	19.1099 (0.8318)	27.9227 (0.3623)
ΔGDP	-1.64685 (0.048)	-1.93445 (0.0265)	37.9457 (0.0613)	80.9466 (0.0000)

According to the result of Fisher Cointegration test, there exists Cointegrating relationship between variables under consideration, as the null hypothesis of no Cointegration has been rejected.

Table 3 Johansen-fisher panel co-integration test results.

	(trace test)	Prob.	(max-eigen test)	Prob.
None	413.2	0.0000	352.0	0.0000
At most 1	151.3	0.0000	131.2	0.0000
At most 2	49.94	0.0014	47.41	0.0030
At most 3	30.33	0.1741	30.33	0.1741
At most 4	413.2	0.0000	352.0	0.0000

Fully modified OLS results for effect of industrial value addition, economic growth and energy consumption on environmental deterioration show that growth has significant and positive impact on carbon emission in Islamic countries. It further reveals that 1% increase in income (GDP) will cause .000813 % increase in carbon emission. A positive relationship found between energy consumption and environmental degradation implying 0.013288 % CO_2 emission owing to 1 % increase in EG (energy consumption) while 1 % increase in IVA cause 0.209021% increase in CO_2 emission and a positive sign shows a significant impact.

Table 4 DOSL and FMOLS results

Variables	DOLS		FMOLS	
	Coefficient	*Probability*	*Coefficient*	*Probability*
EG	0.018162	0.0003	0.013288	0.006
IVA	0.137291	0.7828	0.209021	0.6188
GDP	0.001006	0.0000	0.000813	0.0000

Robust Analysis

Lastly, the present research utilizes PMG test for robust analysis. In consistent with the outcomes of the FMOLS and DOLS, the results of the PMG have shown the long run association between the variables of the study. On

the other hand, the value of the Cointegrating equation term is around -0.293, which shows that speed of adjustment, is 29%. In sum, the findings of the panel data techniques depict a long run relationship among the variables.

Table 5 Robust analysis results.

Variable	Coefficient	t-statistics	Probability
Long Run results			
EG	0.035804	8.435701	0.0000
LNIVA	0.446698	4.277596	0.0000
GDPC	0.000296	8.893340	0.0000
Short Run result			
COINTEQ01	-0.292799	-3.559274	0.0005
D(EG)	0.016982	1.646254	0.1023
D(IVA)	1.726096	0.813618	0.4175
D(GDPC)	0.000569	2.197445	0.0299

The result depicts that 1% increase in GDP causes 0.035804% CO_2 emission. The positive relationship shows an increase in CO_2 emission due to increased economic growth. While the results show that industrial value addition has minimum significant value but it influences the environmental deterioration in Islamic countries. There is substantial impact of coal, gas and oil consumption which directly cause environmental deterioration in the form of CO_2 emission. Production of goods in industry such as cement, iron, chemicals and petroleum lead to more exploitation of energy, which in turn causes CO_2 emission.

Conclusion

The research established the co-integration among the four economic factors such as CO_2 emission, GDP per capita, energy use and industrial value addition. The long run result reveals a significant positive relationship between the given parameters showing that increase in per capita GDP and CO_2 are positively correlated. Demands of energy in transportation and production sectors lead to increase environmental degradation which shows a positive correlation between energy consumption and CO_2 emission. The coefficient of industrial value addition shows a positive and statistically significant effect on environmental degradation, in the long term. These developing countries are in a transition state of development which leads to environmental degradation. Due to economic development and industrial production, which use non-renewable energy sources, but after a threshold level of income, the quality of environment improves because of willingness to pay and awareness about health and environment. This study recommends using cleaner or green technology for industrial development using renewable energy sources, and environmental taxes on CO_2 emission for achieving sustainable goals of development without degrading the environment.

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