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Financial Development Consequences on the Quality of the Environment: A Case of Developing Countries

Shahzad Jamil*, Abdul Qayyum Khan, Muhammad Yar Khan

Department of Management Sciences, COMSATS University Islamabad, WAH Campus, Pakistan. *Email: shahzad_sk@hotmail.com

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ABSTRACT

The study aims to analyze the Financial Development, Economic Development, Governance, and consumption of Fossil Fuels impact on Environmental Quality. Panel data of 40 developing countries for the period of 1996–2019 were examined by applying the System Generalized method of moments technique of Blundell and Bond (1998). The results show that financial and economic development in developing countries is at the stake of environmental degradation. The governance impact is negative but low compared to other variables in the study, which shows that governance in these developing economies is not up to the mark and needs continuous improvement to maximize the impact of governance on environmental quality. Fossil fuels consumption in the sample countries showed a devastating effect on environmental quality. Financial reforms are needed to encourage and give incentives to the firms to adopt environmentally friendly technologies, which will result in development in a more sustainable way in developing economies. Easy access to low-interest loans in developing economies will help farmers and live stockholders to adopt new technologies and rethink their approaches to using fertilizers and livestock production to mitigate the emissions of CH4 and N_2O. Renewable energy sources (solar panel-generated energy in industries and households, electric cars, etc.) in these developing economies will help to tackle the increase in greenhouse gases emissions because of fossil fuel consumption.

Keywords: Financial Development, Economic Development, Governance, Fossil Fuels, Environmental Quality, Generalized method of moments
JEL Classifications: G2;O1;O16;Q5;Q32;Q32;Q54

1. INTRODUCTION

Greenhouse gases (GHG) like carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) are the main contributors to environmental changes, and these emissions are the products of activities necessary for financial and economic development in the country (Marjanović et al. 2016). Climate change can be induced by both natural and human factors, recent studies are focusing on human-induced environmental changes. The reason for focusing on human-induced factors is that they can largely be avoidable (Schellnhuber et al., 2016). Environmental changes are not the same across the globe, underdeveloped countries are likely to face the consequences earlier and most hence intensive efforts are required to mitigate these drastic changes in the environment (Nicholas, 2006). The increase in greenhouse gas (GHG) emissions resulting from day-to-day activities like the consumption of fossil fuels, coal burning, and deforestation leads to drastic changes in environmental quality. CH4 is emitted from natural gas and oil consumption and is also emitted by the decay of organic waste. CH4 has 80 times more warming capability than CO2; at least 25 percent of current global warming is a result of methane emitted from human actions (Mark, 2021) N2O emissions occurring during industrial activities, combustion of fossil fuels, agriculture and treatment of wastewater (Pachauri et al. 2007). Particulate matter (PM2.5), 2.5 is the size of the particle in micron meters. PM2.5 are tiny particles present in the air that come primarily from the combustion of fossil fuels and are considered dangerous to human health (Shi et al., 2022). When PM2.5 levels are elevated in the air, they reduce visibility because the air appears to be hazy. PM2.5 particles because of their size are able to travel deep into the respiratory tract, in the upper respiratory tract, they can cause irritation in the nose and throat. PM2.5 can also affect the lungs and may result in pulmonary-related serious conditions.

Environmental quality is improved with the efficiency of the financial system, and counties with an effective financial sector are more likely to have better environmental conditions (Dasgupta et al., 2001). An ample number of studies focus on the environmental degradation resulting from financial and economic development. Previous studies' the results are inconsistent, some studies show that financial development (FD) results in an increase in CO2 emissions (Zhang, 2011a) in the context of China, (Boutabba, 2014) in the context of India, (Jamel and Maktouf, 2017) in 40 European countries and (Kayani et al., 2020) in top ten CO2 emitters. While (Tamazian et al., 2009) in BRIC economies, (Shahbaz et al., 2013) in Indonesia, (Al-Mulali et al., 2015) in 129 global economies classified by income levels, (Abbasi and Riaz, 2016) in the context of Pakistan and (Gokmenoglu and Sadeghieh, 2019) in context of Turkey, argue that financial and economic development enhances the environmental quality by reducing the emissions.

Governance is a style of managing the country's economic, political, and administrative affairs. Good governance is not limited to corruption free societies, but it gives its countrymen the right and the ability to be part of the decision-making process that can impact their lives and for the accountability of the government (UNDP Policy, 1997). The government organization provides the "rules of the game" which also focuses on the instruments of economic growth, these economic instrument help firms to adopt environmentally friendly strategies to achieve better environmental performance (Tietenberg, 1990). Developed financial system promotes governance in firms and results in less threat to environmental quality. Governance of public and private institutions can also impact the environmental quality in the country (Husted and Sousa-Filho, 2017).

FD increases the consumption of energy through various effects: first, the demand for consumption of energy is increased, due to easy access to funds from the financial institutions, second is the business effect, business related activities are increased as a result of FD which also increases the consumption of energy. Development activities in emerging economies are at the expense of consumption of more energy sources and mostly rely on consumption of fossil fuels (Sadorsky, 2011).

The above discussion leads to the point that environmental quality is affected by financial and economic development and these changes will affect both developing as well as developed economies. Therefore, it is significant to understand how financial and economic development will impact the environmental quality in developing countries. To date, several studies use only CO2 emissions as a proxy for environmental quality. This study added CH4, N2O, and PM2.5 in their analysis. Therefore, this study analyzes the impact of FD, Economic Growth, Governance, and fossil fuel consumption on Environmental Quality; the proxies for environmental quality are CO2 emissions, CH4 emissions, PM2.5 particulate matter concentration and N2O emissions in 40 developing countries, for the period of 1996–2019 by using System Generalized Methods of Moments (GMM).

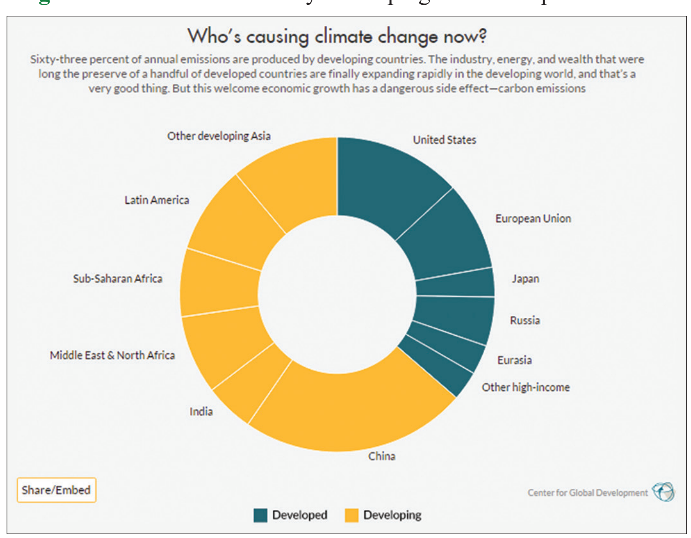
2. LITERATURE REVIEW

Developing economies prioritize financial and economic activities to achieve targeted economic growth by the outlay of environmental quality (Figure 1). Greenhouse gas emissions, particularly CO2, methane (CH4), particulate matter (PM2.5), and Nitrogen oxide (N2O) from fossil fuel consumption and other human activities become a severe problem of global environmental degradation.

2.1. FD and Environmental Quality

Environmental quality is affected by financial and economic development and this relation is empirically analyzed by many researchers and their findings are diverse. These diverse findings in the existing literature are discussed under two aspects. The first aspect is environmental quality is improved by FD, for example; Tamazian et al. (2009) examine correlation between CO2 emissions, economic growth, and FD in BRICS countries from 1992 to 2004 and find out that financial liberation improves the quality of the environment. Shahbaz et al. (2013) studied CO2 emissions with economic and FD in the case of Indonesia and found out that CO2 emissions are mitigated by economic and FD. Al-Mulali et al. (2015) Analyze the FD impact on environmental quality in 129 global economies for the period 1980–2011 and find out the positive affect of FD on the quality of environment. Abbasi and Riaz (2016) Analyze CO2 emissions as a result of FD in Pakistan for the period 1988–2011 using ARDL approach and find out that CO2 emissions are negatively impacted by FD. Gokmenoglu and Sadeghieh (2019) also finds out that CO2 emissions are reduced with the increase in FD in the context of Turkey from 1960 to 2011. Tan et al. (2021) Examine the FD impact on the quality of air in the context of republic of China by using ARDL model and find out that FD improves air quality in the short term. Habiba et al. (2021) Study the effect of financial

Figure 1: Annual emissions by developing and developed countries[1]



1. (Center for Global Development, 2018)

market development on the emissions of CO_2 in developed and developing economies for the period 2000–2018 and find out that developed financial markets lead to a reduction in CO_2 emissions in both group of countries.

The second aspect is that FD leads to the degradation of environmental quality. Zhang (2011b) Study the relation in China for the period 1980-2009, by using Granger causality test and find out that FD leads to a surge in CO_2 emissions. Boutabba (2014) find out FD in India leads to increase the emission of CO_2 by employing ARDL approach. Al-Mulali and Sab (2012) Examine 30 sub-Saharan economies for the period of 1980-2008 and find out that FD encourages more energy consumption resulting in increased CO_2 emissions. Kayani et al. (2020) Study the relation of the global top ten carbon emitters for the period 1990-.2016 by using VECM and PFMOLS and find the correlation between FD and environmental degradation. Jamel and Maktouf (2017) found out that the positive and significant relation between FD and emission of CO_2, they use panel data for 40 European countries by using OLS model and causality test. Dogan and Turkekul (2016) examined the relationship in United States of America (USA) by using ARDL model and argued that they find no impact of FD on environmental quality.

2.2. Governance and Environmental Quality

Good governance also seems to be affected by economic factors and has a positive impact on environmental performance (Husted and Sousa-Filho, 2017). Samimi et al. (2012) Studied the effectiveness of governance on the environmental quality in 21 countries of Middle Eastern and North African (MENA) region from 2002-2007 and found out that governance indicators affect the environmental quality. Mukherjee and Chakraborty (2013) Study the influence of socioeconomic (human development and corruption) and sociopolitical factors (democratic rights) on the environment in 146 countries for the period of 2007-08 and found a positive impact of these factors on environmental sustainability (Haseeb et al., 2018). Empirically analyze the governance impact on degradation of the environment in world economies classified by income groups for the period 1995–2015 and find out that bad governance impacts low-income countries more than high-income countries (Mahjabeen et al., 2020) Argued that for environmental quality and economic growth, institutional quality is the prerequisite, they analyze the nexus of environmental quality, institutional stability, and consumption of energy in D-8 economies from 1990 to 2016 and found out that institutional quality is vital for environment. Further, they added that energy consumption positively affects both growth in the economy as well as the environmental degradation.

2.3. Fossil Fuel Consumption and Environmental Quality

Developing countries rely on the consumption of energy sources for development activities and mostly rely on the consumption of fossil fuels compared to developed countries (Mirza and Kanwal, 2017). Examine the causation effect of energy consumption on the emission of CO_2 in Pakistan and the results show bidirectional causality between these indicators (Shahbaz et al., 2013). Study the relationship of energy consumption on environmental quality in Malaysian economy and find out that growth in the economy and utilization of energy resources leads to an increase in the CO_2 emissions (Khan et al., 2016). Study the impact of depletion of energy resources, changes in the environment, and utilization of health resources in developed countries and for the period of 2000–2013 by using GMM, their results show that fossil fuel consumption results in an increase emission of other GHG and damages the infant health (Shahbaz et al., 2014). Study energy consumption and its impact on environment in Tunisia from 1971 to 2010. Their result shows that higher energy consumption leads to degradation of the environment (Khan, 2019). Analyze the role of logistics operation in the emissions of CO_2 in ASEAN for the period 2007-2017 using GMM, and find out that inefficient logistics operations in developing countries significantly impact the environmental quality.

2.4. Methane (CH_4), N_2O, and Particulate Matter (PM2.5)

GHG like CO_2, CH_4, and N_2O are the main contributors to the environmental change, and these emissions are the products of economic activities in a country (Turk et al., 2016). CH_4 is more potent GHG than CO_2, in 20% of all GHG gases, and 50–60% is emitted as a result of human caused activities (Janardanan et al., 2017). Study the relationship of economic growth and CH_4 emissions in ASEAN countries for the period 1985–2012. Their finding shows that economic growth in the long run causes to decrease CH_4 emissions while energy consumption tends to increase the CH_4 emissions in the sample countries. N_2O is very potent to cause environmental damage, researchers argue that N_2O apart from its impact on environment, and its impact on the economic growth should also be studied (Narayan and Narayan, 2005). Fujii and Managi (2016) examine the impact of industrial environmental pollutants on economic growth in 39 countries for the period 1995–2009 and find out that economic development and pollutants emissions varies with the industry (Haider et al., 2020). Examine the link between environmental degradation (CO_2, CH_4, N_2O emissions) in two groups of countries divided by the top 15 NO_2 and CO_2 emitters and the top 18 agriculture GDP countries. The analysis shows that the use of agriculture land results in NO_2 emissions. Particulate matter, specifically PM2.5, are fine air particles and can cause serious health complications, it is estimated that around 3.1 million deaths are caused by PM2.5 exposure (WHO and Regional Office for Europe, 2013). Stern and van Dijk (2017) study the relation of economic growth and PM2.5 pollutants in 151 countries for the period of 1990–2010 and suggested there is positive but relatively small impact on the emission of particulate matter. Ouyang et al. (2019) Study the impact of economic growth on PM2.5 emissions in 30 OECD countries and suggest that further studies are required to confirm the bidirectional relation of economic growth and PM2.5.

3. DATA AND VARIABLES

Panel data of 40 developing countries (Table 1) were used for analysis, for the period of 1996–2019. These countries are selected for two reasons, first, the share of the financial sector is rapidly increasing in these countries and secondly, as a group these economies are responsible for 60% of global emissions (Argyriou, 2017).

This study uses Financial Market (FM) and Financial Institutions (FI) development indices and their subindices as a proxy for FD developed by IMF. Real GDP is used as a proxy for economic development measure USD at 2005 price level. World Governance Indicators (WGI) developed by Kaufmann et al. (2011) is used for Governance. The various aspects of governance that cover in the index are the accountability, stability of political system and terrorism, rule of law, effectiveness of institutions, assurance of quality of regulatory authority, and corruption. Coal, crude oil and natural gas are considered fossil fuels, which for more than a century are used in transportation, industries and to light our homes. Oil, gas, and coal meet our 80% energy need. Fossil fuels are considered the root cause of air and water pollution and global warming. This study also adds fossil fuels consumption to analyze its impact on environmental quality (Table 2). CO2, N2O, Particulate matter (PM2.5), and Methane (CH4) are used as proxy for environmental quality, variables data are collected from World Development Indicators (WDI)[2], World Governance Indicators (WGI) and FD Index[3]. These indicators and indices are also used in other studies (e.g., Khan et al. 2014; Fujii and Managi, 2016; Ouyang et al. 2019; Yu and Liu, 2020; Khan, 2019; Iqbal et al. 2021; Azam et al., 2019; Iqbal et al. 2021).

3.1. Descriptive Statistics

The descriptive summary (Table 3) is measured to analyze the data characteristics before moving to the final analysis. A big difference can be noticed between the mean values of the selected variable, i.e., the mean value of value of governance is just −0.238, while on the other side GDPC mean value is $10,509.61. Therefore, the data is log-transformed to reduce the gap between data points and normalize its skewness before the final analysis.

3.2. Cross-sectional Dependency Test

Two tests were performed, Pesaran Cross sectional Dependence (CD) and Breusch-Pagan Lagrange Multiplier (LM). The results of both tests in reject the null hypothesis of no cross-sectional dependence. Therefore, it shows that there is cross-sectional dependence among developing economies (Table 4).

3.3. Unit Root Test

To analyze the stationarity issue of the data, second generation unit root tests are applied, i.e., CIPS and Bai and Ng (PANIC) test. The results show no stationarity issue as in (Table 5).

3.4. Cointegration Test

The panel cointegration test is used to check the integration between the series over the long run. It examines the degree of sensitivity of the selected variables to a particular phenomenon, so that they cannot deviate from the equilibrium over time. To check whether the relationship between the variables is long run Kao cointegration test is used. The existence of co-moments between the variables is confirmed by the test results. The Table 6 show t-stat value −2.841397 and P-value reject the null hypothesis of no cointegration.

4. EMPIRICAL MODELS AND METHODOLOGY

Humans influence the environment by overpopulation, fossil fuel consumption, deforestation etc., these anthropogenic activities

2. https://databank.worldbank.org/
3. https://data.world/imf/financial-development-fd

Table 1: List of Countries

East Asia and Pacific region	Europe and Central Asia	Latin America and Caribbean	Middle East and North Africa	South Asia	Sub-Saharan Africa
Malaysia	Azerbaijan	Argentina	Algeria	India	Angola
Philippines	Belarus	Brazil	Egypt	Pakistan	South Africa
Thailand	Croatia	Chile	Iran	Sri Lanka	
Indonesia	Hungary	Colombia	Kuwait		
China	Kazakhstan	Dominican Republic	Libya		
	Poland	Ecuador	Morocco		
	Romania	Mexico	Oman		
	Russian Federation	Peru	Qatar		
	Turkey	Uruguay	Saudi Arabia		
	Ukraine	Venezuela	United Arab Emirates		

Source: International Monetary Fund (IMF)

Table 2: Variables and Data Sources

Variables	Symbol	Unit of Measurement	Source
FD	F.D	Financial development Index	IMF
Economic Development	E.D	Real GDP in constant 2005 USD	W.D.I
Governance	GOV	WGI	WGI
Fossil Fuels consumption	F.Fuel	% of total energy	WDI
Carbon dioxide emissions	CO2	Metric Ton Per capita	WDI
Methane	CH4	Kt of CO_2 equivalent	WDI
Nitrous oxide emissions	N2O	Thousand metric tons of CO_2	WDI
Particulate matter	PM2.5	Micrograms per cubic meter	WDI

Table 3: Descriptive Stats

Variables	Mean	S.D.	Min.	Max.	Observation
F. D	0.339069	0.148030	0.025606	0.753043	960
E. D	10509.61	12763.97	711.9288	69679.09	960
GOV	−0.238539	0.602436	−1.933031	1.287036	960
FFUEL	82.56823	16.34662	22.12487	100.4788	960
CO2	6.349878	7.402195	0.451521	47.69993	960
CH4	114778.6	212814.9	1910.000	1242150	960
NO2	35855.55	80047.66	200.0000	546990.0	960
PM2.5	33.69052	21.10895	9.197441	97.59938	960

Table 4: Cross sectional dependency test statistics

Variables	Pesaran CD	P value	Breusch-Pagan LM	P value
F.D	62.84551	0.0000	83.73601	0.00000
E.D	82.73061	0.0000	12624.02	0.00000
GOV	32.56431	0.0000	6789.966	0.00000
FFUEL	42.84673	0.2904	3588.772	0.00000
CO2	31.73352	0.0000	7644.465	0.00000
CH4	36.29861	0.0000	11498.01	0.00000
NO2	53.85196	0.0000	8692.086	0.00000
PM2.5	32.41623	0.0000	10836.14	0.00000

Table 5: Panel unit root test

Variables	CIPS		Bai and Ng (PANIC)	
	Level		Level	
	t-stats	P-value	t-stats	P-value
F.D	−2.73945	<0.01	±Inf	0.00000
E.D	−1.61587	≥0.10	1.58029	0.01404
GOV	−1.71574	≥0.10	±Inf	0.00000
FFUEL	−2.03042	≥0.10	±Inf	0.00000
CO2	−2.20666	<0.05	±Inf	0.00000
CH4	−3.17192	<0.01	±Inf	0.00000
NO2	−0.26378	<0.01	±Inf	0.00000
PM2.5	−1.46677	≥0.10	2.92381	0.00346

Table 6: Kao Residual Cointegration

			t-Statistic	Prob.
ADF			−2.841397	0.0022
Residual var			0.000301	
HAC var			0.000562	
Variable	**Coefficient**	**Std. Error**	**t-Stat**	**Prob.**
RESID (-1)	−0.105667	0.013812	−7.650481	0.0000
D (RESID (-1))	0.149245	0.032812	4.548493	0.0000
R^2	0.073984	Mean dep. var		−0.000513
Adjusted R^2	0.072922	S.D. dep. var		0.021787
S.E. of regression	0.020978	AIC		−4.888436
Sum squared residual	0.383732	SC		−4.877514
Log likelihood	2238.247	HQ		−4.884258
Durbin-Watson	2.052508			

result in environmental degradation. The basic model IPAT developed by Ehrlich and Holdren (1971), proposes that three main factors influencing the environment I are Population (P), affluence (A), and technology (T), equation (1) shows the relation:

$$I = PAT \tag{1}$$

Dietz and Rosa (1994) This IPAT model and formulated STIRPAT model as follows:

$$I_{it} = \theta P_{it}^{\vartheta} + A_{it}^{\pi} + T_{it}^{\partial} + \in_{it} \tag{2}$$

i is the cross section and t is the time. θ is the constant term and ∈ is the error term. The STIRPAT model is transformed by taking the log of equation (2).

$$InI_{it} = \theta + \vartheta \text{InP}_{it} + \pi\, InA_{it} + \rho\, InT_{it} + \in_{it} \tag{3}$$

Equation 3 can be further modified by adding other factors of environmental degradation (Feng, 2017). To study the FD, economic development, governance, and fossil fuels impact on environmental quality as per theoretical empirical literature (Abid, 2017; Li et al., 2015; Yasin et al., 2021; Gök and Sodhi, 2021; Haider et al., 2020; Maciejczyk et al., 2021; Samimi et al., 2012; Zhu et al., 2022) the equation 3 is extended into the following models:

$$\ln(CO_2)_{it} = \theta + \delta_1 \ln FD_{it} + \delta_2 \ln ED_{it} + \delta_3 \ln GOV_{it} + \delta_4 \ln(FFUEL)_{it} + \varepsilon_{it} \tag{4}$$

CO2 is carbon dioxide emission proxy for environmental quality, θ is the constant term, FD is the FD, E.D is the economic development proxy for per capita GDP, GOV is the governance and FFUEL is fossil fuel consumption and the error term is represented by ε.

$$\ln(CH4)_{it} = \vartheta + \delta_1 \ln FD_{it} + \delta_2 \ln ED_{it} + \delta_3 \ln GOV_{it} + \delta_4 \ln(FFUEL)_{it} + \varepsilon_{it} \tag{5}$$

CH4 is methane proxy for environmental quality.

$$\ln(PM2.5)_{it} = \vartheta + \delta_1 \ln FD_{it} + \delta_2 \ln ED_{it} + \delta_3 \ln GOV_{it} + \delta_4 \ln(FFUEL)_{it} + \varepsilon_{it} \tag{6}$$

PM2.5 is Particulate matter 2.5ug proxy for environmental quality.

$$\ln(N2O)_{it} = \vartheta + \vartheta + \delta_1 \ln FD_{it} + \delta_2 \ln ED_{it} + \delta_3 \ln GOV_{it} + \delta_4 \ln(FFUEL)_{it} + \varepsilon_{it} \tag{7}$$

N2O is Nitrous Oxide proxy for environmental quality.

System GMM (Blundell and Bond, 1998) are designed for the situations where (T < N) means time periods "T" are less than Panels "N". This study time periods are 24 years and 40 countries data. The System GMM estimate is more efficient by overcoming the issue of endogeneity by using a set of instrumental variables, heteroskedasticity and autocorrelation (Apergis and Payne, 2015). This study applied System GMM to Equations (4) to (7) by following the methodology of Roodman (2006). The diagnostics test as recommended by (Roodman, 2006) Hansen test (Hansen, 1982) for validity of the instruments and AR (2) test i.e. Arellano Bond test (Arellano and Bond, 1991) for autocorrelation are estimated. The null hypothesis is that there is no second-order serial correlation in error term. These tests results show the validity of GMM estimation.

5. FINDINGS AND DISCUSSIONS

Shows the results of model 4, the lagged dependent CO2 value is.92474[4], positive value of FD shows that it will result in the increase of CO2 emissions in developing countries. If there is a 1% increase in FD which will result in 0.26% increase in CO2 emissions, a 1% in GDPC (proxy for economic development (ED) will lead to 0.15 % increase in CO2 emission, (−0.027) indicates that CO2 emissions decreases with the improvement in the quality of the Governance in the developing countries. Fossil fuel consumption has a devastating impact on the emissions of CO2. 1% increase consumption of fossil fuels will lead to 0.7620% increase in CO2 emissions. The Hansen test value of 0.189 rejects the null hypothesis of overidentification of the instruments. AR (2) value is 0.557, also rejects the null hypothesis of auto-correlation (Table 7).

Table 7: Model 4 results

Variables	GMM
L.CO2	0.924747 (0.000)***
In F.D	0.2643 (0.002)***
In E.D	0.1523 (0.014)**
In Gov	−0.0271 (0.021)**
In F.Fuel	0.7620 (0.023)**
Prob<χ^2	0.000
Observations	879
Instruments	28
No of groups	40
AR (1)	0.001
AR (2)	0.557
Hansen test	0.189

***, **, *Indicate the level of significance, i.e., at 1%, 5%, and 10%, respectively. P-value is shown in parenthesis

Table 8 shows the results of model 5, the lagged dependent CH4 value is .85832, the positive value of FD shows that it will result in the increase of CO2 emission in developing countries. If there is a 1% increase in FD will result in 0.79% increase in CH4 emissions, a 1% increase in GDPC (proxy for economic development [ED]) will lead to 0.406% increase in CO2 emissions, Governance is negative, but the results are insignificant. 1% increase consumption of fossil fuel consumption results in 0.528% increase in the emissions of CH4. The Hansen test value of 0.096 rejects the null hypothesis of overidentification of the instruments. AR (2) value is 0.209, also rejects the null hypothesis of autocorrelation.

Table 8: Model 5 results

Variables	GMM
L.CH4	0.85832 (0.000)***
In F.D	0.7956 (0.000)***
In E.D	0.40612 (0.002)***
In Gov	−0.06183 (0.230)
In F.Fuel	0.5289 (0.016)**
Prob<Chi^2	0.000
Observations	877
Instruments	28
No of groups	40
AR (1)	0.003
AR (2)	0.209
Hansen test	0.096

***, **, *Indicate the level of significance, i.e., at 1%, 5%, and 10%, respectively. P-value is shown in parenthesis

Table 9 shows the results of model 6, the lagged dependent N_2O value is 1.02052, the positive value of value of FD shows that it will result in the increase of CO2 emission in developing countries. If there is a 1% increase in FD will result in 0.4696% increase in N2O emissions, a 1% increase in GDPC (proxy for economic development (ED) will lead to 0.5701% increase in N2O emission, Governance is negative and significant which shows that the increase in governance quality will results in decrease in N2O emissions by 0.035%. 1% increase consumption of fossil fuel consumptions results in 0.989 % increase in the emissions of N2O. The Hansen test value of 0.111 rejects the null hypothesis of overidentification of the instruments. AR (2) value is 0.987, also rejects the null hypothesis of auto-correlation.

Table 9: Model 6 result

Variables	GMM
L.N2O	1.02052 (0.000)***
In F.D	0.4696 (0.002)***
In E.D	0.5701 (0.016)**
In Gov	−0.0358 (0.072)
In F.Fuel	0.98912 (0.023)**
Prob<χ^2	0.000
Observations	879
Instruments	28
No of groups	40
AR (1)	0.007
AR (2)	0.987
Hansen test	0.111

***, **, *Indicate the level of significance, i.e., at 1%, 5%, and 10%, respectively. P-value is shown in parenthesis

Table 10 shows the results of model 7, the lagged dependent PM2.5 value is 1.038, the positive value of FD shows that it will result in the increase of CO2 emission in developing countries. If there is a 1% increase in FD will result in 0.825 % increase in PM2.5 emissions, a 1% increase in GDPC (proxy for economic development (ED) will lead to 0.367 % increase in N2O emission, Governance is negative and significant which shows that the increase in governance quality will results in decrease in PM2.5 emissions by 0.0276 %. 1% increase in the consumption of fossil fuel consumption results in 1.059 % increase in the emissions of N2O. The Hansen test value of 0.127 rejects the null hypothesis of overidentification of the instruments. AR (2) value is 0.333, also rejects the null hypothesis of auto-correlation.

4. The lagged value is in the credible range i.e., (0.733-1.045), the value shows that there is no specification problem as discussed by Roodman (2006)

Table 10: Model 7 results

Variables	GMM
L.PM2.5	1.038 (0.000)***
In F.D	0.82540 (0.022)**
In E.D	0.36696 (0.000)***
In Gov	−0.027652 (0.040)**
In F.Fuel	1.059 (0.019)**
Prob<Chi2	0.000
Observations	879
Instruments	28
No of groups	40
AR (1)	0.000
AR (2)	0.333
Hansen test	0.127

***, **, *Indicate the level of significance, i.e., at 1%, 5%, and 10%, respectively. P-value is shown in parenthesis

6. CONCLUSIONS AND RECOMMENDATIONS

This study analyzes the impact of FD, Economic Development, Governance, and consumption of Fossil Fuels on Environmental Quality in 40 emerging economies for the period of 1996–2019. System GMM technique of Blundell and Bond (1998), using the methodology of Roodman (2006) is applied for analysis. The result shows that the increase in FD and economic development will result in degradation of the environment by increasing CO2, CH4, N2O, and PM2.5 emissions (used as a proxy for environmental quality).

Financial reforms are needed to encourage and give incentive to the firms to adopt environmentally friendly technologies, which will result in development in a more sustainable way in developing economies. Easy access to low interest loans in developing economies will help farmers and livestock holders to adopt new technologies and rethink their approach of using fertilizers and livestock production to mitigate the emissions of CH4 and N2O.

The Governance impact is negative but low compared to other variables in the study, which shows that governance in these developing economies is not up to the mark and needs continuous improvement to maximize the impact of governance in increasing the quality of the environment.

Fossil fuels consumptions in these developing countries show a devastating effect on environmental quality. Fossil fuels are the main cause of the increase emissions of PM 2.5 particles, CH4, and N2O in the environment in these countries. Increase PM 2.5 particles in the air results in health hazards mainly related to respiratory tract infections and cause haze, which impact the daily routine in these economies. The use of renewable energy (solar panel, generated energy in industries and households, electric cars, etc.) in these developing economies will help to tackle and increase GHG emissions as a result of fossil fuel consumption.

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