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Financial Development, Exports, and Industrial Pollution: Evidence from Lower and Upper Middle-Income Countries

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Abstract

This study aims to investigate the relationship between financial development (FD), exports, and industrial pollution by applying OLS, fixed effects (FE), random effects (RE), and GMM models for 36 upper-middle-income countries (UMICs) and 38 lower-middle-income countries (LMICs) from 1990 to 2019. The findings of the OLS indicate that financial development (FD), exports, and other factors including energy use, capital, and urban population significantly increase industrial pollution in UMICs and LMICs. The empirics of FE, RE, and GMM models also confirmed that exports, FD, and energy use have harmful effects on the environment. The study suggests that financial development should be directed toward projects and sources of energy that are favorable to the environment.

***Keywords*:** Industrial Pollution, Exports, Financial development, UMICs, LMICs

1. Introduction

Developing countries are dealing with serious environmental issues due to their contribution to global greenhouse gas (GHG) emissions (Yang et al., 2020; Ali et al., 2021). The increasing trend in GHG emissions leads to global warming. Individual behavior regarding resource exploitation and non-renewable energy consumption results in huge amounts of GHG that contribute to global warming (Audi et al., 2020; Usman and Lorente, 2022). The dangerous substances (chemicals, particulates, toxic gases) in the atmosphere for a long period cause to harm humans, animals, and plants, such a condition is referred to as air pollution. Fossil fuel combustion, mining activities, and exhaust gases from factories are the main factors contributing to air pollution. Atmospheric pollution is mainly caused by emissions of gases from industries, smoke, and chemicals that the industries discharge into the atmosphere. The reactions of these industries are inflicting negative impacts on our health (Siddique and Kiani 2020; Ali et al., 2021). The middle-income countries are facing the damages of this type of pollution.

Land pollution incorporates liquid chemical wastage of industries, household trash, and garbage. The smoke found on prehistoric cave ceilings is adequate proof of the pollution linked with improper ventilation of open fires. The burning coal has contributed significantly to air pollution, and the process of turning coal into coke for iron smelting has made the situation worse. During the 19th century, an unhealthy urban environment and overcrowding in urban areas led to difficulties related to water and air pollution. However, pollution has become a global issue due to the rapid increase in population and industrialization.

Industrial activities are the considerable root of air, water, and land pollution, and leads to illness and sometimes loss of life for human and other living things across the globe. The whole world is facing the problem of the depletion of the ozone layer because of atmospheric pollution. The ozone layer which is extending from 10-50 kilometers above our earth filters the ultraviolet rays of the sun. Chlorofluorocarbon (CFCs) contains chlorine, fluorine, and carbon which are damaging the layer of ozone by destroying the molecules of ozone from this layer. Depletion of the ozone layer becomes the cause of higher temperatures which leads to global warming. Pollution from the industrial side is also causing acid rain by burning fossil fuels, combined with the water vapors in the atmosphere from the acids like Sulphur and nitrogen dioxide.

In the 20th century, the process or production patterns of exports-goods industries changed in middle-income countries. These types of industries not include only labor-intensive or traditional production patterns but also move towards capital-intensive or modern industries. With this type of modern industrialization, these countries are facing the problem of pollution.

It is multiplicity regarding the ecosystem which is unpleasant for the health of an environment. Increasing human activities, such as trade, financial development, capital formation, and growing urban population has exerted the effects and raised the universal heat and set the extreme oppression down onto earth natural supplies in both direct and indirect means. The secretion of carbon dioxide in surroundings depends on plenty of elements that are responsible for pollution besides the consumption of energy, trade, growth of urban population, capital formation, financial development, industrialization, and population growth rate (Ali & Audi, 2017; Ali et al., 2022). Financial development is one of the more representative that may illustrate pollution.

Many countries have stressed financial sector enlargement to have well-balanced economic diversification and environmental deterioration. While scrutinizing an impression of financial development and pollution emissions, certain measures are used in literature, e.g., income, international trade, consumption of energy, and financial advancements. A destructive connection between FD and pollution have been drawn previous studies (Jalil & Feridun, 2011; Chen et al., 2020; Charfeddine & Khediri, 2016; Ali & Audi, 2016). A notable perspective is the

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growth of the financial sector in a situation of economic advancement is accountable for the industrial side toxic waste (Sehrawat et al., 2015).

Trade liberalization and international economic integration have been the most frequent trends globally. According to the report of WTO of 2017, with the increase in international trade, the world economy has undergone a significant transformation. So, global trade diversification proposes a query of whether the benefits from the trade are favorable or not for the environment. Consequently, several researchers have substantial apprehension regarding the globalization outcomes on the environmental quality (Barrows and Ollivier, 2014). Promoters of trade believe that green technologies, and trade help to reduce pollution emissions more quickly (Hasson et al., 2017; Managi, 2008).

Some emerging economies have to track the fewer rigorous strategy to develop the relative authorities in the construction or manufacturing. So, because of orthodox ways of production, trade may become adverse for developing countries as an outcome of generating export activities which are emission-extensive goods on huge balance to the advanced and established nations (Farhani and Ozturk, 2015; Sbia, 2014).

The relationship between FD, exports, and recent environmental conditions is the debated issue in the economic development process. The present study provides evidence of the critical relevance of comprehending the extent to which the financial and trading development of countries contribute to environmental pollution. The study aims to investigate the impression of a few variables such as exports and financial development which are responsible for the environmental deterioration in Middle-Income Countries (MIC) and to indicate a few policy implications for the governments to formulate exports and development of the finance to maintain these two without hampering the environment.

This research is organized in such a way that the review of the selected prior studies is presented in section 2. In sections 3 and 4, theoretical frameworks and methodology are described. Section 5 describes the variables as well as the data. Section 6 comprehends findings and discussion while the last section concludes and recommends some policies.

2. Literature Review

This section reviews the previous work to check the relations between exports, financial development, and industrial pollution, which is divided into two parts, 2.1 holds the connection between FD and pollution emissions and 2.2 contains the exports and pollution emissions.

2.1. Financial Development and Pollution

Zhao et al. (2020) examined the link between financial effect and deterioration of the environmental quality in China during 1997–2016 by retaining GMM and panel vector autoregressive (PVAR) methodology. The findings demonstrate that firstly, financial control can considerably lessen economic growth but economic development is inversely related to financial influences. Secondly, economic growth provided a vital impulse to boost CO_2 emissions. Lastly, CO_2 has inversely pushed up financial influence.

Mohammadi (2017) investigated that the level of output and use of energy have a noteworthy and direct effect on pollution. Financial development delivered incentives for converting to green technologies but not operative for applying fuel effective technologies in energy consumption in 16 MICs during 1970-2013.

Jamel and Maktou (2017) analyzed the nexus between FD and CO_2 carbon in European states from 1985 to 2014. The empirics of the OLS approach confirmed the occurrence of EKC hypothesis for FD and pollution. Cetin and Ecevit (2017) investigated the effect of FD on the environment in Turkey from 1960-2011. The results of the ARDL model revealed the effectiveness of EKC hypothesis. Omri et al. (2015) also verified the presence of the EKC hypothesis for FD and pollution in Middle East North Africa (MENA) from 1990 to 2011.

Halkos and Polemis (2016) inspected the stimulus of financial sector development upon the EKC hypothesis for OECD economies from 1970-2014. Findings indicate that pollutants redefine the EKC hypothesis in the existence of the indicators of FD. Shahbaz et al. (2016) analyzed the influence of FD on the worth of the environment in Pakistan from 1985Q1 to 2014Q4. The empirics of the ARDL approach state that FD has harmful influences on environmental quality. The findings of Nasreen and Anwar (2015) proved that FD lessens pollution in higher-income panel and harms the quality of environment in the middle and lower-income panels over 1980-2010. Granger causality outcomes showed indication of two-way causality between pollution and FD in the higher income countries and one-way causality from FD to the pollution in middle and lower-income panels.

Tamazian et al. (2009) found financial development is the element of the quality of the environment in BRIC economies for 1992-2004. The empirics showed higher amount of financial and economic growth improves the environmental quality. The study suggested that FD and trdae are vital elements for the reduction of CO_2 emissions. Similarly, Tamazian and Rao (2010) examined the association for environmental degradation, financial and institutional development. The study employed a standard reduced-form modeling method to manage country-specific unnoticed heterogeneity and GMM to manage endogeneity. The study considered 24 transition countries using a panel set of 1993-2004. The outcomes sustained the EKC hypothesis but established the prominence of institutional quality and FD for the performance of the environment.

2.2. Exports and Pollution

The study of Naqvi et al. (2020) found that the use of energy does not have much impact on pollution but trade led to pollution in higher and lower-middle-income economies from 1990 to 2017. Feng et al. (2013) investigated the pollution and export on the behalf of input-output model during 2002 and 2007 in the context of China. The study highlights the issue of the global transmission of pollution from developed countries to China by looking at the local movement of export carbon emissions. The outcomes of the study of Chebbi et al. (2011) show a progressive influence of trade on pollution in both the short and long run as well in Tunisia. Jena and Grote (2008) scrutinized the nexus between trade and the environment for Indian leading industrial states between 1991 and 2003. The results demonstrate that trade has an impact on pollution. Shahbaz et al. (2016) also investigated that trade openness hampers the quality of the environment to the global, low, middle, and high-income panels but the influence fluctuates in these countries. Outcomes from the panel VECM highlighted feedback influence between trade and pollution at the universal level and in MICs.

Adamu et al. (2019) analyzed the impacts of energy use and export diversity on the deterioration of the environment with the EKC in India. The outcomes of DOLS exposed that energy, export diversity, and income positively donated to the deterioration of the environment. Consequences also present the EKC hypothesis doesn't happen in India whereas, bidirectional causality is viewed among the export diversity and environmental deterioration.

Chen and Guo (2017) investigated how a carbon tariff would affect Chinese trade in industrial goods and efforts to reduce emissions by the GATP model. The conclusions indicated that carbon tariff results in a fall in exports for higher-carbon industries and higher exports for lower-carbon industries. Furthermore, carbon tariff leads to a decline in imports for low-carbon industries. A carbon tariff will also make a discernable growth in light industry output, and a decline in heavy industry output and it has a visibly progressive impact on the fall of carbon emissions for the industrial sector of China, which allows the greatest concern of the fall of carbon emissions.

Dogan and Turkekul (2016) investigated environmental impact of consumption of energy, real GDP, urbanization, trade, and development of the financial sector in the USA from 1960-2010. The study does not provide support for the EKC.

Bernard and Mandal (2016) measured the effect of trade on the environmental quality in sixty developing economies during 2002-2012. The study used two proxies to measure quality of environment; the environmental performance index (EPI) and CO_2 emissions. The results of the fixed effects approach demonstrated that trade significantly improves the EPI while it enhances the level of CO_2 emission. But the findings of GMM reported that trade has harmful effects on the environment.

Rahman et al. (2022) found the asymmetric connection between export and CO_2 emissions quality are investigated using NARDL and PMG methods in 22 developed countries for 1990 to 2018. The anticipated outcomes have supported the presence of the EKC hypothesis and factors such as export quality and renewable energy have been identified as helping to lower CO_2 emissions. The relationship between exports and CO_2 emissions was also inspected by Bosupeng (2016). The Toda and Yamamoto causality technique is performed in the paper to assess the direction of causality for 37 countries during the time spanning 1960 to 2010. The study found a unidirectional link from exports to pollution in 12 countries and bidirectional causality between exports and pollution in the USA and Burkina Faso.

3. Theoretical Framework

Pollution is included among the furious subject beyond climate change. Many researchers tried to inspect the sources which cause the degradation of the environment. Expanding human and economic activities are accountable for global warming. A variety of factors such as exports, energy consumption, and financial sector development are accountable on behalf of the diverse outline of industrial pollution. Keeping in view the studies of Sehrawat, (2015), Hayami & Nakamura (2002), Davis & Caldeira (2010), Zafar et al. (2020), and Uttara et al. (2012), the functional form of FD, exports, and industrial pollution is represented as,

$$IP = f(FD, EX, E, CF, UP) \quad \ldots\ldots(1)$$

Due to the linear specification of the study, equation (1) is formulated to natural logarithms However, the transformed econometric equation is stated as.

$$lnIP_{it} = \alpha_1 + \alpha_2 lnFD_{it} + \alpha_3 lnEX_{it} + \alpha_4 lnEN_{it} + \alpha_5 lnCF_{it} + \alpha_6 lnUP_{it} + \mathcal{E}_{it} \quad \ldots\ldots(2)$$

where, lnIP is the natural logarithm of industrial pollution and is also considered the dependent variable which is measured by CO_2 emissions. And lnFD, lnEX, lnEN, lnCF, and lnUP represent the natural logarithm of financial development, exports, energy consumption, gross capital formation, and urban population, respectively. The terms Ɛ, i, and t are used for error term, cross sections, and the number of periods from 1990 to 2019 whereas α_1 and α_2, α_3, ……, α_6 represent the slope-intercept and elasticities of FD, Ex, EN, K, UP respectively.

4. Methodology

In cross-country analysis, a variety of techniques are employed to show how different economic factors affect environmental degradation. Panel data analysis has been employed because of many positive aspects, including

the capacity to interpret parameters perfectly and allow for more freedom and variation in the data, for this purpose, we have employed pooled OLS, fixed effects, random effects, and GMM models.
Firstly, we applied the pooled OLS to get the empirical results. This regression is helpful to find out the degree and type of connection between explanatory and dependent variables. In the next step, the reason to apply the fixed effects (FE) model is that it figures out the influence of coefficients that changes over time. The method evaluates a relationship between dependent and independent variables in all cross-sectional units because every unit has its attributes that might influence the independent variable. The random effects (RE) model is also a suitable approach in case of variation over the structure has an impact on the dependent variable and it considers the time-uniform parameters. The leading statement of the RE method is an intercept of every cross-sectional unit is arbitrarily strained by the means of the persistent average rate of intercept.
To estimate the unknown parameters of the economic model, the generalized method of moments (GMM), combines observed economic data with the knowledge of population moment situations. The expectation of these moment circumstances at the true values of the parameters is zero since they are functions of both the model parameters and the data. It is an estimation technique similar to maximum likelihood (ML). It is more resistant than ML because it makes assumptions about specific moments of the random variables rather than assumptions about the entire circulation.

5. Data

This study considers the 36 upper-middle-income countries (UMICs) and 38 lower-middle-income countries (LMICs) and the data for the sample regions has been gathered from WDI (2020) which covers the period from 1990 and ended in 2016. Industrial pollution is considered the dependent variable that is measured by CO_2 emission (metric tons per capita). Exports and FD are employed as the main independent variables while energy consumption, gross capital formation, and urban population are the control variables.
Industrial pollution is released into the atmosphere due to the manufacturing of the cement and burning of fossil fuels. They include carbon formed throughout depletion or usage of solid, and liquid as well as burning and flaring of gas. Pollution emissions lead to climate change, and the indications of these situations are the melting of polar ice caps which becomes the reason for rising levels of seas and oceans, a disorder of humans, animals, natural habitats, risky climatic processes, and a lot of adverse things which hamper whole of the world adversely.

Table 1: Descriptive Statistics

For UMICs					
Variables	Obs.	Mean	St. Dev	Min.	Max.
IP	1014	3.7479	3.0524	0.0281	24.3983
FD	828	47.0281	34.7017	6.2009	164.6643
EX	1119	36.5508	19.4141	6.5918	125.7485
CF	1070	24.5325	7.3305	-0.6929	57.9904
EN	870	1510.306	1008.801	266.6018	5941.586
UP	1140	61.9518	16.9278	22.7040	91.9910
For LMICs					
IP	966	1.1562	1.5145	0.0084	15.1386
FD	932	28.2801	21.9191	2.0104	137.9121
EX	1043	32.2603	16.3979	5.9083	106.7956
CF	1041	24.9376	9.6803	1.5251	77.8900
EN	742	633.5570	573.7355	9.5480	4856.642
UP	1080	41.1583	16.7054	8.8540	76.4400

Domestic lending to the private sector serves as a measure of financial development (FD). FD denotes financial assets provided to the private sector through acquiring trade credits, non-equity confidences, and other types of receivables with a claim for refund and loans. Financial institutions hold monetary establishments and deposit money banks as well where information is available.
Exports of products and services (% of GDP) account for a significant portion of the value of global markets for goods and services. Exports cover the cost of goods, travel, shipping, insurance, travel, and royalties and also include the services of a business, communication, financial, governmental as well as personal services.
Energy consumption is the amount of primary energy used before it is changed into further end uses of fuel, it is equivalent to the amount used for domestic production as well as stock fluctuations and imports, minus exports and the amount used to fuel ships and airplanes used for worldwide transportation.
Gross capital formation is spending on new economic fixed assets combined with net changes in inventory levels. Fixed assets include land enhancements, purchase of plant, machinery, equipment, and the building of roads, railways, and other structures of a similar nature such as hospitals, schools, and private as well as industrial

structures. Stocks of goods kept in reserve by businesses to cover brief or unforeseen swings in demand as well as ongoing work are known as inventories.
Urban population is the number of individuals who reside in city areas as clear through national statistical offices. The United Nations Population Division is responsible for gathering and smoothing the data.

5.1. Descriptive Statistics

Table 1 carries the mean, standard deviation, maximum, and minimum values of all the series for UMICs and LMICs. Maximum and minimum values of industrial pollution are 24.3983 and 0.0281 respectively whereas its mean value is 3.7479. FD has maximum value of 164.6643 and its minimum value is 6.2009 while its mean value is 7.0281. Exports range from 6.5918 to 135.7485. The values of energy consumption and capital are also mentioned. The values of all variables of LMICs are also presented in Table 1.

5.2. Correlation between Variables

Table 2 describes the correlation matrix for UMICs, accordingly FD, energy consumption, exports, capital, and urban population positively correlated with industrial pollution. Table 2 also carries the correlation between variables that describe FD, exports and the rest series have a positive relation for LMICs.

Table 2: Correlation Matrix

For UMICs						
Variables	IP	FD	EN	EX	CF	UP
IP	1.0000					
FD	0.2479	1.0000				
EN	0.8986	0.1607	1.0000			
EX	0.5082	0.1593	0.5406	1.0000		
CF	0.1225	0.1169	0.0618	-0.0459	1.0000	
UP	0.2946	-0.1689	0.2296	0.2311	-0.1091	1.0000
For LMICs						
Variables	IP	FD	EN	EX	CF	UP
IP	1.0000					
FD	0.4595	1.0000				
EN	0.6811	0.3155	1.0000			
EX	0.5249	0.3294	0.5055	1.0000		
CF	0.1954	0.1413	0.1353	0.2892	1.0000	
UP	0.5931	0.0958	0.4459	0.2648	0.0366	1.0000

6. Results and Discussion

Table 5 depicts the empirics for the panel of UMICs. The results of OLS state that FD, exports, energy, capital, and urban population are the increasing factors of industrial pollution. The coefficient of FD shows if there is a 1% rise in FD leads to 0.1178% increase in pollution. The coefficients of energy and exports show that a 1% change in energy and exports cause a 1.0809% and 0.0035% change in pollution, respectively. Capital is harmful to the environment and causes a 0.1696% increase in pollution. Urban Population (UP) shows a 1% enlargement in UP harms the quality of the environment by 0.4826%. These results are consistent with the research work of Jiang and Ma (2019), Bayar et al. (2020), Mohammadi et al. (2017), Feng et al. (2013), and Hamilton & Turton (2002).
Table 5 also holds the outcomes of the fixed effects model for UMICs. The coefficients of FD and exports indicate that a 1% rise in FD and exports bring a 0.0706% and 0.1107% rise in environmental degradation, respectively. The coefficient of energy comprises that a 1% change in energy enhances industrial pollution by 0.3391%. Shoaib et al. (2020), Iqbal et al. (2022), and Jian et al. (2019) also found that FD and energy consumption leading factors of pollution. Capital and urban population also have insignificant but harmful impacts on the environment.
The empirics of the random effects model reveal that a 1% rise in FD causes a 0.0576% rise in pollution and these are consistent with Chienwattanasook (2021). Exports have a coefficient of 0.1035 which means that it increases 0.1035% industrial pollution by a 1% increase in exports and it is similar to the study of Liu et al. (2016). Ccapital and urbanization insignificantly while Energy consumption significantly pollute the environment in UMICs.
The results for the GMM model for UMICs reveal that FD and exports have a positive influence on carbon emissions. Coefficients of FD, exports, and energy lead to enhance industrial pollution by 0.0142%, 0.0507%, and 0.1004%, respectively. The coefficient of the lag value of pollution is 0.7332 and it is highly significant for UMICs. Capital Formation has a coefficient of 0.0391 which expresses that a 1% rise in capital enhances the carbon emissions by 0.0391% whereas the urban population also insignificantly reduces pollution.
The empirics for LMICs are described in Table 6. The findings of the OLS model expose that the coefficients of FD, energy, and exports expose that a 1% rise in FD, energy and exports lead to enhance pollution by 0.3113%, 0.6109%, and 0.0994%, respectively. Capital and urban population have positive and harmful impacts on the

environmental quality by 0.1676% and 0.8612%, respectively, and the outcomes are similar with the work of Gulistan et al. (2020).

In the fixed effects model, FD and exports have a significant role to induce pollution for LMICs with elasticities of 0.0808 and 0.1670 respectively. The other factors including energy, capital, and urbanization are increasing the level of pollution by 0.5642%, 0.1799%, and 0.7447% respectively in the case of LMICs.

The long-run estimates of the random effects model (RE) among LMICs reveal that the rapid increase in FD, exports and other factors including energy consumption, capital, and urbanization are the sources of decline the environmental quality.

The results for the GMM model for LMICs show that FD pollutes the environment and has a coefficient of 0.0439 which expresses that a 1% rise in FD becomes the source of a 0.0439% increase in pollution. Exports and capital positively increase the level of pollution. The lag value of pollution, energy, and urbanization are also reasons to enhance environmental degradation. These outcomes are similar with the studies of Feng et al. (2013) and Kamal et al. (2021).

Table 5: Results of OLS, FE, RE, and GMM for UMIC

Dep. Variable: Industrial Pollution				
Variables	OLS Model	FE Model	RE Model	GMM Model
IP(-1)	-	-	-	0.7332***
	-	-	-	(0.0000)
FD	0.1178***	0.0706***	0.0576***	0.0142**
	(0.0000)	(0.0001)	(0.0011)	(0.0231)
EN	1.0809***	0.3391***	0.4516***	0.1004*
	(0.0000)	(0.0000)	(0.0000)	(0.0993)
EX	0.0035***	0.1107***	0.1035***	0.0507*
	(0.7395)	(0.0000)	(0.0000)	(0.0974)
CF	0.1696***	0.0195	0.0226	0.0391***
	(0.0002)	(0.4363)	(0.3642)	(0.0000)
UP	0.4826***	0.0383	0.0156	-0.0777
	(0.0000)	(0.7728)	(0.8890)	(0.2968)
C	-4.2156***	-1.9313	-2.1470	-
	(0.0000)	(0.0000)	(0.0000)	-
N	498	498	498	452
R^2	0.8367	0.9757	0.4350	

Note: level of significance *p<0.10, **p<0.05, ***p<0.01

Table 6: Results of OLS, FE, RE, and GMM for LMIC

Dep. Variable: Industrial Pollution				
Variables	OLS Model	FE Model	RE Model	GMM Model
IP(-1)	-	-	-	0.3621***
	-	-	-	(0.0000)
FD	0.3113***	0.0808***	0.1042***	0.0439**
	(0.0000)	(0.0048)	(0.0002)	(0.0117)
EN	0.6109***	0.5642***	0.4074***	0.4389***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
EX	0.0994***	0.1670***	0.1633***	0.0832***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CF	0.1676**	0.1799***	0.1994***	0.1185***
	(0.0313)	(0.0002)	(0.0000)	(0.0000)
UP	0.8612***	0.7447***	0.8465***	0.5106***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
C	-4.7881***	-4.8837***	-4.5395***	
	(0.0000)	(0.0000)	(0.0000)	
N	569	569	569	518
R^2	0.6661	0.9486	0.5132	

Note: level of significance *p<0.10, **p<0.05, ***p<0.01

7. Conclusion

This study empirically examines the impact of financial development (FD) and exports on industrial pollution in 36 UMICs and 38 LMICs covering the period from 1990 to 2019. Techniques such as Panel OLS, FE, RE, and GMM models are applied. In this study, we have used CO_2 emissions as a proxy for industrial pollution whereas exports and financial development are the main explanatory variables. A few control variables are also used to specify the model i.e., energy use, gross capital formation, and urban population. The results of the OLS model in the case of UMICs demonstrate that FD and exports lead to a rise the pollution while energy use, capital, and urban population also enhance environmental degradation, respectively. The outcomes of the OLS model specify that FD, exports, and energy use are polluting the environment, whereas, capital and urbanization are also a source of industrial pollution in LMICs. The FE and RE models conclude that FD and exports have become the polluting factors in UMICs and LMICs but capital and urban population are proved as insignificant factors in UMICs and significant in the case of LMICs. The GMM results have confirmed that the lag values of pollution significantly harms the environment in the case of UMICs and LMICs.

Policymakers should be concerned about the degradation of environmental consequences of the financial sector. They should find a balance between FD and CO_2 emissions by considering the particular circumstances of each country and building long-term plans to promote both the financial system and ecological sustainability. Governments should therefore put more effort into allocating funds to fostering technical advancement in the manufacturing sector, including by offering loans for projects that result in products with less pollution and funding alternative energy programs. Long-term development can be ensured with the support of environmental legislation and financial sector oversight. Since UMICs and LMICs export substantial volumes of carbon-intensive goods, their governments should modify their export structures to offset the carbon emissions.

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