A Composite Impact of Urbanization and liberalization on Environmental Degradation in Developed and Developing Economies

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Abstract: Now a days, urbanization and liberalization play a crucial role in environmental degradation. However, the composite impact of urbanization and liberalization on environmental degradation is missing in the existing literature. To cover this gap, the current study used the annual panel dataset of 103 developed and developing countries over the period from 1980 to 2018, to empirically investigates the composite impact of urbanization and liberalization on environmental degradation. For estimation purposes, this study employed the fixed, Random effect, Least Square Dummy Variables (LSDV), and 2SLS approach. The study results indicate that the composite impact of globalization and urbanization have a positive effect on CO2 emissions in developed economies, which explains that globalization speeds up urbanization with increasing carbon emissions. Furthermore, the results show that globalization is linked to urbanization through trade, economic growth, capital-labor ratio, and financial integration in developing economies by reducing the environmental quality. Based on estimates results, the current study recommends that a comprehensive policy is required for urban improvement and for the creation of smart cities to decrease the urbanization influence on environmental pollution.

Keywords: Urbanization, Liberalization, Environmental Degradation, Least Square Dummy Variable (LSDV), Two-Stage Least Square (2SLS).

1 Introduction

The relationship between environment and economy has been unavoidable since the beginning of life. It not only provides resources but also acts as a sink for emissions and waste. The environment and economic growth have a complex relationship with each other. Economic growth works with different drivers that come into play, such as the scale of the economy, urbanization, and globalization. This century has experienced a greater migration of the world's population to urban dwellers. However, urbanization refers to a general increase in the city's population. There are many causes of urbanization but one of the reasons that forces people to move from rural areas to cities is more job opportunities. A few of the most essential reasons are industrialization, better education, social benefits, services, employment opportunities, modernizations, and changes in lifestyle [1]

The movement of people from rural to urban has both positive and negative effects. However, increasing urbanization is inevitable; therefore, urbanization issues depend on effective planning, development, and infrastructural management. This unplanned population growth is associated with population demands that supersede infrastructure and service capabilities, leading to environmental degradation [2].

The different historical patterns and backgrounds of economic development and urbanization may create significant contrasts in the expression of the urban stream syndrome among high-income and low-income countries [3,4,5]. According to a UN report, the population of world cities was 34% in 1960. There is a consistent growth in the urban population, but in 2014 it jumped to 54% and is expected to reach 66% by the end of 2050 [6]. Generally, there are two causes of urban growth. One is due to natural growth as we experienced in the last three decades birth rate has improved due to advancements in medical terms. The other major factor is migration when people move from one place to another place. Migration is the result of economic growth, development, and

technological changes [7] and possibly also conflict and social disruption. Migration is driven by pull and push factors that drive rural areas away from urban areas. Also, in cities, there are somehow better job opportunities which is one of the major pull factors.

Urbanization also has positive impacts on the environment. The cluster of economic and human resources, gathered in place, helps to stimulate innovation and development in business, science, technology, and industry. Relatively simple approaches to health, education, social services, and cultural activities are more readily available to people in urban areas than rural areas [8]. On the other hand, population density in cities makes it easier and cheaper for government and public services to provide basic goods and services [9]. The rapid growth of the urban population often creates an urban sprawl with negative economic, social, and environmental consequences. In Ethiopia, the increase in the urban population often strains the capacity of local and national governments to provide urban residents with even the most basic water supply, sewerage, and solid waste disposal [10] are some of the negative impacts of urbanization on the environment.

Population growth in cities can also affect the broader regional environments. These regions downwind of huge and congested industrial areas also cause an increase in the amount of precipitation, air pollution, and the increase in the number of days of thunderstorms. Urbanization not only affects weather patterns but also leads to changes in the pattern of runoff water. Perhaps the urban area due to pollution generally generates more rain, but indeed the infiltration of water lowers the water tables. That means that this runoff happens faster with higher peak flows. This has led to an increase in the volume of floods and water pollution that occurs downstream.

Globalization is not a new terminology that is used nowadays. From the beginning of civilization, communalities have had a habit of trading among each other with their surplus of goods and services. With advancements in cultures, they were able to travel farther afield to trade their goods for desirable products found elsewhere. Liberalization or globalization in economics refers to the process by which organizations, businesses, and countries begin to operate internationally.

Globalization is most commonly used in an economic context, but it is also affected culturally and politically. Thus, in general, globalization has been shown to raise living standards in both developed and developing countries. On the other hand, some analysts warn that globalization may harm local or emerging economies and individual workers. The positive impact of globalization is that it also helped to increase the movement of raw materials and food from one region to another. Previously, populations used only locally grown food, but globalization has given the privilege to consume products that have grown in other economies

Liberalization is being considered as most widely represented in debates on environmentalism, and green activists have highlighted to its far-reaching effects. Activists have pointed out that liberalization has led to an increase in the consumption of goods and services, which has impacted the ecological cycle. An increase in consumption of goods and services mean or leads to an increase in manufacturing of goods and services which in turns automatically puts pressure on the environment. Liberalization is a global phenomenon that affects human well-being through its effects on the socio-economic and political aspects of human life [11]. It improves economic well-being through trade, capital flows, the diffusion technology, and even cultural and public policies [12]

Liberalization stimulates economic growth through trade openness and financial capital, but it has far-reaching environmental consequences across economies [13]. Moreover, developing countries are more interested in increasing the size of their business activities in urban areas.

On the other hand, there is an increase in pollution due to urbanization and liberalization with the rest of the world. This implies that urbanization and liberalization can be significant indicators of environmental degradation. However, to put it another way, importing technology and energy can be beneficial for production and economic activity, but the imported energy and technology are carbon emission-free in developing countries.

Additionally, economic development through rapid industrialization and urbanization causes environmental pollution positively. Urbanization has promoted the transfer of labor from rural to urban areas, resulting in economic transformation in several countries [14]. However, urbanization has improved living standards and expanded job opportunities with the negative effect of increasing CO_2 emissions.

Interestingly, many researchers have analyzed the environmental degradation hypothesis with the importance of urban growth and globalization and panel-specific studies. All these studies report mixed results regarding their dynamic

characteristics. Accordingly, the first group found that liberalization reduces pollution in their studies ([15], [16], [17], [18], [19], [20] and [21] but neglects the importance of urbanization. While the group of other researchers ([22], [23], [24] and concluded that urbanization increase CO2 emissions worldwide.

From the review of literature, it has been noted that very limited studies have analyzed the impact of liberalization, urbanization, and environmental degradation in the context of developing countries. [25] discussed the issue of environmental degradation and economic growth. [26] examined that financial instability increases in environmental degradation evidence from Pakistan. Consequently, few studies have focused on the reality of the liberalization effect on urbanization which is accompanied by environmental degradation. Although, other studies have not considered structural breaks in environment, liberalization, and urbanization. The empirical estimates can be misleading and estimations through econometric methods may include biases in the presence of structural breaks [27],[28],[29]. Based on the opposing arguments in the existing literature, it is important to review the empirical studies conducted on the environmental degradation hypothesis. Hence, to overcome the abovementioned gaps, this study aims to examine the following objectives: i) To explore a composite impact of urbanization and liberalization on environmental degradation in developed and developing countries. ii) To conduct a comparative analysis of environmental degradation between developing and developed countries. The current study investigates these relationships between developed and developing countries over the period from 1980-to 2017.

This study will be beneficial for policymakers in developing countries. Policymakers will make a better decision regarding environmental degradation. This study offers a new look at environmental degradation from today's perspective. Especially, based on this study, all developing countries can draw important conclusions regarding the context of liberalization and urbanization. This study will also be beneficial for policy reviewers and researchers to understand the dynamics and behavior of liberalization and urbanization and their impact on environmental degradation in developing countries.

The general intention of the study is to compare the composite impact of urbanization and liberalization on environmental degradation in both developed and developing countries. In addition, this study will also serve to explore the significant impact of the composite interactive factor to explore urbanization and liberalization on environmental degradation.

The remaining section of this study is arranged as follows: section 2, describes the material and methods. Section 3, discusses the results and discussion. Lastly, concludes the study results and suggests some policy recommendations.

2 Material and Methods

2.1 Empirical Model

The current study examines the effect of liberalization and urbanization on environmental degradation using the following functional form of the model followed by [30],[31],[32],[28],[33].

$$ED_{it} = f(URB_{it}, LIB_{it}, GDPC_{it}, FD_{it}, IND_{it}) \quad (1)$$

Where *ED* denotes the environmental degradation such as CO2 emissions, *URB* denotes urbanization, *LIB* is the liberalization. In this model we also include the control variables such as GDPpc is the GDP per capita, FD is the financial development, and *IND* denotes the industrialization that also affects the environmental degradation, respectively.

The abovementioned relationship between liberalization and urbanization on environmental degradation can also be written in panel equations. The ordinary least squares (OLS) regression without dummy variables, a pooled regression model, assumes a constant intercept and slope. The econometric form of the model has been formulated as follows:

$$ED_{it} = \beta_0 + \beta_1 URB_{it} + \beta_2 LIB_{it} + \beta_3 GDPpc_{it} + \beta_4 FD_{it} + \beta_5 IND_{it} + \varepsilon_{it} \quad (2)$$

where, i = number of countries, t = time period (1990-2018). Similarly, ε_{it} is the error term, respectively. We used the interaction term *(URB.LIB),* then our model becomes like this.

$$ED_{it} = \beta_0 + \beta_1 URB_{it} + \beta_2 LIB_{it} + \beta_3 (URB.LIB_{it}) + \beta_4 GDPpc_{it} + \beta_5 FD_{it} + \beta_6 IND_{it} + \varepsilon_{it} \quad (3)$$

Similarly, our model also used the time-specific dummies known as Least Squares Dummy Variable (*LSDV*). The new extended model is:

$$ED_{it} = \beta_0 + \beta_1 URB_{it} + \beta_2 LIB_{it} + \beta_3 (URB.LIB)_{it} + \beta_4 GDPpc_{it} + \beta_5 FD_{it} + \beta_6 IND_{it} + \alpha_i + \varepsilon_{it} \quad (4)$$

2.2 Estimation Methods

For estimation purposes, we have used the panel estimation techniques such as fixed effect (FE) and

random effect (RE). Additionally, the Hausman test has been used to identify whether FE is more appropriate or RE is more appropriate. Further, in this study, we have used the LSDV regression and two-stage least square (2SLS) regression analysis. LSDV regression is the ordinary least square (OLS) regression equation with dummy variables.

Two-Stage Least Squares (2SLS) regression analysis is a statistical tool that is applied in the analysis of structural equations. Hence this technique is an extension of the OLS method. It is mainly used when the dependent variable error terms are correlated with independent variables. Several ways help to lessen simultaneity bias, but the most regularly used in econometrics as an alternative to OLS is called 2SLS. 2SLS is a method of avoiding simultaneity bias by systematically creating variables to replace the endogenous variables where they appear as independent variables in simultaneous equations systems.

2.3 Data Sources and Variables Description

This study used a balanced panel of annual data which includes 103 developed and developing countries for the period 1990–to 2018. All variables data has been taken from the published source of World Development Indicator (WDI) except globalization.

Globalization data has been taken from the KOF Index of Globalization (2018) dataset. We have taken overall globalization into three components: economic, social, and political globalization. Moreover, economic globalization has been used as a proxy for economic liberalization. The list of countries is given in appendix-A1. Countries have been selected based on data availability.

Table1. Variables Description

Variables	Description	Unit	Data Source
ED	Environmental degradation (used as a proxy of CO2 emission.	Metric tons per capita	WDI
URB	Urbanization	Percentage of the urban population to total population	WDI
EG	Economic Liberalization is used as a proxy of economic globalization	overall globalization taken into three components: economic, social, and political globalization.	KOF Index of Globalization (2018) dataset
GDPpc	GDP per capita	GDP as percentage of growth	WDI
FD	Financial Development	Broad money as a percentage of GDP	WDI
IND	Industrialization	Manufacturing value-added percentage of GDP	WDI

Source: Author's own collections

3 Results and Discussion

The results consist of developed and developing economies. First, we report the estimates of developed economies using the FE, RE, LSDV, and 2SLS methodology in Table 2.

Table 2. Environmental Degradation in Developed Countries: Role of Urbanization and liberalization

Variables	Model 1 FE	Model 2 RE	Model 3 LSDV	Model 4 2SLS
EG	-0.008 (0.046)	-0.010 (0.046)	-0.013 (0.047)	-0.220*** (0.076)
URB	0.785*** (0.123)	0.783*** (0.123)	0.783*** (0.122)	1.404*** (0.204)
EG*URB	0.983*** (0.234)	0.984*** (0.233)	0.974*** (0.235)	1.553*** (0.244)
IND	-0.220*** (0.029)	-0.218*** (0.029)	-0.236*** (0.029)	0.929*** (0.142)
GDP	0.064*** (0.014)	0.065*** (0.014)	0.075*** (0.014)	0.338*** (0.039)
FD	-0.028** (0.014)	-0.027* (0.014)	-0.031** (0.014)	0.141*** (0.030)

Y_{1980}	-	-	0.106*** (0.031)	-
Y_{1990}	-	-	0.004 (0.030)	-
Y_{2000}	-	-	0.059* (0.031)	-
Y_{2010}	-	-	-0.026 (0.031)	-
Y_{2018}	-	-	-0.117*** (0.031)	-
Constant	7.889*** (0.528)	7.888*** (0.618)	7.868*** (0.524)	-0.454 (1.279)
Obs	1,170	1,170	1,170	1,170
R-square	0.286	0.376	0.305	0.298
No of code	30	30	30	30
Hausman test	5.05**			

Notes: Standard errors in parentheses. The significance of coefficients at the 10%, 5%, and 1% levels are shown by *, **, and ***, respectively.

The first column of Table 2 shows the FE model results, which explains that the coefficient of economic globalization is statistically insignificant for developed countries. While a similar result is found in the RE model (Column 2), the coefficient of urbanization is positive and significant in both FE and RE regression models. It implies that a 1 % increase in urbanization causes a 78.5% increase in carbon emissions in developed countries.

Further, a composite impact of globalization and urbanization has a positive effect on CO2 emissions in developed economies under both FE and RE models, which indicates that globalization speed up urbanization with increasing carbon emissions. This also means that globalization connects with urbanization through trade, economic growth, capital-labor ratio, and financial integration in developed economies by lowing the environmental quality. This result is also consistent with [34],[35], which infers that urbanization improves the economy by increasing transportation with rising traditional and modern energy consumption, which enhances the CO2 emotions. Fast speed in urbanization can affect energy use, economic activities, and carbon emissions. However, previous literature reports mixed results regarding the relationship between urbanization and CO2 emission, but our finding confirms the positive effect of urbanization on carbon emissions. One of the possible reasons is that urbanization is related to economic activity, which explains that higher economic activity creates wealth and richer residents often demand more energy apparatuses products which can upsurge environmental pollution.

The coefficient of GDP is positive and significant in both FE and RE regression models. Our results also show that industrialization has a negative effect on carbon emissions under both FE and RE models.

The variable, financial development, is negative and significant in both FE and RE models, which indicates that financial development has a negative influence on carbon emissions. This result explains that an increase in financial development improves the clean and green energy in developed economies which in turn decreases environmental pollution.

Lastly, we compare FE and RE models. The result of the Hausman test shows that the fixed effect is the best-fitted model in our analysis

Additionally, the current study estimates the results by using LSDV method to determine the relationship between, economic globalization, urbanization, and economic growth. The advantage of using LSDV over FE/RE is that it considers the time dummy effect in the analysis which is more important in real analysis. The results of LSDV test explain that the coefficient of economic globalization coefficient remains negative and insignificant. While urbanization has also similar results in LSDV method, which means that urbanization has increased the environmental pollution.

Further, a composite impact of globalization and urbanization has a similar effect on CO2 emissions as in previous models. The same results are also found for industrialization, GDP, and financial development in LSDV model.

The results also show that the dummy year (1980) has a positive effect on carbon pollution while over the period, the time effect on the environmental pollution is changed from positive to negative in the dummy year (2018) under LSDV model.

This also means that environmental pollution is decreasing in developed economies with the passage of time.

Finally, we apply the 2SLS method to improve our findings by dealing the potential endogeneity problem. The possibility of endogeneity due to reverse causality, measurement error, and omitted variable biases. Therefore, in the presence of endogeneity FE, RE, and LSDV estimates become inefficient and biased. Therefore, to address the problem of endogeneity, we apply the 2SLS in our analysis for better results. The results of 2SLS are given in Column 4.

The 2SLS model result explains that the coefficient of economic globalization is negative significant at 1 % level, which reveals that a 1 % increase in economic globalization leads to a decrease in carbon emissions by 22.0 %. This implies that globalization is a global phenomenon that affects environments through socio-economic-political aspects of human life. Globalization also stimulates economic activities through financial, trade openness, and FDI, but it has also considerable environmental quality consequences across economies. This result is conclusive with [36] which stated that globalization is one of the main factors that enhance the environmental health quality for developing and developed countries and worldwide it has various consequences. The variable, urbanization, the result is similar to the previous models. However, the interesting finding is that the industrialization coefficient is turned negative to positive in 2SLS. This implies that a 1% increase in industrialization has a 92.9% increase in carbon emissions in developed economies. While the composite impact of globalization and urbanization result has been maintained in 2SLS. This also infers that industrialization is also one of the main sources of environmental pollution in advanced economies. However, the result of variable GDP is similar in 2SLS while the coefficient of financial development changes signs from negative to positive in 2SLS. This indicates that as financial development increases it leads to an increase the environmental pollution.

Next table 3 explains the impact of urbanization and globalization on environmental pollution in the context of developing economies. The results are based on FE, RE, LSDV, and 2SLS estimators.

The first column of Table 3 shows the FE results, which indicate that the coefficient of economic globalization is statistically positive and significant for developing countries. We have found similar results in the RE model in Column 2. The results also show the positive influence of economic globalization on environmental pollution, which indicates that trade and technology innovation enhances environmental pollution by hurting the trade and technology policies related to control of air quality and world environment concerns. Further, economic globalization is an essential determinant of environmental pollution as supported by [37], [38], [39],[40]. Developing economies also obtain ecological benefits from economic globalization via access to energy-saving and energy-efficient innovative machinery from developed nations. This is very helpful in environmental quality. However, our result is contradicting these facts. Another explanation is that globalization enables nations to attain trade and environmental benefits from these resources. This also implies that globalization allows developing economies to enlarge their industrial sector production at the cost of environmental quality.

The estimated results also show that the effect of urbanization is positive and significant in FE and RE regression models. It implies that a 1 % increase in urbanization leads to an increase carbon emissions by 1.55% in FE and 1.545% in RE regression model.

Table 3. Environmental Degradation in Developing Countries: Role of Urbanization and liberalization

Variables	Model 1 FE	Model 2 RE	Model 3 LSDV	Model 4 2SLS
EG	0.012***	0.012***	0.011***	0.026***
	(0.001)	(0.001)	(0.001)	(0.004)
URB	1.555**	1.545**	1.715**	0.001
EG*URB	(0.000)	(0.000)	(0.000)	(0.002)
IND	1.852**	1.854**	1.952**	1.011***
GDPpc	(0.012)	(0.011)	(0.013)	(0.012)
FD	0.003***	0.003***	0.003***	0.005***
Y_{1980}	(0.001)	(0.001)	(0.001)	(0.001)
Y_{1990}	0.483***	0.474***	0.479***	0.084
Y_{2000}	(0.013)	(0.013)	(0.013)	(0.116)
Y_{2010}	0.108***	0.109***	0.111***	0.227***
Y_{2018}	(0.014)	(0.014)	(0.014)	(0.038)
Constant				
			-0.217***	
Observations			(0.040)	
R-Squared			-0.054	
Hausman Test			(0.039)	
			0.114***	
	-4.853***	4.850***	(0.039)	6.893***
	(0.080)	(0.268)	0.008	(0.594)
	2,846	2,846	(0.040)	2,846
	0.62		0.072*	
	6.54**		(0.040)	
			4.925***	
			(0.084)	
			2,846	
			0.625	

Note: Standard errors are in parentheses. *, ** and *** are the 10%, 5%, and 1% levels, respectively.

This also implies that globalization has also stimulated urbanization in developing economies which is a possible source of environmental pollution. This shows that globalization has created an increasing level of interdependence in urbanization, which is one of the sources of air pollution in a new era. We also found that globalization affects CO2 emissions through urbanization in composite forms. Our results revealed that industrialization has a negative effect on carbon emissions in developing economies while similar results have been found in developed economies. However, the effect of GDP is positive and significant in FE and RE regression models, this means that economic activity is more producing environmental pollution. Financial development has a positive and significant influence on carbon emissions which implies that an increase in financial development improves the fossil fuel energy in developing economies which in turn increases environmental pollution. In the end, the Hausman test shows that the fixed effect is significant and our preferred model and gives better estimates our estimates.

We also estimate our model by using the LSDV method to determine the relationship between, economic globalization, urbanization, and economic growth in developing economies. We have found that the economic globalization coefficient remains positive and significant, implying that a 1% increase in economic globalization increases environmental pollution by 1.10% in developing economies. While urbanization has also similar results in LSDV method as compared to FE and RE, which means that urbanization increased carbon pollution.

Similarly, industrialization, GDP, and finance effects also exist in LSDV. The results also show that the dummy of the year1980 has a negative effect on carbon pollution, while with the passage of time, time effect on the environmental pollution is turn into negative to positive significant in LSDV model. This also means that magnitude of the time period is converted from negative to positive effects, this shows that environmental pollution is more in the latest era compared to the initial period.

Finally, we have also employed the 2SLS estimation to improve our results by dealing with the potential endogeneity problem using the developing economies dataset. The results are given in Column 4, the coefficient of economic globalization is positive and significant at 1 % level of significance revealing that a 1 % increase in economic globalization causes carbon emissions to decrease by 2.6%. While the urbanization impact on carbon emissions is positive and insignificant with a magnitude of 0.1%. However, the remarkable finding is that industrialization has a positive effect in 2SLS, the magnitude is higher as compared to other models. This implies that a 1% increase in industrialization has 0.5% increase in carbon emissions in developing economies. This also revealed that industrialization is one of the main indicators of environmental pollution in developing economies. However, the result of variable GDP deviates from the previous models in 2SLS, while financial development has a positive influence on carbon emissions.

Table 4 shows the result of the full sample of developing and developed economies using FE, RE, 2SLS, and LSDV. The results reported in Column 1 and 2 shows that economic globalization has a positive effect on environmental pollution at a statistically significant at 1%. It means that

economic globalization is not a helping factor in air quality in the globe. For instance, economic globalization affects air quality. Similarly, the effect of urbanization in Column 1 and 2 is statistically significant. The result also shows that composite impact is also a positive influence on carbon emissions. However, industrialization has a positive and statistically significant impact on carbon emissions in both columns. The coefficient of industrialization in Column 1 and 2 shows that a 1% increase in industrialization will cause 0.3% increase in carbon emissions. Finally, the parameter estimate on GDP is positive and significant at 1% percent level implying that economic activity causes an unfavourable impact on environmental health.

Overall, similar results have been found in FE and RE models. This also implies that GDP and financial

development have also an adverse effect on environmental pollution. In the Hausman test, FE is our preferred model.

Column 3 of table 4 shows that economic globalization and urbanization have a positive significant influence on carbon emissions indicating that if economic globalization and urbanization increase by 1% then carbon emissions will increase by 0.5% and 2.65%. Composite effects are also remaining the same in regression. This finding also infers that the magnitude of urbanization is more compared to economic globalization. This result is reliable with facts, empirics, and theory. Regarding control variables, we found that industrialization, GDP, and finance variables have a significant positive influence on carbon emissions. While table 4 shows empirical results when 2SLS is used. The coefficient of economic globalization in Column 3 shows that a

1% rise in economic globalization will lead to a 6% increase in environmental pollution and this result is statistically significant. While the urbanization indicator is insignificant, this implies that urbanization is not mattered in global pollution. The coefficients of control variables have expected sign and become statistically positive significant indicating that industrialization, GDP, and financial development will directly affect the carbon emissions in the globe.

4 Conclusion and Policy Implications

The present study explores the effect of liberalization and urbanization on environmental degradation by using FE, RE, LSDV, and 2SLS models in both developed and developing economies over the period from 1980 to 2018. The findings revealed that economic globalization negatively affected the carbon emissions in developed economies. Moreover, urbanization has a positive and significant impact on CO2 emissions.

This means that economic globalization, urbanization, and the combined effect of twin indicators has also a positive influence on environmental pollution in developing economies. Our results of the full sample are also consistent with the previous sample of developing and developed economies.

Based on our empirical evidence, we find that the outcomes are varied across the developed and developing sampled countries. Thus, there is always a need to conduct analysis at country level in direction to determine the association among variables at the gross root level for better policy implication.

Table 4. Urbanization, Liberalization, and Environmental Degradation in Developed and Developing Economies (Full sample)

Variables	Model 1 FE	Model 2 RE	Model 3 LSDV	Model 4 2SLS
EG	0.005***	0.005***	0.005***	0.060***
	(0.001)	(0.001)	(0.001)	(0.011)
URB	2.556***	2.546***	2.655***	0.001
	(0.000)	(0.000)	(0.000)	(0.002)
EG*URB	2.863***	2.774***	2.951***	1.019
	(0.019)	(0.021)	(0.020)	0.022
IND	0.003***	0.003***	0.003***	0.012***
	(0.001)	(0.001)	(0.001)	(0.002)
GDP	0.384***	0.385***	0.383***	1.085***
	(0.011)	(0.011)	(0.012)	0.298
Finance	0.125***	0.126***	0.127***	0.519***
	(0.012)	(0.012)	(0.012)	0.085
Y_{1980}	-	-	-0.127***	-
			(0.034)	
Y_{1990}	-	-	-0.064*	-
			(0.033)	
Y_{2000}	-	-	0.091***	-
			(0.033)	
Y_{2010}	-	-	-0.013	-
			(0.034)	
Y_{2018}	-	-	0.040	-
			(0.034)	
Constant	6.044***	6.033***	6.086***	13.92***
	(0.076)	(0.215)	(0.080)	(1.603)
Observations	4,016	4,016	4,016	4,016
R-squared	0.487		0.491	
Number of code	103	103	103	103
Hausman test	6.09**			

Note: Standard errors are in parentheses. *, ** and *** are the 10%, 5%, and 1% levels, respectively.

It is more important to implement a proper plan of policies for urban improvement and create smart cities to decrease the urbanization influence on environmental pollution. Authorities should use environmental-friendly apparatuses in the urban areas and provide energy-efficient public transport for residents. Unplanned urbanization and the speed of urbanization are one of the key problems in developing economies. Therefore, developing nations should build the road map of new urbanization and should impose environmental taxes to lessen the effect of urbanization and industrialization on the environment. Moreover, authorities build green belts to reduce CO_2 emissions, however, better environmental regulations, political regime, institution quality, and human capital are also essential to attract clean urbanization and environmental quality.

Regulations should increase the quality of the atmosphere of any strategies for urban transformation. Developing economies should redesign the industrialization policies in the context of environmental quality. Authorities can be a separate an industrial zone from outside the urban areas. In addition, asymmetric panel data estimation techniques can be incorporated in the analysis along with globalization, industrialization, and urbanization in future research for each developing and developed countries separately.

References:

[1] Asoka, G. W., Thuo, A. D., & Bunyasi, M. M. (2013). Effects of population growth on urban infrastructure and services: A case of Eastleigh neighborhood Nairobi, Kenya. *Journal of Anthropology and Archaeology*, *1*(1), 41-56.

[2] Ocholla, G. O., Bunyasi, M. M., Asoka, G. W., Pacha, O., Mbugua, H. K., Mbuthi, P., ... & Kamau, H. K. W. P. K. (2013). Environmental issues and socio-economic problems emanating from salt mining in Kenya; a case study of Magarini district. *International Journal of Humanities and Social Science*, *3*(3), 213-223.

[3] Booth, D. B., A. H. Roy, B. Smith, and K. A. Capps. (2016). Global perspectives on the urban stream syndrome. *Freshwater Science* 35,412–420.

[4] Hale, R. L., Scoggins, M., Smucker, N. J., & Suchy, A. (2016). Effects of climate on the expression of the urban stream syndrome. *Freshwater Science*, *35*(1), 421-428.

[5] Parr, T. B., Smucker, N. J., Bentsen, C. N., & Neale, M. W. (2016). Potential roles of past, present, and future urbanization characteristics in producing varied stream responses. *Freshwater Science*, *35*(1), 436-443.

[6] World Urbanization Prospects (2014), Department of Economic and Social Affairs Population Division. https://population.un.org/wup/publications/files/wup2014-report.pdf.

[7] Marshall, A. (2009). *Principles of economics: unabridged eighth edition*. Cosimo, Inc..

[8] Mulholland, P. J., Helton, A. M., Poole, G. C., Hall, R. O., Hamilton, S. K., Peterson, B. J., ... & Thomas, S. M. (2008). Stream denitrification across biomes and its response to anthropogenic nitrate loading. *Nature*, *452*(7184), 202-205.

[9] Brockerhoff, M. (2000). *An urbanizing world*. Washington, DC, USA: Population Reference Bureau.

[10] MWUD 2008 Environmental and Social Management Framework Ministry of Works and Urban Private and confidential MWUD. 2008. Environmental and Social Management Framework. Ministry of Works and Urban Development, Ethiopia.

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

[12] Shahbaz, M., Mallick, H., Mahalik, M. K., & Loganathan, N. (2015). Does globalization impede environmental quality in India?. *Ecological Indicators*, *52*, 379-393.

[13] Henderson, V. (2003). The urbanization process and economic growth: The so-what question. *Journal of Economic growth*, *8*(1), 47-71

[14] Al-Mulali, U., & Tang, C. F. (2013). Investigating the validity of pollution haven hypothesis in the gulf cooperation council (GCC) countries. *Energy Policy*, *60*, 813-819.

[15] Behera, S. R., & Dash, D. P. (2017). The effect of urbanization, energy consumption, and foreign direct investment on the carbon dioxide emission in the SSEA (South and Southeast Asian) region. *Renewable and Sustainable Energy Reviews*, *70*, 96-106.

[16] Hakimi, A., & Hamdi, H. (2016). Trade liberalization, FDI inflows, environmental quality and economic growth: a comparative analysis between Tunisia and Morocco. *Renewable and Sustainable Energy Reviews*, *58*, 1445-1456.

[17] Sapkota, P., & Bastola, U. (2017). Foreign direct investment, income, and environmental pollution in developing countries: Panel data analysis of Latin America. *Energy Economics*, *64*, 206-212.

[18] Seker, F., Ertugrul, H. M., & Cetin, M. (2015). The impact of foreign direct investment on environmental quality: a bounds testing and causality analysis for Turkey. *Renewable and Sustainable Energy Reviews*, *52*, 347-356.

[19] Tang, C. F., & Tan, B. W. (2015). The impact of energy consumption, income and foreign direct investment on carbon dioxide emissions in Vietnam. *Energy*, *79*, 447-454.

[20] Zhang, Y. J., Peng, Y. L., Ma, C. Q., & Shen, B. (2017). Can environmental innovation facilitate carbon emissions reduction? Evidence from China. *Energy Policy*, *100*, 18-28.

[21] Dogan, E., & Turkekul, B. (2016). CO2 emissions, real output, energy consumption, trade, urbanization and financial development: testing the EKC hypothesis for the USA. *Environmental Science and Pollution Research*, *23*(2), 1203-1213.

[22] Farhani, S., & Ozturk, I. (2015). Causal relationship between CO2 emissions, real GDP, energy consumption, financial development, trade openness, and urbanization in Tunisia. *Environmental Science and Pollution Research*, *22*(20), 15663-15676.

[23] Ozatac, N., Gokmenoglu, K. K., & Taspinar, N. (2017). Testing the EKC hypothesis by considering trade openness, urbanization, and financial development: the case of Turkey. *Environmental Science and Pollution Research*, *24*(20), 16690-16701.

[24] Shafiei, S., & Salim, R. A. (2014). Non-renewable and renewable energy consumption and CO2 emissions in OECD countries: a comparative analysis. *Energy policy*, *66*, 547-556.

[25] Alvarado, R., & Toledo, E. (2017). Environmental degradation and economic growth: evidence for a developing country. *Environment, Development and Sustainability*, *19*(4), 1205-1218.

[26] Shahbaz, M., Shahzad, S. J. H., Ahmad, N., & Alam, S. (2016). Financial development and environmental quality: the way forward. *Energy Policy*, *98*, 353-364.

[27] Shahbaz, M., Shahzad, S. J., Mahalik, M. K., & Hammoudeh, S. (2017). Does Globalisation Worsen Environmental Quality in Developed Economies? *Environmental Modeling &*

Assessment, *23*(2), 141-156. Doi:10.1007/s10666-017-9574-2.

[28] Pata, U. K. (2017). The effect of urbanization and industrialization on carbon emissions in Turkey: evidence from ARDL bounds testing procedure. *Environmental Science and Pollution Research*, *25*(8), 7740-7747.doi:10.1007/s11356-017-1088-6

[29] Xu, Z., Baloch, M. A., Danish, 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. Doi:10.1007/s11356-018-2876-3.

[30] Paramati, S. R., Alam, M. S., & Apergis, N. (2018). The role of stock markets on environmental degradation: A comparative study of developed and emerging market economies across the globe. *Emerging Markets Review*, *35*, 19-30.

[31] Iqbal, M., Breivik, K., Syed, J. H., Malik, R. N., Li, J., Zhang, G., & Jones, K. C. (2015). Emerging issue of e-waste in Pakistan: a review of status, research needs and data gaps. *Environmental pollution*, *207*, 308-318.

[32] Nassani AA, Aldakhil AM, Abro MMQ, Zaman K (2017) Environmental Kuznets curve among BRICS countries: spot lightening finance, transport, energy and growth factors. J Clean Prod 154:474–487. https://doi.org/10.1016/j.jclepro.2017.04.025.

[33] Hafeez, M., Yuan, C., Yuan, Q., Zhuo, Z., Stromaier, D., & Sultan Musaad O, A. (2019). A global prospective of environmental degradations: economy and finance. *Environmental Science and Pollution Research*, *26*(25), 25898-25915.

[34] Cole, M. A. (2004). Trade, the pollution haven hypothesis and the environmental Kuznets curve: examining the linkages. *Ecological Economics*, *48*(1), 71-81.Doi:10.1016/j.ecolecon.2003.09.007.

[35] Jena, P. R., & Grote, U. (2008). Growth-trade-environment nexus in India. http://hdl.handle.net/10419/39895.

[36] Lee, K.H. and Min, B. 2014, Globalization and carbon constrained global economy: A fad or a trend?, *Journal of Asia-Pacific Business*, 15(2), 105-121.

[37] Shahbaz, M., Mahalik, M. K., Shahzad, S. J. H., & Hammoudeh, S. (2019). Testing the globalization-driven carbon emissions hypothesis: international evidence. *International Economics*, *158*, 25-38.

[38] Shahbaz, M., Mallick, H., Mahalik, M. K., & Loganathan, N. (2015). Does globalization impede environmental quality in India?. *Ecological Indicators*, *52*, 379-393.

[39] Salahuddin, M., Gow, J., Ali, M. I., Hossain, M. R., Al-Azami, K. S., Akbar, D., & Gedikli, A. (2019). Urbanization-globalization-CO2 emissions nexus revisited: empirical evidence from South Africa. *Heliyon*, 5(6),1-9.

[40] Chishti, M. Z., Ullah, S., Ozturk, I., & Usman, A. (2020). Examining the asymmetric effects of globalization and tourism on pollution emissions in South Asia. *Environmental Sciences and Pollution Research*, *27*(2),27721-27737.

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