Do Human Capital and Governance Thresholds Matter for the Environmental Impact of Fdi?: the Evidence From Mena Countries

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Abstract

This paper studies whether foreign direct investment (FDI)-CO_2 emissions relationship may change depending on the data-driven estimated threshold levels for the country characteristics (CC) including human capital and governance in a sample of 13 Middle East and North Africa (MENA) economies during the 1996–2019 period. Our results strongly suggest that endogenously estimated CC thresholds matter for the impact of FDI on CO_2 emissions. The pollution haven hypothesis which maintains that FDI is associated with higher levels of pollution, appears to be valid for economies with weak CC. In addition to this, the pollution halo argument suggesting FDI lowers the emissions appears to be hold in countries with strong CC. The results in this study may indicate that policies aiming to improve human capital and governance may be expected not only to increase the economic benefits of FDI in terms of growth but also mitigate the negative environmental impacts of FDI in the MENA region.

JEL Classification: C13, C33, F21, F30, O50, Q56.

1. Introduction

Environmental deterioration has been one of the serious concerns for developing countries containing the Middle East and North Africa (MENA) economies. Abumoghli and Goncalves (2020) draws attention to the substantial utilization of not only fossil fuels but also non-renewable energy sources in production along with prevailing environmental issues such as air pollution, loss of biodiversity and inadequate waste management. According to World Development Indicators (WDI) database, CO_2 emissions per capita in 1975 were 0.48 kg in the MENA and it is around 0.56 in Organization for Economic Co-operation and Development (OECD) countries. However, the carbon emissions of MENA have been increased to 0.73 in 2017 while the carbon emissions of the OECD decreased to 0.22.

High CO_2 emissions may prevent developing countries to achieve their development goals, particularly the Sustainable Development Goals which focus on promoting a green economy. “Greening” is associated with the low-carbon energy transitions aiming not only access to renewable energy sources but also reduction in poverty along with job creation (Siciliano et al., 2021). Therefore, mitigation of CO_2 emissions is crucially important to provide the sustainability of environment. Implementing proactive strategies to mitigate ecosystem vulnerability and ensure the environmental sustainability matter for policymakers in developing countries, including MENA.

The environmental economics literature investigates the possible determinants of environmental degradation. The earliest of these studies consider income per capita (Grossman and Krueger, 1995) and energy consumption (Pao and Tsai, 2010) as the important determinants of CO_2 emissions. Afterwards, the effects of many other variables such as technological innovation (Khan et al., 2020), trade openness (Copeland and Taylor, 2005), financial development (Ozturk and Acaravci, 2013), urbanization (Zhang et al., 2017) and foreign direct investment, FDI, (Levinson and Taylor, 2008; Lee, 2009) on pollution are investigated. Among these variables, one of the most important, especially for developing countries, is the FDI. The international economics literature maintains that FDI often leads to better growth episodes not only by providing efficient allocation of capital, access to financial markets and new technology but also by increasing total factor productivity. While FDI inflows have often been associated with high growth rates, the environmental economics literature often remarks that FDI may provide deleterious results for the environment. The purpose of this article is to study FDI-pollution relationship for MENA economies.

The literature investigating the environmental effect of FDI has been centered around two views: The first one is the “pollution haven” hypothesis maintaining that FDI leads to environmental degradation. This may be consistent with the fact that advanced economies locate pollution-intensive activities to developing countries with lax environmental restrictions and regulations by FDI linkages (Levinson and Taylor, 2008). The second one is the “pollution halo” hypothesis suggesting the impact of FDI is environmental improvement (Cole et al., 2011). This may be in line with the argument that international firms with high environmental quality may bring sophisticated, energy-efficient, environmentally cleaner technologies to host economies along with better environmental management systems (Wang and Chen, 2014). Although it has been widely studied by the literature, the investigation of FDI inflows and pollution is amongst the important research topics in the literature.

The literature often suggests that FDI-pollution relationship is invariant to the country characteristics (CC) including human capital and institutional quality and governance levels. However, the investment decisions of multinational firms may be affected by the prevailing CC (Mengistu and Adhikary, 2011; Noorbakhsh et al., 2001; Cantwell et al., 2010). In this context, conventional wisdom

maintains that more educated labor demands clean environment, promotes the use of renewable energy products, energy efficiency and tends to better adopt environmental regulation as well as greener technology. On the other hand, economies with well-established rules, norms and regulations allow them to implement environmental protection policies. In this vein, the empirical findings by Wang and Chen (2014), Bokpin (2017), Omri and Hadj (2020), and Bouchoucha (2021) show that improvements in institutions mitigates the effect of FDI on pollution. The empirical findings by Tang et al. (2021) suggest the crucial importance of human capital and institutions for sustainable development prioritizing lower pollution. Considering all these issues, we may plausibly assume that the level of CC matters for FDI-pollution relationship. Furthermore, the CC may provide a threshold for the effect of FDI on pollution. To our knowledge, this is the first article that maintains data-driven estimated threshold level of CC may affect the FDI-pollution relationship. In this novel empirical context, we examine the thresholding effect of CC to explain the FDI-pollution relation by utilizing panel fixed effects threshold estimation method of Hansen (1999) for 13 MENA countries during the 1996–2019 period.

Our panel fixed effects threshold estimation results suggest that CC including human capital and institutional quality and governance provide data-driven estimated thresholds in explaining the impact of FDI on pollution. Accordingly, FDI leads to pollution in economies with weak CC consisting of less educated labor and unfavorable institutional quality and governance. FDI, on the other hand, enhances environment in economies with better CC including more educated labor and favorable institutional quality and governance. The empirical results in this study suggest that pollution haven hypothesis stands for economies with weak CC while pollution halo is the case for the economies with strong CC. The results in this paper suggest that to reap the environmental enhancing effect of FDI, MENA countries whose growth requires the promotion of FDI inflows, may implement policies aiming to improve human capital and institutional environment.

This article is planned as follows. A brief literature review on FDI-pollution relation is provided in Section 2. Section 3 explains the data and reports some descriptive statistics. Section 4 introduces the panel threshold estimation method and reports the estimation results. The empirical methodology is explained in Section 4.1. Section 4.2 presents estimation results for the thresholding effect of human capital and Section 4.3 presents the results for the thresholding effect of institutional quality and governance. Finally, we conclude and provide some policy implications in Section 5.

2. A Brief Literature Review

Most of the studies in the literature notes that FDI is crucially important for growth, albeit the environmental effect of FDI is mixed. Bashir (2022) briefly reviews the literature on pollution haven hypothesis. The literature on FDI-pollution relation points to the “pollution haven” and “pollution halo” hypotheses.

The “pollution haven” hypothesis maintains that FDI inflows may increase growth and thus CO_2 emissions in the host country. This is mainly related with not only higher production caused by FDI but also prevailing lax environmental restrictions and exemptions in developing economies. The former increases energy consumption and CO_2 emissions. The latter suggests that developed countries shift their emission intensive economic activities to developing countries causing them to have a pollution haven (Aliyu, 2005). It is argued that FDI inflows from developed to developing countries are used to finance pollution-intensive, environmentally inefficient production and infrastructure projects. (Jorgenson, 2009).

FDI, on the other hand, may lower emissions by the transmission of environment-friendly production and management techniques from advanced to developing economies, as suggested by the “pollution halo” hypothesis. FDI inflows may lead to the expansion of less polluting labor-intensive industries by taking advantage of the cheap labor in emerging market economies (He, 2006).

The empirical literature often studies whether FDI is related with pollution haven or halo hypotheses. However, FDI-pollution relationship is mixed. Some studies find that FDI increases pollution and thus “pollution haven” hypothesis holds. Mukhopadhyay (2006) finds that Thailand was a pollution haven for OECD countries in 2000. The cointegration-based empirical results by Acharyya (2009) suggest that FDI augments pollution in India during the 1980–2003 period. Zhang (2011) notes that FDI and carbon emissions are positively associated in China. This appears also to be the case for Africa (Kivyiro and Arminen, 2014; Bokpin, 2017). The empirical findings by Seker et al., (2015), Salahuddin et al., (2018) and Abdouli and Hammami (2017) suggest the environmental degradation effect of FDI is also the case for the members of MENA. Shahbaz et al., (2015) report that FDI lowers pollution in high-income countries while increases degradation in low-income countries. For middle-income countries, they indicate that thresholding effect of FDI matters for FDI-pollution relation. The empirical results by Wang and Chen (2014) show that FDI from OECD countries supports the pollution haven hypothesis while FDI from Hong Kong, Macao, and Taiwan do not lead to environmental degradation in

China. Shahbaz et al., (2019) report that N-shaped relation holds among the FDI and CO_2 emissions for MENA countries. Xie et al. (2020) investigates both direct and indirect effects of FDI on CO_2 emissions. Their results suggest that the direct effect of FDI is to increase CO_2 emissions while FDI lowers emissions indirectly by economic growth.

Some other studies suggest that “pollution halo” hypothesis holds (List and Co, 2000; Mielnik and Goldemberg, 2002; Wheeler, 2001; Zhu et al., 2016). These studies often suggest that “pollution halo” hypothesis prevails by arguing that FDI from developed economies contribute to energy efficiency in developing countries. Similarly, Wheeler (2001) demonstrates that FDI decelerates air pollution in Brazil, China, and Mexico. Using panel quantile regressions, Zhu et al. (2016) also support the “pollution halo” hypothesis for the Association of Southeast Asian Nations (ASEAN) economies. Muhammad and Long (2021) show that pollution halo is the case for high income economies. The panel fixed effects threshold estimation results by Aluko et al. (2021) show that the level of income and globalization provide thresholds for the effect of FDI on pollution. They find that FDI lowers pollution in economies with lower levels of income and globalization while it leads to environmental degradation in higher levels of income and more globalized countries.

Conventional wisdom maintains that more educated labor demands clean environment, promotes the use of renewable energy products, energy efficiency and tends to better adopt environmental regulation as well as greener technology. As consistent with this argument, the empirical literature investigating the human capital-environment relationship suggests that pollution is lower in economies with better educated labor. For example, human capital leads to less pollution in Pakistan according to Bano et al. (2018). Also, the results by Ahmed and Wang (2019) show that human capital decreases ecological footprint in India. Shobande and Asongu (2021) finds that human capital development mitigates CO_2 emissions. Lan et al. (2012) report that FDI diminishes pollution for the provinces of China with better educated labor.

According to institution-based approach, the institutional structure of the host country is effective for the environmental impacts of FDI inflows (Wang and Chen, 2014; Abid, 2016; Ali et al., 2019). In economies with better institutions, environmental rules are clear, transparent, consistent and strict. (Wang and Chen, 2014). Shojaeenia et al. (2022) finds that better institutions promote the environment-friendly energy consumption as compared to conventional dirty energy sources. The presence of a good institutional environment which is an indicator for the implementation of better environmental protection policies, has been led multinational corporations to invest in environmentally friendly technologies and implement more responsible waste creation and management (King and Shaver, 2001; Christmann, 2004). In this vein, it may be plausible to assume the impact of FDI is environmental enhancing in economies with better institutions. In a more institutionally sound environment, local businesses tend to increase their efficiency and innovation to compete with multinational firms (Wang and Chen, 2014). Bokpin (2017), Omri and Hadj (2020), Baksh et al. (2021) and Bouchoucha (2021) find that good governance is essential for FDI inflows to decrease carbon emissions.

3. Fdi-co Emissions: The Data And Some Descriptive Statistics

This article examines the relationship between foreign direct investment (FDI) inflows and CO_2 emissions. We analyze this crucially important question for a balanced panel of 13 Middle East and North Africa (MENA) economies (Algeria, Bahrain, Egypt, Iran, Israel, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Tunisia, Turkey and the United Arab Emirates) over the 1996–2019 period. Our sample is determined by the availability of the data. Considering that MENA cannot be treated as a single unit because of the heterogeneity in natural resource endowments, we study the FDI-CO_2 emissions relationship also for the samples of oil-exporting (Algeria, Bahrain, Egypt, Iran, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates) and -importing (Israel, Jordan, Morocco, Tunisia and Turkey) MENA.

In this study, CO_2 stands for the log. of CO_2 emissions in terms of per tones per capita, GDPpc shows the log. of real GDP per capita, REC represents the renewable energy consumption as a percent of total energy consumption, GOV corresponds to the institutional quality and governance, HC is the human capital index and FDI denotes the foreign direct investment inflows as a percent of GDP. The data for CO_2 emissions are from Joint Research Centre Emissions Database for Global Atmospheric Research. GDPpc and FDI data are taken from United Nations Conference on Trade and Development database. The data for GOV are taken from World Bank Governance Indicators. The governance and institutional quality data consider the six characteristics including voice and accountability, political stability and violence, government effectiveness, regulatory quality, rule of law and control of corruption (Kaufmann et al., 2005). These variables are between − 2.5 and 2.5 with higher values denoting better institutional quality and governance. We consider a simple average of six variables to provide an indicator for institutional quality and governance. HC is the

human capital index measured as not only the schooling years but also educational returns. The data for HC are from Penn World Table (Feenstra et al., 2015).

Table 1
Some Descriptive Statistics

	CO_2	FDI	GDPpc	REC	HC	GOV
	Whole Sample					
Mean	13.141	2.661	18858$	4.636	2.355	0.539
Median	7.486	1.808	8312$	0.907	2.273	0.545
St. Dev.	13.4	3.309	19043	6.048	0.473	0.243
	Oil-exporting MENA					
Mean	18.825	2.149	24171$	0.962	2.298	0.500
Median	19.732	1.096	20688$	0.062	2.262	0.490
St. Dev.	14.252	3.244	20668	2.113	0.307	0.274
	Oil-importing MENA					
Mean	4.046	3.481	10357$	10.515	2.445	0.603
Median	3.036	2.597	4141$	11.875	2.335	0.560
St. Dev.	2.774	3.259	11988	5.640	0.647	0.167
Note: St. Dev. represents standard deviation for the corresponding variable.						

Table 1 presents some descriptive statistics for our variables of interest. Accordingly, the mean of CO_2 emissions per tones per capita[1] is around 13.14 for the whole sample, 18.83 for the oil-exporting MENA and 4.05 for the oil-importing MENA. As compared to the oil-importing MENA, CO_2 emissions are much higher and more volatile in oil-exporting MENA. The mean FDI inflows is around 2.7 for the whole sample, albeit it is slightly much higher in oil-importing MENA economies. The volatility of FDI is almost the same both in oil-exporting and -importing MENA. The mean income per capita is around 19000$ for the whole sample. In comparison to the oil-importing MENA, the mean and volatility of income are much higher for the oil-exporting MENA. On the other hand, the mean renewable energy consumption is higher in oil-importing MENA economies. The means of human capital and governance are almost the same in both sub-samples.

[1] The mean pollution level is much higher in oil-exporting countries. This may provide a support for the division of whole sample as oil-exporting and -importing countries.

4. Empirical Methodology And Estimation Results

4.1. Empirical Methodology

To study the effect of FDI on CO_2 emissions, our benchmark equation is:

$$CO2_{it} = \alpha_i + \alpha_1 GDPpc_{i,t-1} + \alpha_2 REC_{it} + \alpha_3 GOV_{it} + \alpha_4 HC_{it} + \alpha_5 FDI_{it} + u_{it}$$

1

In Eq. (1), the subscript i represents the countries, the subscript t shows the years, CO2 shows the log. of CO_2 emissions, GDPpc stands for the logarithm of real income per capita, REC indicates the renewable energy consumption as a percent of total energy consumption, GOV presents the average of six aspects of institutional quality and governance, HC is the human capital index and FDI shows the foreign direct investment inflows as a percent of GDP.

Eq. (1) maintains that CO_2 emissions can be explained by income, renewable energy consumption, governance and institutional quality, human capital and FDI inflows. Considering the conventional environmental Kuznets curve maintaining that CO_2 emissions first increase and then decrease with income, real GDP per capita may be potentially endogenous for CO_2 emissions. To take this issue into account, we consider lagged income per capita.

In Eq. (1), a positively (negatively) significant coefficient for FDI suggests the validity of the pollution haven (halo) hypothesis. Eq. (1) suggests that FDI-CO_2 emissions relationship is invariant to the country characteristics (CC) including human capital and institutional quality levels. The conventional wisdom maintains that more educated labor demands clean environment, promotes the use of renewable energy products, energy efficiency and tends to better adopt environmental regulation. Kwon (2009) notes that better educated labor provides efficiency related solutions like employment of emission reduction technologies. On the other hand, well-established rules, norms and regulations for the environment may affect the sensitivity of CO_2 emissions to FDI inflows. In this vein, economies having better institutions implement policies to protect the environment. All of these may indicate that FDI-pollution relationship may not be the same in economies with better CC and weak CC. Furthermore, the CC consisting of human capital (HC) and institutional quality and governance (GOV) may provide data-driven estimated thresholds in explaining the impact of FDI on pollution. Thus, we regard the following equation:

$$CO2_{it} = \alpha_i + \alpha_1 GDPpc_{i,t-1} + \alpha_2 REC_{it} + \alpha_3 GOV_{it} + \alpha_4 HC_{it} + \alpha_5 FDI_{it}(CC_{it} \leq \lambda) + \alpha_6 FDI_{it}(CC_{it} > \lambda) + u1_{it}$$

2

Alternatively, we can also specify Eq. (2) as the following:

$$CO2_{it} = \alpha_i + \alpha_1 GDPpc_{i,t-1} + \alpha_2 REC_{it} + \alpha_3 GOV_{it} + \alpha_4 HC_{it} + \begin{cases} \alpha_5 FDI_{it} if CC_{it} \leq \lambda \\ \alpha_6 FDI_{it} if CC_{it} > \lambda \end{cases} + u2_{it}$$

3

Under the null hypothesis that $\alpha_5 = \alpha_6$ in eq.s (2) and (3), there is no significant thresholding effect of CC for the FDI-pollution relation, and we obtain Eq. (1). First, we trim 5% of the smallest and largest observations and investigate the threshold by considering the rest of the observations as potential candidate. For each one of the potential candidates, we utilize panel least squares and determine the threshold that gives the minimum sum of squared residuals. The endogenously (data-driven) estimated CC threshold, λ, allows the whole sample to partition into the two regimes. For instance, if $CC \leq \lambda$, the estimated parameter α_5 represents FDI-pollution relation in the low regime containing weak CC. Otherwise, if $CC > \lambda$, the estimated parameter α_6 indicates the FDI-CO_2 emissions relationship in the high regime consisting of better CC.

We estimate the Eq. (2) for 13 MENA economies during the 1996–2019 period by utilizing panel threshold estimation procedure by Hansen (1999). Considering the natural resource endowments are heterogeneous in the whole sample, we estimate this equation also for the oil-exporting and -importing MENA.

4.2. Thresholding Effect of Human Capital

First, we investigate the thresholding effect of HC. Our estimated equation is as follows:

$$CO2_{it} = \alpha_i + \alpha_1 GDPpc_{i,t-1} + \alpha_2 REC_{it} + \alpha_3 GOV_{it} + \alpha_4 HC_{it} + \alpha_5 FDI_{it}\,(HC_{it} \leq \lambda) + \alpha_6 FDI_{it}(HC_{it} > \lambda) + u3_{it}$$

4

Table 2
Thresholding Effect of Human Capital

	Whole Sample	Oil-Exporting MENA	Oil-Importing MENA
	Eq. (4.1)	Eq. (4.2)	Eq. (4.3)
Threshold HC	2.699***	2.582***	3.404**
F_B[.]	20.59 [0.00]	9.79 [0.00]	16.73[0.05]
FDI_{it}	0.006**	0.008**	0.003
$(HC_{it} \leq \lambda)$	(0.002)	(0.003)	(0.002)
FDI_{it}	-0.016***	-0.017**	-0.026***
$(HC_{it} > \lambda)$	(0.005)	(0.008)	(0.007)
$GDPpc_{i,t-1}$	0.681***	0.734***	0.713***
	(0.052)	(0.067)	(0.086)
REC_{it}	-0.003	-0.027	-0.012**
	(0.004)	(0.021)	(0.004)
GOV_{it}	-0.111**	-0.055	-0.232***
	(0.041)	(0.055)	(0.069)
HC_{it}	-0.071*	-0.001	-0.316***
	(0.038)	(0.047)	(0.064)
Constant	-4.118***	-4.500***	-4.102***
	(0.445)	(0.617)	(0.655)
Statistics	N = 13 NT = 299 R^2 = 0.574	N = 8 NT = 184	N = 5 NT = 115
	F = 62.74[0.00]	R^2 = 0.550	R^2 = 0.799
		F = 34.59 [0.00]	F = 68.88 [0.00]

Note: * < %10, ** < %5, *** < %1.

F_B is the bootstrapped F-test results with p-value in the brackets. The standard errors are in parentheses. N and NT are, respectively, the numbers of countries and observations.

Eq.s (4.1), (4.2) and (4.3) in Table 2 provide the panel fixed effects threshold estimation results of Eq. (4), respectively, for the whole sample, oil-exporting and oil-importing MENA. Accordingly, human capital provides data-driven estimated threshold for the effect of FDI on CO_2 emissions. The threshold level of human capital is around 2.7 for the whole sample, 2.6 for the oil-exporting MENA and 3.4 for the oil-importing MENA. Table 1 reports that the mean of human capital is around 2.4. The data-driven estimated threshold is approximately the same with the mean of human capital for the whole sample and oil-exporting MENA, albeit it is slightly higher for oil-importing MENA. Almost 20 percent of the observations belong to the high regime including more educated labor episodes.

The estimation results in Table 2 suggest that, for the oil-exporting MENA and whole sample, FDI and CO_2 emissions are positively associated in the low regime including observations with less educated labor. On the other hand, for all equations, the sensitivity of pollution to FDI is negative and significant in the high regime including more educated labor episodes. This empirical finding may show that pollution haven tends to be the case for economies with less educated labor while pollution halo holds in economies with better educated labor. An increase in income which is the aggregated measure of economic activities leads to higher CO_2 emissions. This is consistent with the scale effect explanations by Grossman and Krueger (1995) maintaining higher income is associated with deterioration in environment. A rise in REC lowers CO_2 emissions for the oil-importing MENA. An improvement in institutional quality and governance decreases CO_2 emissions in oil-importing MENA economies and whole sample. Human capital and pollution are

negatively associated for the oil-importing MENA and whole sample. This empirical finding is in concordance with the results by Lan et al., (2012), Bano et al., (2018) and Ahmed and Wang (2019) suggesting that better educated labor tends to diminish the pollution potentially by advocating the use of renewable energy products, energy efficiency and adopting environmental regulation.

4.3. Thresholding Effect of Governance

We now proceed with the investigation of thresholding effect of governance (GOV) for the impact of FDI on CO_2 emissions. In this vein, we estimate:

$$CO2_{it} = \alpha_i + \alpha_1 GDPpc_{i,t-1} + \alpha_2 REC_{it} + \alpha_3 GOV_{it} + \alpha_4 HC_{it} + \alpha_5 FDI_{it}\left(GOV_{it} \leq \lambda\right) + \alpha_6 FDI_{it}(GOV_{it} > \lambda) + u4_{it} \quad (5)$$

Eq.s (5.1), (5.2) and (5.3) in Table 3 provide the results of Eq. (5), respectively, for the whole sample, oil-exporting and oil-importing MENA economies. The results by Table 3 suggest that FDI-pollution relationship may change with respect to the threshold values for GOV^2. The endogenously estimated threshold level is around 0.4 for the whole sample and oil-exporting MENA and 0.6 for the oil-importing MENA. These threshold values are almost the same with the mean of GOV as reported by Table 1. Almost 2 % of the observations belong to the high regime including observations with better institutional environment. FDI inflows lead to higher pollution in the low regimes including weak governance episodes. However, FDI diminishes CO_2 emissions in the high regime containing better governance observations. Our estimation results may indicate that pollution haven hypothesis holds for the countries with weak institutional levels while pollution halo hypothesis appears to be hold in economies with better institutional environment. This finding is mainly in accord with the results by Bokpin (2017) suggesting that institutions have a responsibility to guarantee that FDI's environmental effects remain within a regulated framework. We find that income elasticity of pollution is positively significant indicating the impact of income is associated with higher pollution. For the oil-importing MENA economies, the higher the renewable energy consumption, it is lower the CO_2 emissions. The direct impact of GOV is associated with lower pollution in oil-importing MENA economies and whole sample. This finding may suggest that better institutional quality causes the countries to implement environmental protection policies and diminishes the emissions. This result is mainly in accord with the findings by Wang and Chen (2014), Bokpin (2017), Omri and Hadj (2020), and Bouchoucha (2021). Better educated labor tends to decrease the pollution in oil-importing MENA and whole sample.

Table 3
Thresholding Effect of Governance

	Whole Sample	Oil-Exporting MENA	Oil-Importing MENA
	Eq. (5.1)	Eq. (5.2)	Eq. (5.3)
Threshold GOV	0.445***	0.445***	0.613*
F_B[.]	16.86 [0.00]	14.69 [0.00]	13.95[0.08]
FDI_{it}	0.007**	0.009**	0.004*
($GOV_{it} \leq \lambda$)	(0.002)	(0.003)	(0.002)
FDI_{it}	-0.019**	-0.023**	-0.011*
($GOV_{it} > \lambda$)	(0.006)	(0.008)	(0.006)
$GDPpc_{i,t-1}$	0.679***	0.742***	0.690***
	(0.053)	(0.066)	(0.092)
REC_{it}	-0.005	-0.018	-0.015***
	(0.004)	(0.020)	(0.004)
GOV_{it}	-0.088**	-0.041	-0.287***
	(0.042)	(0.054)	(0.071)
HC_{it}	-0.083**	-0.006	-0.364***
	(0.038)	(0.046)	(0.066)
Constant	-4.061***	-4.575***	-3.765***
	(0.448)	(0.608)	(0.698)
Statistics	N = 13 NT = 299 R^2 = 0.568	N = 8 NT = 184	N = 5 NT = 115
	F = 61.28 [0.00]	R^2 = 0.561	R^2 = 0.776
		F = 36.27[0.00]	F = 60.18 [0.00]

Note: * < %10, ** < %5, *** < %1.

F_B is the bootstrapped F-test results with p-value in the brackets. The standard errors are in parentheses. N and NT are, respectively, the numbers of countries and observations.

[2] In the appendix, Table A1 reports that this effect is driven by control of corruption, regulatory quality, rule of law and government effectiveness.

5. Conclusion And Policy Implications

The international economics literature maintains that foreign direct investments (FDI) bring many benefits including better growth episodes, access to financial markets and new technology along with higher total factor productivity. However, the environmental economics literature often reports mix results for FDI-pollution relation. This article investigates this relation for the Middle East and North Africa (MENA) economies. We especially focus on the MENA because the region has various environmental concerns such as water shortages, air pollution, and deterioration of coastal ecosystems (Abumoghli and Goncalves, 2020).

Our panel fixed effects threshold estimation results support an argument that FDI-pollution relationship may change depending on the level of country characteristics (CC), including human capital and governance. According to our estimation results, CC provides data-driven estimated thresholds for FDI-pollution relation in MENA. This appears also be the case for the samples of oil-exporting and -importing MENA.

We find that FDI leads to more pollution in economies with weak CC containing less educated labor and worse institutional environments. On the other hand, FDI enhances the environmental quality in countries with strong CC including better educated labor and institutional environment. These empirical findings may suggest that pollution haven holds in weak CC economies while pollution halo is the case for the economies with strong CC.

Our findings also indicate that income and pollution is positively associated implying higher income levels are associated with more pollution. This empirical result is in line with the scale effect explanation by the conventional literature including Grossman and Krueger (1995). Renewable energy consumption decelerates CO_2 emissions. More educated labor and better institutional environment led to less pollution.

The results of this paper imply that policies aiming to improve human capital and institutional environment may be expected to enrich not only the economic benefits of FDI in terms of growth but also negative environmental effects of FDI in MENA. Acemoğlu et al. (2012) point the importance of human capital as one of the essential ingredients for green growth. Investing in human capital eases the employment of environment-friendly technologies and increases the environmental awareness. Consistent with an argument maintaining good institutional environment is closely associated with the implementation of better environmental protection policies, enhancing institutional quality and governance is expected to both diminish the emissions and the degradational effect of FDI inflows. Xing and Kolstad (2002) suggests the necessity of cooperative solutions to overcome the pollution since the environmental policy gap leads the movement of pollutive production activities to economies with lax environmental regulations. Considering higher income levels are associated with more pollution, the policies aiming to promote energy efficiency, energy conservation and emissions diminishing technologies may alleviate the procyclicality of pollution to income. These policies may also lead the countries to succeed in the sustainable development goals which promote the green economy. “Greening” may also be considered as the low-carbon energy transitions aiming not only access to renewable energy sources but also reduction in poverty along with the job creation. All these may contribute to environmental sustainability and sustainable development goals. The environmental management systems aiming to reduce emissions may require the institutional and regulatory reforms, green investment, better governance, regional cooperation, and participation of all stakeholders (Abumoghli and Goncalves, 2020). Therefore, implementing proactive strategies to mitigate pollution is critical for policymakers in developing countries, including MENA countries. Future studies investigating whether our empirical findings for the MENA are robust to different samples like developed, emerging market and developing economies may be considered as a promising research topic. This may be extended by employing sector-specific FDI inflows and other pollution measures. Furthermore, investigating the thresholding effect of country characteristics for the sensitivity of pollution to FDI by using some other alternative endogenously estimated threshold procedures appears to be an important research topic most potentially covering our empirical findings presented by this study.

Declarations

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Consent for publication: Not Applicable.

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Authors' contributions:

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