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Unpacking the FDI-Poverty-Environment Link : Insights from the MENA Region

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ABSTRACT

This paper aims to investigate the causal links that may exist between foreign direct investment, poverty and environmental quality and this study is particularly relevant for a set of countries in the MENA region. By performing an estimation for a simultaneous equation model using the the Three-Stage Least Squares (3SLS) technique for the period from 1996 to 2022, the results reveal a bidirectional causality between poverty and CO2 emissions. Notably, a unidirectional causal relationship emerges, with CO2 emissions influencing poverty without any feedback mechanism. However, no evidence of a significant relationship between FDI and poverty is found.

Keywords : Causality, Environmental quality, Foreign direct investment, MENA region, Poverty, Simultaneous equation model.

JEL Classification : C33, F21, I32, N17, Q50.

INTRODUCTION

While the current global concern and Millennium Development Goal (MDG) aim to combat extreme poverty, some countries still suffer from persistently high rates (Brum M. & De Rosa M., 2021). This situation adds additional pressure on both developing and developed nations, particularly in the wake of the recent global health crisis of Covid-19, which has unfolded in recent years and whose adverse consequences are still being felt (Gupta J. et al., 2021). It is widely acknowledged that Foreign Direct Investments (FDIs) tend to improve the economic outcomes of host countries by fostering their economic growth. They can provide direct capital financing and also generate positive externalities through the transfer of technology and expertise from technologically advanced countries to transitional ones (Angelopoulou A. & Liargovas P., 2014). This could thus justify the implementation of policies aimed at promoting and attracting more FDIs to host countries.

The study of the relationship between Foreign Direct Investment (FDI), poverty, and environmental quality in the MENA region assumes crucial significance due to the significant impact these variables can have on the region's sustainable development (Shahbaz et al., 2018). Sustainable development entails the interaction between various spheres, including economic, social, and environmental aspects. Concurrently investigating this nexus among these three variables could facilitate the formulation of strategies to attract FDIs, alleviate poverty, and implement effective environmental policies. Notably, the role of the environmental factor in the linkage between FDI and poverty has received much less attention from academic researchers (Dhrifi A. et al., 2020).

While the relationship between FDI and poverty has been extensively addressed in the literature, the findings remain somewhat mixed regarding the substantial impact of FDI on poverty alleviation (Agarwal et al., 2017 ; Ganić, 2019 ; Ogunniyi & Igberi, 2014). Empirical analyses have primarily focused on assessing the positive impact of FDI through the growth channel and have overlooked the potential effect that could occur through other channels, particularly CO2 emissions generated by incoming FDI flows (Shahbaz et al., 2015). While they tend to foster growth in certain countries according to several researchers (Sunde T., 2017), they can nevertheless be a significant source of environmental degradation. There are few studies that have attempted to investigate the impact of FDI on poverty, and the results remain somewhat mixed. Indeed, some find that FDI positively

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contributes to poverty reduction, while others observe a negative impact between these variables. Some studies find no significant impact between FDI and poverty.

In this context, Uttama (2015) attempted to examine this effect for a set of ASEAN countries over the period between 1995 and 2011. Their results suggest a statistically significant impact of FDI on poverty reduction. Similar findings were reported by Reiter & Steensma (2010) and Fowowe & Trinh (2017), underscoring the importance of the role played by FDI in alleviating poverty. Additionally, the work of Calvo and Hernandez (2006) reinforces this result for a panel composed of 20 Latin American countries. Durowah (2017) suggests that for a sample of 91 developing countries over the period from 2000 to 2014, FDI contributes to poverty reduction. Similarly, Ukamaka et al. (2016) reached the same conclusion regarding Nigeria during the period from 1970 to 2001, using ordinary least squares for their analysis.

Several studies have found a positive impact, notably Lazreg & Zouari (2018), who used Fully Modified Ordinary Least Squares (FMOLS) to examine this impact for the case of North Africa. They concluded that FDI contributes to an increase in poverty, using the GINI index as a measure. Another segment of the literature suggests no significant impact of FDI on poverty reduction. For example, Ogunniyi & Igberi (2014) observed in their study that FDI had a positive but statistically insignificant impact on Nigeria from 1980 to 2012. Likewise, Ganić (2019) reached a similar conclusion when examining 12 European countries for the period 2000-2015.

Some authors have also explored the causal relationship between these two variables. For instance, Teixeira & Loureiro (2019) examined the contribution of FDI to reducing inequality and poverty in Portugal from 1973 to 2019 using time series data. They found evidence suggesting a bidirectional long-term causal relationship between FDI and poverty. The study of Fauzel and al. (2016) indicate a unidirectional relationship from FDI to poverty for the period 1990-2010 in Sub-Saharan countries, using Granger causality. Similar findings were also reported in studies conducted by Gohou & Soumare (2012) and Soumare (2015).

Despite the importance of empirical investigations into the relationship and impact of FDI on poverty reduction, the results remain somewhat mixed, and the impact of FDI depends on several other factors in poverty alleviation. These factors include the degree of trade openness, the quality of institutions, infrastructure, but most importantly, environmental degradation that may be generated by incoming FDI flows. While FDI has positive implications as a driver of sustainable development in some countries, it is important to consider its environmental consequences.

Within this framework, several theoretical and empirical studies have emerged, attempting to understand the relationship between foreign direct investment and CO2 emissions. For instance, the study conducted by Pao & Tsai (2010) for the BRIC nations suggests a bidirectional causality between these two variables during the period from 1992 to 2007. By conducting a nonlinear correlation for 99 countries between FDI and environmental quality using Fully Modified Ordinary Least Squares (FMOLS) for the period 1975-2012, Shahbaz et al. (2015) found a positive relationship between the two, confirming the Pollution Haven Hypothesis (PHH). Their results also suggest a bidirectional causality. Omri et al. (2014) conducted a noteworthy study exploring the correlation among FDI, environmental decline and economic advancement. They analyzed a broad dataset comprising 54 nations across three regions—Europe and North Asia, Latin America and the Caribbean and the Middle East, North Africa, and Sub-Saharan Africa from 1990 to 2011. The research revealed a two-way causal relationship between economic growth and FDI across all regions, along with a reciprocal link between FDI inflows and CO2 emissions across all regions except Europe and North Africa.

With the aim of examining simultaneously the relationship between Foreign Direct Investment (FDI), carbon dioxide (CO2) emissions, and poverty, Dhrifi et al. (2020) conducted a study using a panel of 98 developing countries. Subsequently, they subdivided this dataset into three regional sub-panels over the period 1995-2017. Employing a simultaneous equations model, the findings unveiled a bidirectional association between FDI and poverty, as well as between CO2 emissions and poverty across the entire dataset. Furthermore, the analysis revealed a unidirectional causality emanating from FDI to CO2 emissions.

The results obtained from these various studies exhibit varying conclusions, yet this study appears intriguing as it seeks to investigate the impact of FDIs on poverty in developing countries while considering the role of

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environmental quality. Investigating the causal relationship between FDI and poverty is also valuable for devising effective policies to alleviate extreme poverty. This study aims to analyze the nature of the relationship among foreign direct investments, poverty, and environmental quality, while simultaneously estimating the contribution of each of these concepts through the Three-Stage Least Squares (3SLS) technique for a set of countries in the MENA region from 1996 to 2022.

METHODOLOGY AND DATA

To undertake the empirical analysis, we employ a simultaneous equations model to examine the simultaneous impact of Foreign Direct Investments (FDIs), poverty, and environmental quality. While FDIs are commonly perceived as catalysts for economic growth, given their potential to stimulate job creation, technology transfer, and increased production, they also exert influences on poverty and environmental conditions. For instance, an increase in FDIs may lead to higher incomes, which could alleviate poverty. However, it can also result in excessive exploitation of natural resources and deterioration of environmental quality. Conversely, environmental quality itself can influence FDIs, as investors increasingly prioritize environmental considerations, influencing their selection of investment destinations that adhere to environmental standards.

Modeling these relationships using simultaneous equations allows for the consideration of these complex interactions and facilitates more precise estimations of the effects of each variable on the others. This approach also helps address potential endogeneity biases that may exist in simple models. In this context, the technique of Three-Stage Least Squares (3SLS) is particularly well-suited for this type of model. The advantage of the 3SLS technique lies in its ability to consistently estimate the model parameters, accounting for the interdependent relationships between variables, endogeneity biases, and correlations among errors. This enables obtaining more reliable and robust estimations of the effects of FDIs on poverty and environmental quality, as well as reverse effects. We have chosen to focus on a set of countries in the MENA region for the period from 1996 to 2022, including Algeria, Tunisia, Morocco, Egypt, Iraq, Iran, Israel, Jordan, Lebanon, and Turkey. We excluded other countries such as those in the Gulf region due to their heterogeneity and the unavailability of data for some others, which could lead to inconclusive results in estimating our model.

The model specification aligns with existing literature, facilitating the exploration of the mechanisms through which FDI flows and other factors affect the poverty rate. To achieve this, we employ a simultaneous equations regression approach, comprising an FDI equation (1), a poverty equation (2), and an environmental quality equation (3). The selected model for our estimation is outlined by the following equations:

$$FDI_{it} = \alpha_0 + \alpha_1 POV_{it} + \alpha_2\, CO2_{it} + \alpha_3 GDP_{it} + \alpha_4\, OUV_{it} + \alpha_5\, INST_{it} + \alpha_6\, INFRA_{it} + \xi_{1it} \qquad (\mathbf{1})$$

$$POV_{it} = \lambda_0 + \lambda_1 FDI_{it} + \lambda_2 CO2_{it} + \lambda_3 GDP_{it} + \lambda_4 URB_{it} + \lambda_5\, POP_{it} + \lambda_6\, FD_{it} + \lambda_7\, INF_{it} + \lambda_8\, EDU_{it} + \xi_{2it} \qquad (\mathbf{2})$$

$$CO2_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 FDI^2{}_{it} + \beta_3 POV_{it} + \beta_4\, GDP_{it} + \beta_5 GDP^2{}_{it} + \beta_6\, EC_{it} + \xi_{3it} \qquad (\mathbf{3})$$

The first equation represents the endogenous variable of the FDI model, measured as net FDI inflows as a percentage of GDP over the period 1996-2022. The second equation tests the effect of several factors, in addition to FDI and CO2 emissions on poverty reduction. These variables have been identified by empirical literature as robust determinants of poverty (Ravaillon 1997). The third equation represents the endogenous variable, environmental quality, measured by CO2 emissions. It is determined by energy consumption per capita (kilotons of oil equivalent).

The various variables selected for estimating the three equations are as follows:

POV: Poverty - Household final consumption expenditure per capita (WDI) ; *FDI*: Foreign Direct Investment net inflows (WDI) ; *CO2*: Carbon dioxide emissions (metric tons per capita) ; *GDP*: Gross Domestic Product per capita (WDI) ; *URB*: Urbanization (% of urban population to total population) (WDI) ; *POP*: Total population (WDI) ; *FD*: Financial Development: Total private sector credit (% of GDP) (WDI) ; *INFRA*: Infrastructure level measured by number of mobile phone lines per 100 inhabitants (WDI) ; *INF*: Inflation rate:

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GDP deflator (%) (WDI) ; *OUV*: Openness represented by trade openness (exports and imports as a % of GDP) ; *EDU*: Education measured by secondary school enrollment (WDI) ; *INST*: Institutional quality variable: Law and order (ICRG) ; *EC*: Energy consumption (kilograms of oil equivalent per capita) (WDI). Non-linear terms of GDP and FDI have been introduced into the environmental quality equation (Equation 3). Where, i denotes the country (i = 1, 2... 10) and t denotes the time period (t = 1996... 2022); **ξ**it is the error term assumed to be independently distributed across all periods of country i.

After conducting descriptive statistics, correlation matrix, and various endogeneity and autocorrelation tests, the table below presents the estimation results of model :

Table 1 : Estimation of the Simultaneous Equations Model

	3SLS technique estimation		
	FDI	**POV**	**CO2**
FDI	___	-.4570776 0.137	-2.003113 0.000***
POV	-.0429138 0.643	___	.1066982 0.212
CO2	-.2529268 0.071*	-1.308092 0.092*	___
PIB	.7872222 0.144	.2707919 0.852	-2.780321 0.251
OUV	1.150028 0.065**	___	___
INST	.7265399 0.006***	___	___
INFRA	.0020725 0.654	___	___
URB	___	.2006628 0.160	___
POP	___	.8804741 0.531	___
DF	___	1.148059 0.068*	___

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INF	___	-1.6643 0.113	___
EDU	___	.0487342 0.167	___
FDI^2	___	___	.1823999 0.000***
GDP^2	___	___	.3394542 0.015***
EC	___	___	-.8106885 0.003***
Cst	-8.013825 0.016	-22.0874 0.516	8.172021 0.435
R^2	0.3784	0.0495	0.7747
Chi2	76.43	12.60	519.24
N.obs	117	117	117
N.pays	10	10	10
Note : Estimation performed using STATA software. *: significance at 10%. **: significance at 5%. ***: significance at 1%. N.obs: number of observations. N.countries: number of countries. R2: overall significance of the model. Chi2: Chi-Square statistic.			

Source: Authors

RESULTS AND DISCUSSION

Looking at the main findings obtained from our estimation of the simultaneous equations model using the 3SLS technique (Table 1), we observe that in the first column representing the first equation, the estimated coefficient of the poverty index appears to be negative and statistically insignificant. Consequently, this result indicates that there is no strong statistical evidence that poverty has a significant impact on attracting FDIs in our econometric model.

However, this effect can be interpreted in several ways. It is true that poverty could have an indirect impact on FDIs by interacting with other variables not included in the model such as political stability or domestic demand. It is also possible that the effect of poverty on FDIs only becomes significant when a certain threshold of poverty is reached. Below this threshold, poverty may not have a significant effect on attracting FDIs, but beyond this threshold, it could begin to negatively influence investor attractiveness. This idea is partially supported by the theory of the « Kuznets curve »[1].

[1] The theory of the "Kuznets curve" suggests that as a country undergoes economic development, poverty initially decreases, then increases up to a certain point. This is also referred to as the threshold effect.

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The coefficient for CO2 emissions appears to be statistically negative and significant at the 10% threshold. This suggests that environmental quality influences foreign investors' decisions, such that higher CO2 emissions dissuade investment in host countries with elevated emission levels, due to environmental risks, future regulatory pressures, and corporate social responsibility concerns. This finding aligns with the results reported by Matthew Cole (2006).

We also found that economic growth does not have a significant impact on FDI inflows. This contradicts the findings of Borensztein et al. (1998) and Bengoa & Sanchez-Robles (2003), who argue that higher GDP growth rates tend to attract potential foreign investors. As for the trade openness variable, it appears to be significantly positive at the 5% threshold, indicating that open trade policies are a source of attractiveness for FDI. Trade not only fosters economic growth but also encourages the adoption and diffusion of technological innovations already present in other countries (Cohen 2007). Regarding the institutional variable, its positive effect indicates that a 1% improvement in institutional quality increases FDI inflows by more than 7.26%. This result is consistent with those of Bisson (2011) and Wernick (2009), who suggested that institutional quality has been one of the key factors attracting FDI in developing economies in recent years. As for the infrastructure variable, the estimated coefficient appears to be statistically positive but not significant. However, it is true that when infrastructure is in good condition, it tends to favor foreign investors, but this is not the case for the countries included in our sample.

The second column presents the results of the poverty equation estimation. The findings regarding FDI show a positive but non-significant effect on poverty reduction. This suggests that FDI does not contribute to poverty reduction in MENA countries. In contrast, Ucal (2014), Uttama (2015), and Soumare (2015) found a significant negative effect in developing countries in Africa, Asia, and Latin America, where FDI is increasingly seen as a source of income growth, employment, and thus poverty reduction. MENA countries will need to improve conditions for attracting FDI and maximizing its benefits for their economies.

Poverty is also negatively and significantly affected by CO2 emissions, as a 1% increase in CO2 emissions raises the poverty rate by approximately 9.2%. Higher pollution levels can therefore reduce a country’s production capacity, decreasing per capita household consumption and increasing poverty rates. Omri et al. (2014) and Khan, Inamullah & Shams (2009) found similar results in the case of Pakistan. The estimation results also show that per capita GDP positively affects poverty reduction, though it is not significant. Dollar and Kraay (2000) suggest that high GDP growth rates are often associated with lower poverty rates, confirming theoretical predictions that emphasize the predominant role of GDP growth in poverty reduction. Regarding the urbanization variable, the results show that it has no significant impact on poverty. This finding is similar to those by Ravallion et al. (2007), who found no significant impact on poverty in African countries. This could be explained by the fact that the relationship between urbanization and poverty is non-linear (Martinez-Vazquez et al. 2009). This impact seems complex and depends on various factors such as the nature and stage of urbanization or the level of development (Bloom et al. 2008).

Concerning the population variable, the results show no significant impact on poverty. This may be explained by the fact that it is not population size that influences poverty, but rather other factors such as age structure, increased life expectancy, education levels, and rising investment in physical and human capital (Bloom & Canning 1999). Another important aspect to note is that the coefficient for the financial development variable shows a significant positive association at the 10% threshold, suggesting that poverty is elastic to financial development. A 1% increase in domestic credit to the private sector increases per capita consumption by 6.8%. This effect could be explained by the fact that credit in this region is directed towards a wealthy segment of the population, leaving others more vulnerable to poverty (Dhrifi 2013; 2015b).

Regarding the impact of inflation, the results show that household final consumption expenditure has a negative but non-significant effect. The negative impact of inflation aligns with Kpodar’s (2006) findings, which argue that inflation exacerbates poverty by negatively affecting households' purchasing power. Similarly, the coefficient for education is positive but statistically non-significant. Education indirectly contributes to basic needs such as healthcare, housing, water, and sanitation. It also influences women's behavior regarding fertility and family planning decisions (Jeffery & Basu 1996).

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The results of the environmental quality equation represent the third focus of this paper, as they concern the impact of FDI flows and poverty on CO2 emissions. In this specification, the estimated coefficient for foreign investment flows appears negative and statistically significant. An increase in FDI flows tends to reduce CO2 emissions. This finding can be interpreted in light of the environmental Kuznets curve (EKC) hypothesis, which suggests that in the early stages of a country's economic development, CO2 emissions increase as the economy grows due to industrialization and urbanization, which in turn drives higher energy demand (Grossman & Krueger 1995). Regarding the estimated coefficient for squared FDI, it appears positive and significant at the 5% threshold. This indicates that FDI initially improves the environment but then degrades environmental quality after a certain level, implying a U-shaped relationship between FDI and the environment rather than an inverted U-shape. However, once a certain level of economic development is reached, countries begin to implement environmental policies, adopt cleaner technologies, and improve energy efficiency. This can lead to a reduction in CO2 emissions despite continued economic growth. The significant positive impact of squared FDI (FDI^2) may reflect this process. Another plausible explanation is the relocation of parent companies to MENA countries, particularly if these countries attract polluting industries due to their lower production costs and less stringent environmental regulations.

As for the linear and non-linear GDP terms, they exhibit opposite signs, with a non-significant negative impact for GDP and a statistically positive impact for GDP^2 at the 1% threshold. This does not indicate an inverted U-shaped curve between GDP growth and environmental quality, suggesting that, initially, economic growth improves environmental quality until a certain threshold is reached, after which it begins to degrade the environment as the economy matures. This result indicates that economic growth alone is not enough to help the studied countries reduce their CO2 emissions. Our results also show that energy consumption is negatively related to CO2 emissions and statistically significant at the 1% threshold. This result may seem counterintuitive, as one would generally expect higher energy consumption to be associated with higher CO2 emissions due to fossil fuel use (Dasgupta et al. 1994). However, the negative effect could be explained by the use of cleaner, low-carbon energy sources in some countries, such as renewable energy and nuclear power. Another explanation is that in certain cases, increased energy consumption may be associated with more efficient energy use, driven by technological advancements, better energy management, or policies promoting energy efficiency.

Our results are consistent with those found by Shahbaz et al. (2015) and provide evidence of a bidirectional causality between FDI and CO2 emissions. We also find a unidirectional causal relationship from CO2 emissions to poverty, with no feedback loop, but no evidence of a relationship between FDI and poverty.

CONCLUSION AND POLICY IMPLICATIONS

The primary objective of this study is to assess the impact of Foreign Direct Investment (FDI) on poverty reduction, with a particular focus on the role of environmental quality in this relationship. We aim to explore the simultaneous causal links between these variables using simultaneous equation models for a panel of 10 developing countries in the MENA region, covering the period from 1996 to 2022. Indeed, the results may vary due to the different institutional and structural characteristics of each economy.

The findings of this study for MENA countries reveal important conclusions about the relationship between Foreign Direct Investment (FDI), poverty, and CO2 emissions. In particular, we identified bidirectional causality between FDI and CO2 emissions, suggesting that foreign investments can influence the carbon intensity of the region's economies. Furthermore, there is a unidirectional relationship from CO2 emissions to poverty reduction, indicating that combating pollution can have social benefits by reducing poverty, without significant feedback. However, it is essential to note that our results did not identify a significant relationship between FDI and poverty in the MENA region. This absence of correlation does not necessarily mean that FDI plays no role in poverty reduction, but rather that other economic, social, and political factors may predominate in this region and influence poverty dynamics.

It is also important to recognize that the links between FDI, environmental degradation, and poverty regardless of their nature are not automatic and largely depend on a multitude of factors (Magombeyi & Odhiambo 2017). These factors include country characteristics such as institutional quality, technological gaps, the scale of political incentives to attract FDI, and the mode or nature of the investment.

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Despite the challenges posed by this research, the study could be improved by using alternative measures and introducing additional interaction variables to better understand, for example, the relationship between poverty and CO2 emissions. In this context, MENA countries should invest in education and skills development for their populations, as this can help reduce poverty by increasing productivity and enhancing employability. FDI can play an indirect role by contributing to skill development through technology transfer and employment opportunities. Additionally, these countries should continue to explore ways to diversify their economies beyond the traditional sectors that often attract FDI, such as energy and natural resources. Greater diversification could help create jobs and stimulate economic growth, which could contribute to poverty reduction.

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