



# The effect of energy consumption, urbanization, trade openness, industrial output, and the political stability on the environmental degradation in the MENA (Middle East and North African) region



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## ABSTRACT

The main goal of this study is to examine the events that caused the environmental degradation in the MENA (Middle East and North African) region. To achieve the goal of this study, a panel model that represents the environmental degradation utilizing ecological footprint as a better indicator is constructed taken the period 1996–2012 investigating 14 MENA countries. The results from the Pedroni cointegration test revealed that ecological footprint, energy consumption, urbanization, trade openness, industrial development and political stability are cointegrated. Moreover, the results of FMOLS (fully modified ordinary least square) concluded that energy consumption, urbanization, trade openness and industrial development increases environmental damage while the political stability lessens it in the long run. In addition, the Granger causality revealed that the used variables have short run and long run causal relationship with the ecological footprint. Moreover, different directions of causal relationship were found between the variables. According to the outcomes of this study, a number of policy recommendations were provided for the MENA countries that can help them to reduce their environmental degradation.

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## 1. Introduction

The MENA (Middle East and North African) region do not only suffers from extreme heat, dust storms, rainfall shortages and harsh geography but also from huge environmental degradation such as ecological footprint<sup>2</sup> as an indicator which increased more than double in the last three decades [17]. This environmental pressure might be caused by several events; such as industrial development, climate change, political turmoil, misused and polluted water and coastal areas and unplanned urbanization [54]. Moreover, the cost of the environmental degradation spills is high in the region which

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<sup>2</sup> The ecological footprint represents environmental limits and the amount that humanity exceeds them; it is essentially the sum of the Cropland, Grazing, Fishing, Forest, CO<sub>2</sub> emissions and Infrastructure footprints. In other words, it is the area of land and ocean needed to support the country's consumption measured in hectares.

plays a sizable average from its total GDP that can have an adverse effect on the region's public finances, household budgets, the competitiveness of the economy, and inter-generational equity [52]. Despite the huge environmental pressure in this region, this issue did not attract the attention by many scholars in spite of wide-ranging literature that have investigated the main factors that contribute to the environmental damage. Therefore, this study is motivated to investigate the main factors that contribute to the environmental damage in the MENA region to provide a number of suggestions to reduce the environmental pressure that the region is witnessing.

The studies that modeled the environmental degradation has been widely investigated by many researchers utilizing different econometric methodologies; investigating many countries and regions over the years. Most of the studies utilized CO<sub>2</sub> emission as an indicator of the environmental damage. Moreover, the most common macroeconomic variables that are used as the main factors of the environmental damage are GDP growth, energy consumption, urbanization, trade openness, financial development, and foreign direct investment. However, from the literature reviewed in Table 1 there are a number of flaws; first it is clear there is a lack of studies

**Table 1**  
Summary of studies that modeled the environmental degradation.

Author	Period	Country/Region/Organization	Environmental damage variable	The environmental damage determinants
[20]	1960–2005	Turkey	CO <sub>2</sub> emission	Energy consumption, GDP, and trade openness.
[28]	1980–2006	ASEAN	CO <sub>2</sub> emission	Energy consumption and GDP.
[33]	1971–2005	BRIC	CO <sub>2</sub> emission	Energy consumption and GDP.
[55]	1995–2007	China	CO <sub>2</sub> emission	Energy consumption and GDP.
[41]	1971–2009	ASEAN	CO <sub>2</sub> emission	Energy consumption and GDP.
[6]	1960–2000	France	CO <sub>2</sub> emission	Energy consumption and GDP.
[26]	1960–2009	South Africa	CO <sub>2</sub> emission	Energy consumption, GDP, and trade openness.
[25]	1971–2007	China and India	CO <sub>2</sub> emission	Energy consumption, GDP, and trade openness.
[7]	1971–2004	Central America	CO <sub>2</sub> emission	Energy consumption and GDP.
[16]	1971–2008	Tunisia	CO <sub>2</sub> emission	Energy consumption, GDP, and trade openness.
[51]	1985–2005	Countries based on income	CO <sub>2</sub> emission	Energy consumption, GDP, urbanization, and trade openness.
[47]	1971–2011	Malaysia	CO <sub>2</sub> emission	Energy consumption, GDP, financial development, foreign direct investment, and trade openness.
[11]	1995–2009	Baltic States	CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O emission	GDP.
[5]	1990–2011	Countries categorized by region	CO <sub>2</sub> emission	Export, imports and total trade of goods and services.
[42]	1980–2009	Malaysia	CO <sub>2</sub> emission	GDP.
[44]	1965–2008	OECD	Road CO <sub>2</sub> emission	Energy consumption and GDP.
[9]	1981–2005	MENA	CO <sub>2</sub> emission	Energy consumption and GDP.
[22]	1971–2007	Indonesia	CO <sub>2</sub> emission	Energy consumption, capital, and urbanization.
[23]	1975–2005	China	CO <sub>2</sub> emission	Energy consumption, GDP, and trade openness.
[43]	1980–2009	Malaysia	CO <sub>2</sub> emission	Energy consumption and GDP.
[46]	1971–2009	Pakistan	CO <sub>2</sub> emission	Energy consumption, GDP, and trade openness.
[48]	1980–2010	Romania	CO <sub>2</sub> emission	Energy consumption and GDP.
[3]	1990–2009	Middle East	CO <sub>2</sub> emission	Energy consumption, GDP, foreign direct investment, and trade of goods and services.
[19]	1990–2007	Canada	CO <sub>2</sub> , greenhouse gas emissions	Energy consumption and GDP.
[50]	1975–2010	Bangladesh	CO <sub>2</sub> emission	Energy consumption, industrial GDP, financial development, and trade openness.
[4]	1990–2010	30 major nuclear energy consuming countries	CO <sub>2</sub> emission	Nuclear energy consumption, fossil fuel energy consumption, and urbanization.
[35]	1980–2007	Brazil	CO <sub>2</sub> emission	Energy consumption and GDP.
[34]	1990–2007	Russia	CO <sub>2</sub> emission from the burning of fossil fuels and the manufacture of cement	Energy consumption and GDP.
[36]	1980–2007	BRIC	CO <sub>2</sub> emission	Energy consumption, GDP, and foreign direct investment.
[45]	1980–2011	OECD	CO <sub>2</sub> emission	Renewable energy consumption, non-renewable energy consumption, GDP, and population size.
[1]	1965–2005	Europe	CO <sub>2</sub> emission	Energy consumption and GDP.
[57]	1995–2010	China	CO <sub>2</sub> emission from fuel consumption	Energy consumption and services GDP and, industrial GDP.
[18]	1965–2009	China and India	CO <sub>2</sub> emission	Coal consumption and GDP.
[49]	1965–2008	South Africa	CO <sub>2</sub> emission	Coal consumption, GDP, financial development, trade openness, and urbanization.
[8]	1992–2004	Common wealth independent states	CO <sub>2</sub> emission	Energy consumption and GDP.
[24]	1953–2006	China	CO <sub>2</sub> emission	Energy consumption, GDP, financial development, and trade openness.
[13]	1971–2008	ASEAN	CO <sub>2</sub> emission	Transport energy consumption, GDP, and foreign direct investment.
[31]	1960–2007	Turkey	CO <sub>2</sub> emission	Energy consumption, GDP, financial development, and trade openness.
[32]	1990–2008	Middle East	CO <sub>2</sub> emission	Energy consumption and GDP.
[30]	1963–2003	OECD	CO <sub>2</sub> emission	Nuclear energy production and GDP.

Note: CO<sub>2</sub> emission is measured as CO<sub>2</sub> emission per capita.

that examined the main factors of the environmental pressure in the MENA region despite its huge environmental problems that the region is witnessing, second; most of the studies used CO<sub>2</sub> emission as an indicator of the environmental degradation which represents only a small portion of it.

This study will examine the main factors and determinants that might contribute to the environmental degradation in the MENA region. The first determinant is energy consumption. The region had witnessed a remarkable boots in energy consumption which increased more than double during the last three decades due to the rapid increase in population growth, urbanization, and GDP growth [53]. Moreover, most of the region's energy use comes from fossil fuels which play a share of 80% from total energy use [53]. Therefore, it is clear that the boost in energy consumption in the region might be a large contributor to the environmental damage in the region. The second determinant is urbanization. The MENA region has witnessed a rapid increase in urban population which

represent 60% of total population in 2000 and expected to exceed 70% in 2015 [52]. Moreover, the urbanization in the region is unplanned with the region weak official abilities for pollution management and control. Thus, urbanization in the region might be a large contributor to its environmental damage. The third factor is industrial output. The region witnessed an increase in its industrial development which is important for the region since it plays an important source of income through trade, increase in employment, and increasing value of the primary products [54]. However, most of the industrial share of this region comes from petroleum and natural gas. Also the capital stock of most industries in the region is old and highly polluted [27]. Thus, the industrial sector might play a role in the environmental destruction in the region. The fourth factor is trade openness since the MENA countries had begun to increase its participation to the global economy during the mid-1990s. Moreover, almost 95% of the MENA countries are now members of the WTO (World Trade Organization). Therefore, most

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