The impact of socio-economic development and political instability on the ecological footprint in the MENA region: Evidence from panel VAR estimations

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- Introduction
- Brief overview of the EF – HDI relationship in the MENA region
- Literature review
- Data and empirical methodology
- Empirical results
- Conclusion and policy implication

Introduction

- the recent climate changes, global warming, and environmental degradation at large have resulted in adverse effects threatening the living of human beings and other species.

- the exaggerated use of pollutant natural resources to fuel the global economy and satisfy a continuously increasing demand was such that these priorities came at the expense of environmental considerations.

- In this paper we investigate the impact of economic development (HDI) on the environment degradation (EF) in MENA countries.

- One of the main motivations of this choice is that these countries have the objective to improve the socio-economic levels
- Exerting an enormous pressure on the environment and the use of natural resources

In shedding light on the EF – HDI relationship in the MENA region and the impact of the 2011 Arab uprising, this paper attempts to answer the following questions:

1) What is the impact of economic growth and human development on the environment in MENA countries?

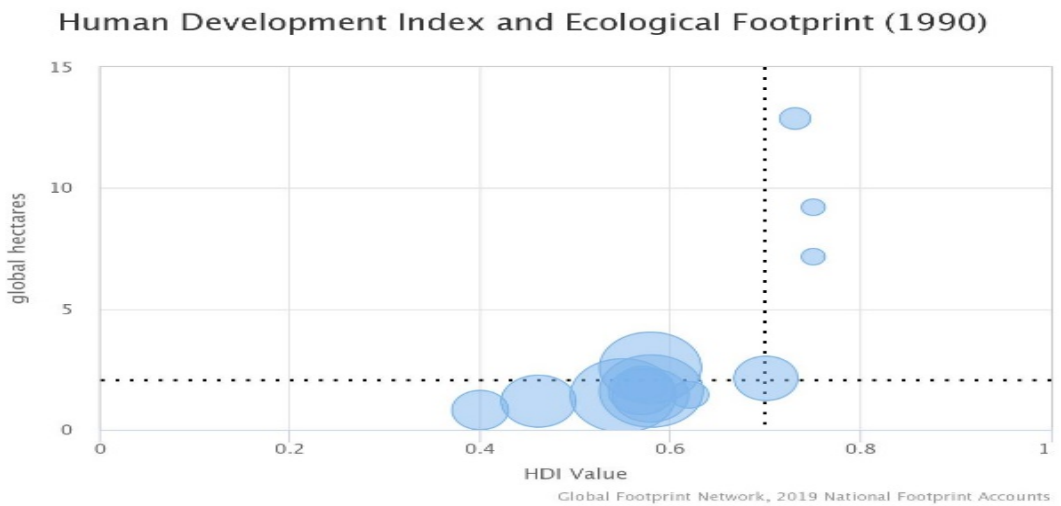
2) Does political instability in the region affect this relationship?

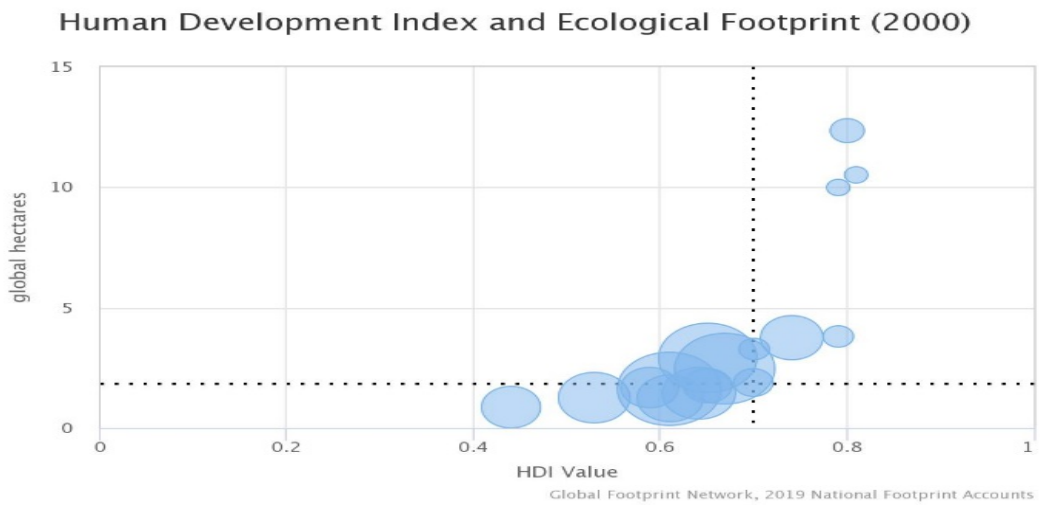
3) What are the other factors affecting environmental degradation in the MENA countries?

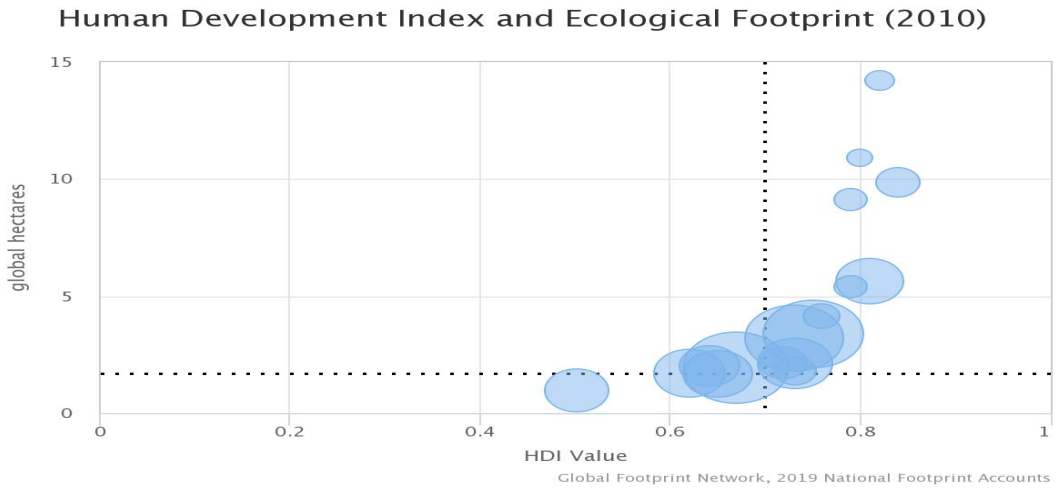
4) What are the pathways in terms of potential social and economic improvements that would help countries and policymakers in their efforts toward a sustainable development?

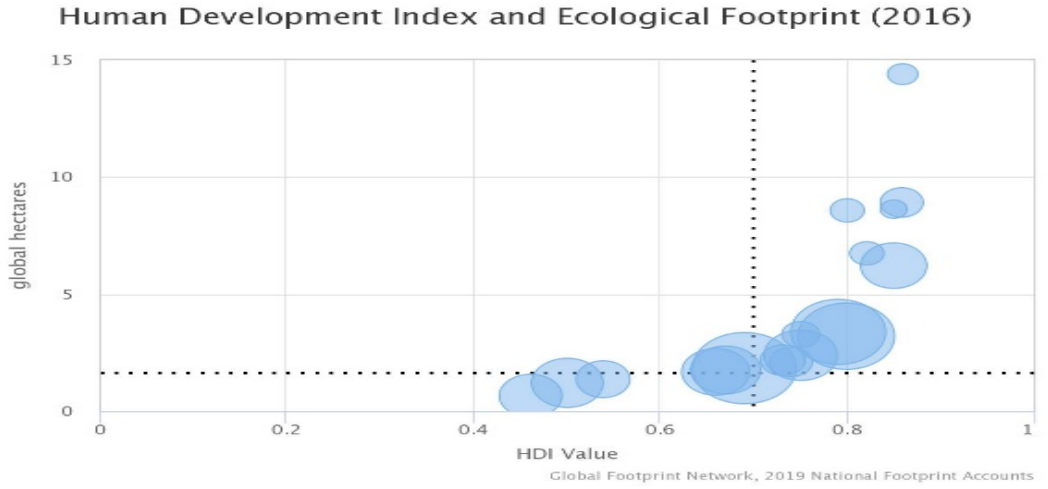
Brief overview of the EF – HDI relationship in the MENA region

Figure 1: The patterns of HDI and EF developments in 1990, 2000, 2010 and 2016









- the HDI has been improving from period to period for this group of countries

- The increase in the HDI was associated with an increase in EF

- The year 2016 is characterized by relatively similar patterns compared to what was observed in 2010 for some countries such as Egypt, Tunisia, Jordan, and Algeria.

- Other MENA region countries have experienced a substantial decline in their levels of HDI and EF. This includes for instance Sudan, Syria, Libya, and Yemen. It is interesting that most of the countries in these groups were concerned or directly impacted by the Arab uprising.

- Figure 1 also shows that other countries have witnessed a slight increase in both HDI and EF indicators including Saudi Arabia, Qatar, Oman, and Turkey.

- Few countries have succeeded in reducing the EF while improving the HDI. These countries are Morocco, the United Arab Emirates, Kuwait, and Bahrain.

Literature review

Table 1

Author	Period	Country / Region	Empirical Methodology	Environmental index	The validity of the EKC hypothesis (Inverted U-shaped)
Panel of countries					
Destek and Sinha (2020).	1980-2014	24 OECD countries	AMG	EF	No
Destek and Sarkodie (2019).	1977-2013	11 industry countries	AMG	EF	Yes
Hdom (2019)	1980-2010	South America	ARDL	CO_2	No
Churchill et al., (2018)	1870-2014	20 OECD countries	AMG	CO_2	Yes
Alsamara et al., (2018)	1980-2017	GCC Countries	GMM and PMG	CO_2 and SO_2	Yes
Shuai et al., (2017)	1960-2011	164 countries	OLS		Yes
Zoundi (2017)	1980-2012	25 African countries	panel cointegration	CO_2	No
Charfeddine and Mrabet (2017)	1975-2007	15 MENA countries	panel cointegration	EF	Yes
Özokcu and Özdemir (2017)	1980-2010	26 OECD and 52 emerging countries	Panel regression	CO_2	No (N shaped)
Aşıcı and Acar (2016).	2004-2008	116 countries	Panel regression	EF	Yes
Brahmasrene and Lee (2017).		South-East Asia			
Al-Mulali and Ozturk (2016)	1990-2012	27 advanced economies	FMOLS	CO_2	Yes
Al-Mulali et al., (2016)	1980-2010	Seven regions	DOLS	CO_2	Yes
Bilgili et al., (2016).	1977–2010	17 OECD countries	FMOLS and DOLS	CO_2	Yes
Abid (2016)	1996-2010	25 Sub-Saharan Africa	GMM	CO_2	No
Jebli (2016)	1980-2010	25 OECD countries	FMOLS	CO_2	Yes
Apergis and Ozturk (2015)	1990–2011	14 Asian countries	GMM Method	CO_2	Yes
Wang et al., (2015)	1995-2011	Cities in China	Panel regression	CO_2	No
Baek (2015)	1960-2010	Arctic Countries	ARDL	CO_2	Yes
Salahuddin et al. (2015)	1980-2012	GCC countries	Fully Modified OLS	CO_2	No
Kasman and Duman (2015)	1992-2010	EU Countries	Panel regression	CO_2	Yes
Omri et al. (2015)	1990-2011	12 MENA	Panel regression	CO_2	Yes
AL-Mulali et al. (2015)b	1980-2008	93 countries	GMM	EF	Yes (upper middle and high-income countries)
Lopez-Menendez et al. (2014)	1996-2010	27 countries	Panel cointegration	CO_2	No
Ibrahim et al. (2014)	2000-2008	69 countries	GMM		No
Farhani et al. (2014)	1990-2010	10 MENA	Fully Modified OLS	CO_2	Yes
Kivyiro and Arminen (2014)	1971-2009	Sub-Saharan African	ARDL	CO_2	Yes
Halkos, G.E. (2011)	36 years	32 countries	Panel regression		No
Narayan and Narayan (2010).	1980-2004	43 developing countries	panel cointegration	CO_2	Yes
Galeotti et al. (2006)	1960-1998	OECD countries	Cointegration test	CO_2	Yes
Permann and Stern (2003)	1960-1990	74 countries	Panel regression	CO_2	Yes

- Grossman and Krueger (1991) have used the concept of EKC developed by Kuznets ,1955 to investigate the relationship between economic development and environmental deterioration.

- They found that, in the first stages of development within a country, economic growth is usually associated with a fast environmental degradation. Beyond a certain level of wealth, countries start experiencing environment improvements. This pattern suggests an inverted U-shaped relationship designated as the EKC hypothesis.

- Table 1 show that several studies have provided an evidence on the long-run relationship between GDP growth, income level, or real GDP and CO_2 emissions but their overall findings are mixed and vary according to the methodology used, the time period examined, and the selected variables to be included in the model.

- Most of the studies in this table incorporated the CO_2 emissions as a proxy for environment degradation and the GDP per capita as a proxy for economic growth.

- This paper employs the EF as a proxy for environmental degradation and the increasing demand on the relatively limited natural resources. EF represents a better measure to examine the interaction between the economic, social, and environmental aspects needed for a sustainable development

- More importantly, the research on the factors affecting the EKC turning points and turning years and the speed at which they converge is relatively inexistent with some few exceptions. For instance, Jiang et al. (2019) indicate that international trade delays the benefits of global CO_2 emission decays.

Data and empirical methodology

- The Ecological Footprint includes several components such as carbon footprint, cropland, grazing land, forest products, built-up-land, and fishing grounds (Ulucak and Lin, 2017; Danish et al., 2019).

- The explanatory variables include the Human Development Index, trade, energy consumption, and urbanization.

- All variables are expressed in logs.

- The data is extracted from the World Bank Development Indicators (WDI) and the Global Footprint Network databases. Our sample includes 16 countries form the MENA region over the period 1990-2016.

- To study the EF – HDI relationship in the MENA region, this paper employs the PVAR methodology.

- This method has several advantages:

  -tackle any problems of small time-series data

  -it allows the presence of heterogeneous individual effects in the model.

  -this method takes into consideration the presence of heteroscedasticity in the data.

  -the PVAR method uses a system of equation where all variables are treated as endogenous

  -Within this estimation technique, the effects of orthogonal shocks can be evaluated, and the impact of a shock of one variable on other variables can be studied

- Before applying the PVAR estimation method , we test the presence of unit root in all variables and if any long-run relationship exist between variables.

- The IPS test reveals that all variables are integrated of order 1 (i.e. I(1)), and the Pedroni (2004) cointegration test reveals the existence of a long-run relationship between variables.

- Moreover, we use the panel impulse response functions (IRFs) to capture the reaction of one variable in response to an innovation in another variable while keeping all other shocks equal to zero.

The PVAR estimation results

Table 2: Estimation results for all, oil-producing and non-oil countries

	Full sample (MENA)	Oil-producing countries	Non-Oil Countries
	d.EF	d.EF	d.EF
d.EF(t-1)	-0.13**	-0.052	-0.40***
d.HDI(-1)	-5.73***	-7.38***	1.118***
d.EC(-1)	0.86***	1.41***	0.059
d.T(-1)	-0.03***	-0.034***	0.14***
d.UB(-1)	1.75***	2.04***	2.40***
Number of Observations	352	176	176

- we particularly focus on the EF – HDI relationships to uncover any potential pathways and policy recommendations that can be implemented to achieve a sustainable development.
- Column 1 of the Table 2 reveals that, for the full sample, a higher level of HDI affects negatively and significantly the ecological footprint.
- A better human development is beneficial to the environment and appears to help reducing harmful emissions and mitigating any pressure on natural resources.

The PVAR estimation results

- A possible explanation of this finding is that when a country develops by improving its levels of income, education, and healthcare services, the awareness of the importance of a safe and high-quality environment is improved. Hence, the negative relationship between EF and HDI.

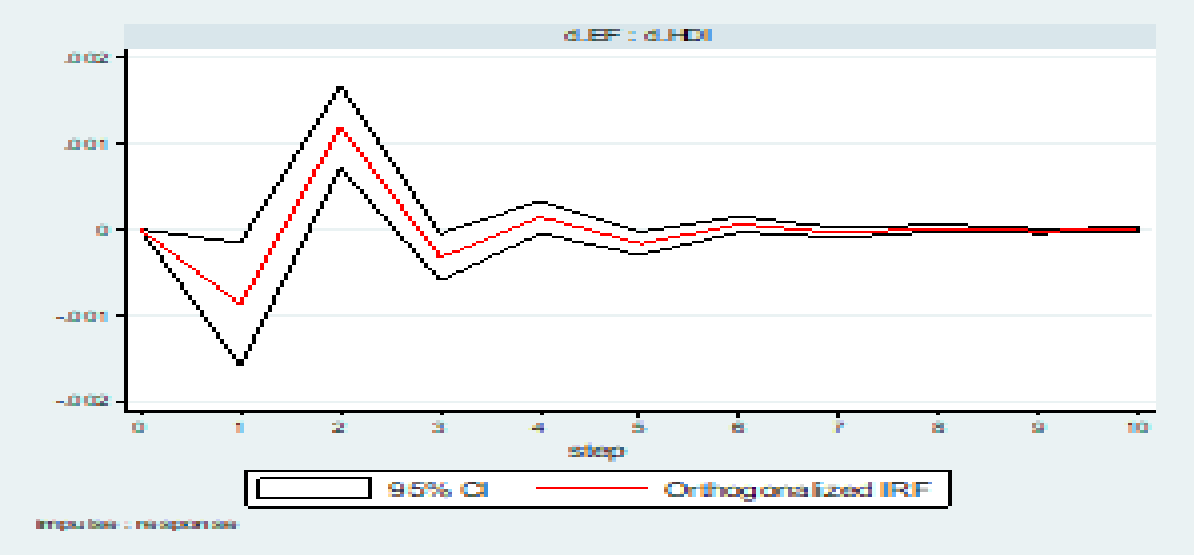
- First, the HDI affects negatively the EF in oil-producing countries but has a positive impact on the EF in the non-oil countries.

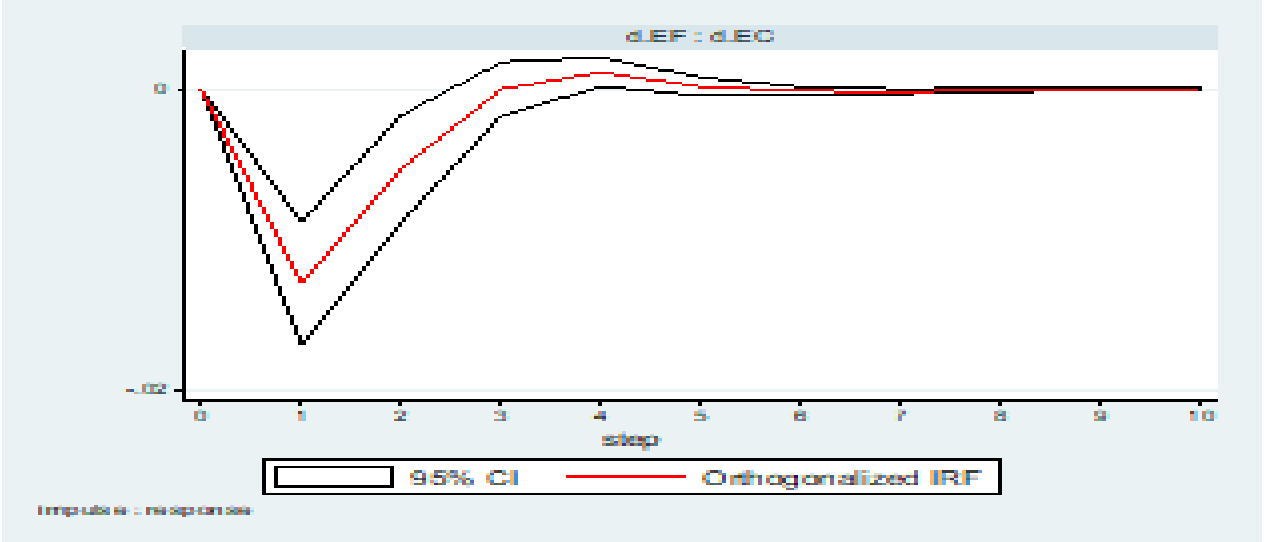
- This result is interesting and suggests that oil and non-oil countries may be at different levels of development affecting the impact of HDI on their EF.

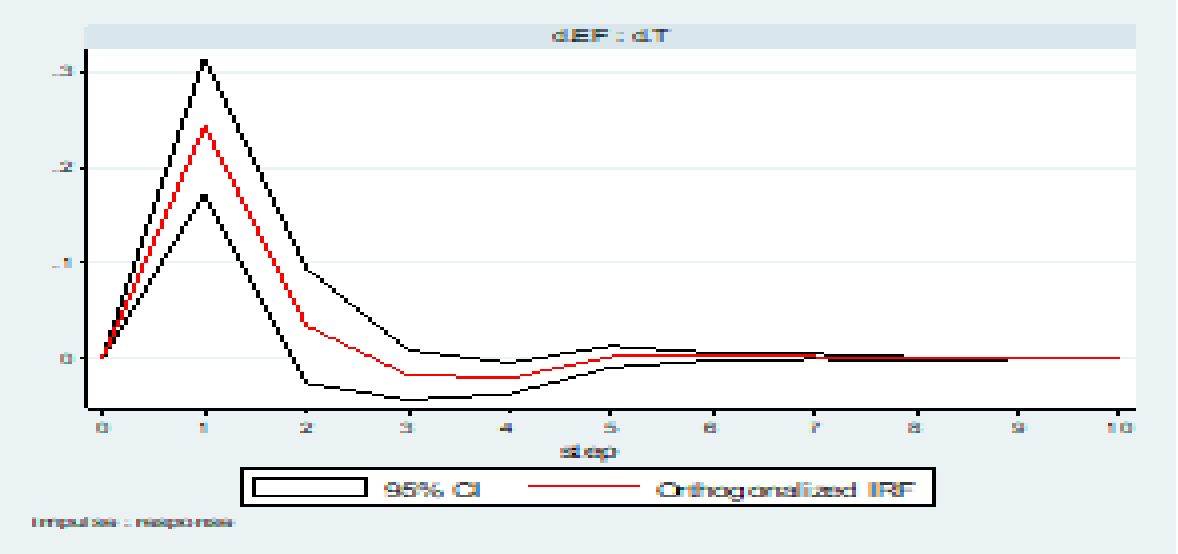
- Our findings advocate that there may be a certain level of human socio-economic development after which the incremental effects of HDI on the environment reverse trend, thereby highlighting the existence of a nonlinear relationship between the HDI and the EF variables

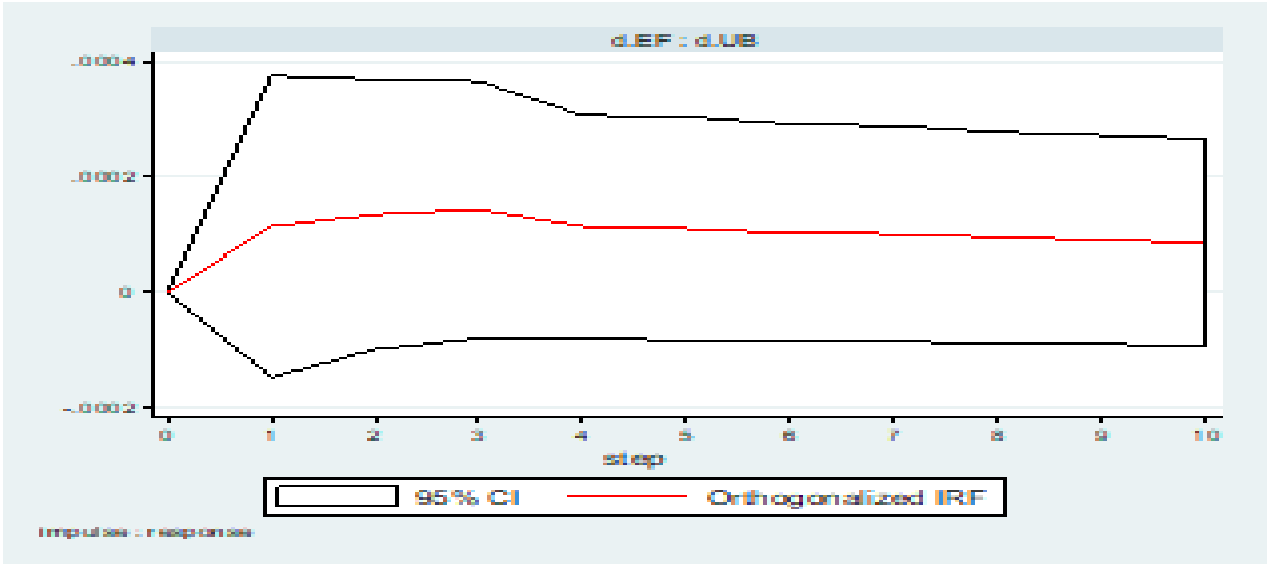
Empirical results: The impulse response function

Figure 1: Orthogonalized impulse-response functions of EF to one-standard error shock in HDI, trade, energy consumption, and urbanization for the full sample

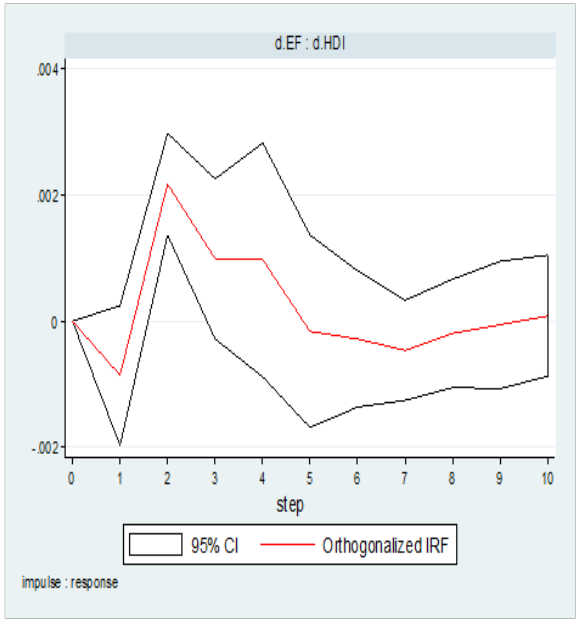


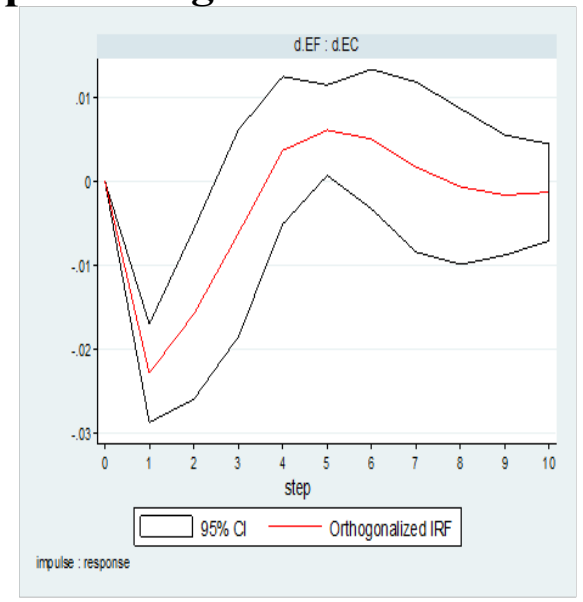


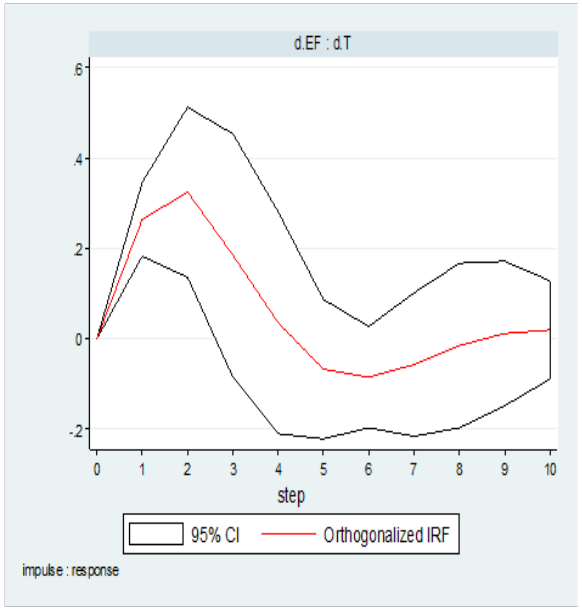


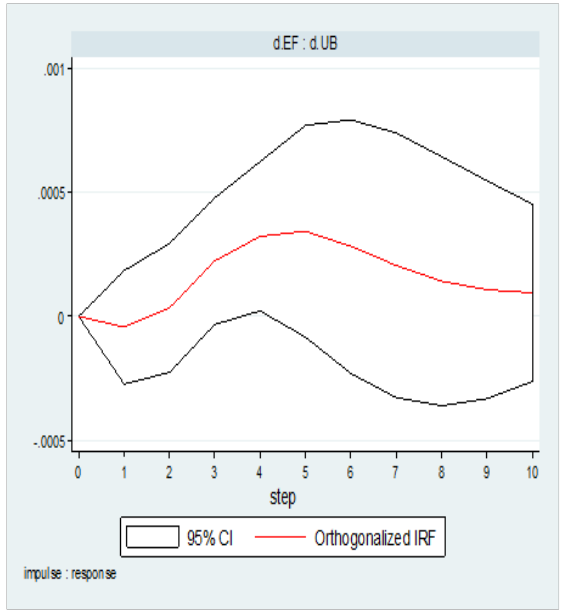


Orthogonalized impulse-response functions of EF to One-standard error shock in HDI, trade, energy consumption, and urbanization for the oil-producing countries

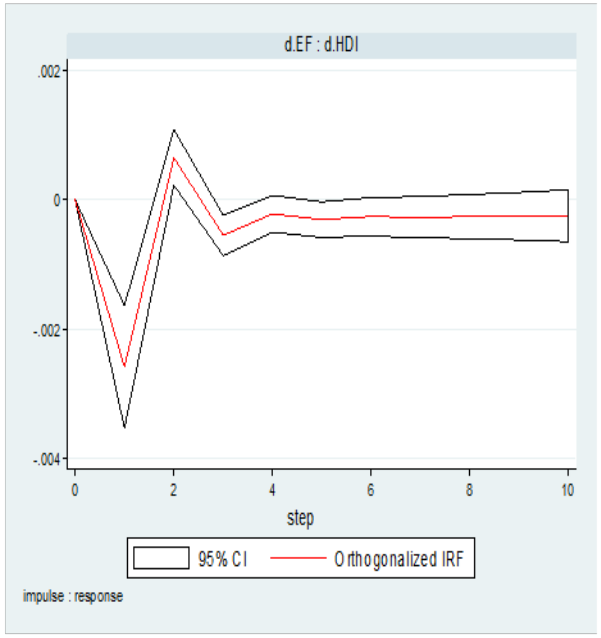


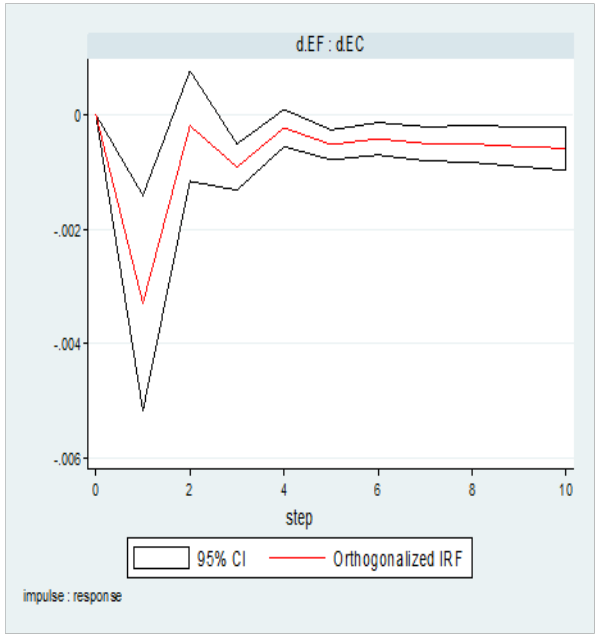


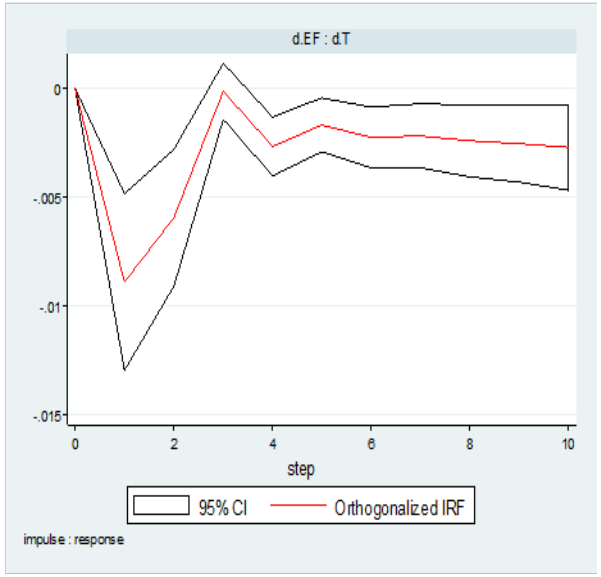


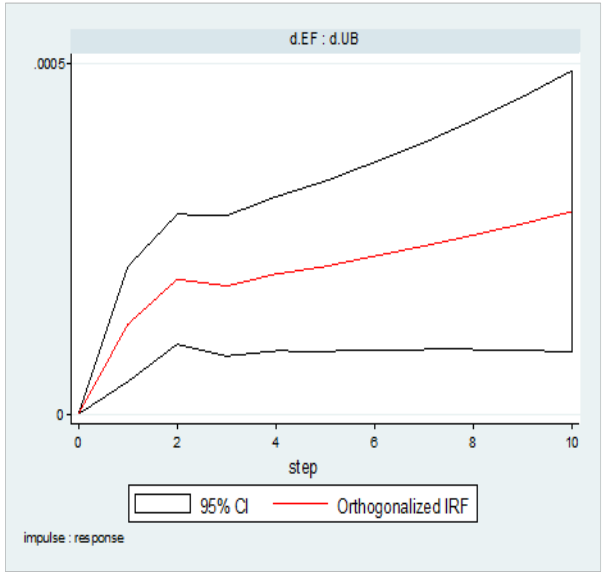


Orthogonalized impulse-response functions of EF to One-standard error shock in HDI, trade, energy consumption, and urbanization for the non-oil countries









Testing the EKC hypothesis

The objective of this subsection is twofold:

- First, we investigate the results of PVAR method suggest that the relationship between EF – HDI may be nonlinear.
- Second, we study the effects of the 2011 uprising on this relationship.
- To do so and inspired by the literature on the EKC hypothesis, we estimate the relationship between EF and the HDI for the full sample and for the two subsamples using equations below:

$$EF_{it} = \alpha_0 + \alpha_1 HDI_{it} + \alpha_2 HDI_{it}^2 + \epsilon_{it}$$

$$EF_{it} = \beta_0 + \beta_1 HDI_{it} + \beta_2 HDI_{it}^2 + \beta_3 dum2011 + \beta_4 dum2011 * HDI_{it} + \beta_5 dum2011 * HDI_{it}^2 + \epsilon_{it}$$

Testing the EKC hypothesis

Table 3: Estimation results of the EF – HDI relationship for all, oil-producing, and non-oil countries

	Full sample (MENA)		Oil-producing countries		Non-Oil countries	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
LHDI	-4.61***	-2.44***	-13.00***	-10.76***	-3.70***	-4.00***
LHDI2	-5.26***	-4.80***	-23.92***	-19.59***	-4.75***	-5.53***
Dum 2011		-1.84***		1.17***		-0.01
Dum2001*HDI		1.87***		3.05***		-0.8***
Dum 2011*HDI2		2.46***		-3.80***		-1.2***
TP	0.64		0.76		0.68	
TP_BUP		0.77		0.75		0.69
TP_AUP		0.88		0.85		0.70
Mean of HDI by sample for 2016	0.71		0.79		0.63	

- Table 3 reveals the presence of an inverted U-shaped relationship that links EF to HDI.

- Indeed, prior to the 2011 uprising (dummy = 0 in equation 2), the turning point for the full sample occurs at a level of HDI equal to 0.77.

- When we take into consideration the 2011 Arab uprising (dummy =1 in equation 3), Table 7 shows that the turning point in the full sample shifts upward to 0.88 due to political changes.

- According to this finding, after the 2011 uprising, countries would need to achieve a higher HDI to experience a better environment quality. Hence, the existence of a decoupling between EF and HDI that would slow down the convergence to the turning point and require more resources to attain environmental improvements.

- The results also reveals that for oil-producing countries, the turning point occurs at a lower level (0.75) compared to the full sample prior to the political uprising in the region when the dummy is set equal to 0.

- However, when the uprising dummy and interactive terms are added the turning point shifts to around 0.85.

- Thus, oil-producing countries must significantly increase their HDI levels to start experiencing a reduction in the EF due to the political unrest.

- The results are similar when the non-oil group of countries are considered. Prior to 2011, the level of the turning point was nearly 0.69.

- Due to the uprising, the turning point shifts to 0.70 and the change is statistically significant at the 1 percent level even though the difference is not economically large. These findings suggest that the 2011 Arab uprising did affect the EF – HDI relationship in this group of countries.

Conclusion and policy implication

- Our results reveal that the ecological footprint is strongly impacted by the level of the human development index suggesting that policymakers are more likely to achieve a sustainable development when the HDI improves.

- we show that there exists an inverse relationship between EF and HDI where environmental enhancements can only be attained beyond a certain level of HDI (turning point) without depleting and harming the natural resources.

- We also find that other factors affect the environmental footprint including trade, energy consumption, and urbanization.
- our study reveals that improving the HDI is a viable policy tool and represents a step forward to sustainable development.
- The 2011 Arab uprising has impacted the EF – HDI relationship by shifting its turning point upward.
- Thus, due to the uprising, MENA countries need a higher level of HDI to start experiencing environmental improvements. Political instability may therefore jeopardize the efforts of a country to attain the sustainable development goals.

Thank you