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Is Globalization Harmful for Environment?

Hasan Farazmand Mahvash Moradi
Department of Economics, Shahid Chamran University, Ahvaz, Iran
Corresponding author: moradi.mahvash67@gmail.com

Abstract
Globalization is an on-going process of global integration that encompasses economic integration through trade, investment and capital flows, political interaction and information technology that all dimensions of globalization affect the natural environment. We develop a model to divide trade's impact on pollution into scale, technique, and composition effects and then examine this theory using data on carbon dioxide concentrations. In addition, this paper asks whether the environmental Kuznets curve hypothesis, which admits the existence of an inverted U-shaped relationship between economic growth and environmental degradation, is in reality for the sample. By using a panel data for MENA region during 1990-2010, we conclude openness reduces the production of pollution. Also, by estimating a quadratic relationship between per capita income and pollution and by employing GLS method, we are able to deduce a U-shaped relation between income and CO_2 emission.
Keywords: globalization, environment degradation, environmental Kuznets curve, MENA

1. Introduction

With increasing globalization, industrialization and higher levels of openness in developing countries, researchers have become concerned as to whether these phenomena improve or degrade the environment. Over past decades, research into the net effect of globalization on the environment has matured, although there remain many outstanding questions. Moreover, there has been little effort exerted at linking up the two broad literatures concerning the direct and indirect effects of globalization on our natural environment. The direct effects include emissions and environmental damage associated with the physical movement of goods between exporters and importers. This includes emissions from fossil fuel use, oil spills, and introductions of exotic species. At the same time, growth in trade and foreign direct investment has numerous indirect effects. These indirect effects are often classified as falling under one of three categories: the scale, technique and composition effects (McAusland, 2008). The scale effect refers to the increase in the size of an economy resulting from openness and how that increased scale is likely to increase pollution. We expect this effect to carry a positive coefficient. The technique effect refers to the positive environmental consequences of changes in production methods that accompany trade and income growth. Indeed, liberalization induces higher income that causes people to increase their demand for a cleaner environment and stricter environmental regulations, encourages firms to adopt cleaner production processes and to reduce emissions. Finally, the composition effect reflects pollution performance of an economy's industrial composition. Given the same production scale, globalization might drive the industrial composition to contain a higher percentage of more polluting sectors. Therefore, we anticipate a positive coefficient for the composition effect. The impact of globalization on emissions is then captured through its influences on the scale, composition and technique characteristics of an economy. Since these three effects should play in opposite directions, empirical studies often attempted to assess the overall effects of trade and openness on pollution (Nasrollahi, Moradi and Rezaei, 2014).

The literature on these three effects has become quite large (Gallagher and Ackerman, 2000). There has been relatively less attention to the "direct" effects of trade on the environment. After all, trade in and of itself is the movement of goods and services across borders. Only a few studies have examined the extent to which increases in trade have affected the environment. In addition, these literature come up with different conclusions and make it difficult for policy makers to look at this emerging literature for policy guidance. Dinda (2006) stated environmental quality could decline through the increasing trade volume (especially export) would expand the size of the economy thereby increasing the extent of pollution. Thus, trade might be a cause of environmental degradation, ceteris paribus. On the other hand, many economists like Birdsall and Wheeler (1993) and Lee and Roland-Host (1993) have long argued that trade is not the root cause of environmental damage. Also, Antweiler et al. (2001) and Liddle (2001) argue that trade may be good for environment. As income rises through trade, environmental regulation is tightened that spurs pollution reducing innovation. Trade relates one country with international communities, one underdeveloped economy may rely on technology transfer through foreign direct investment that may reduce pollution. Tisdell (2001) points out that globalization can be a driving force for global economic growth.

The setup of this paper is as follows: Second section as usual offers literature review. Section 3 is used to provide a look at environmental Kuznets hypothesis. In section 4, model and econometric results are introduced. In section 5, we offer conclusions and policy recommendation.

2. Literature review

The empirical work on the relationship between trade and environment through the early 1990s has been thoroughly reviewed by Grossman and Krueger's pioneering work (1993) on trade, growth and pollution which led foundation for a large body of research in this field. This work constituted the starting point of what is called the Environmental Kuznets Curve (EKC) literature. They proposed a model, which suggests that a country's pollution rises with development, and industrialization up to a turning point, after which it falls again as the country uses its increased affluence to reduce pollution concentrations.

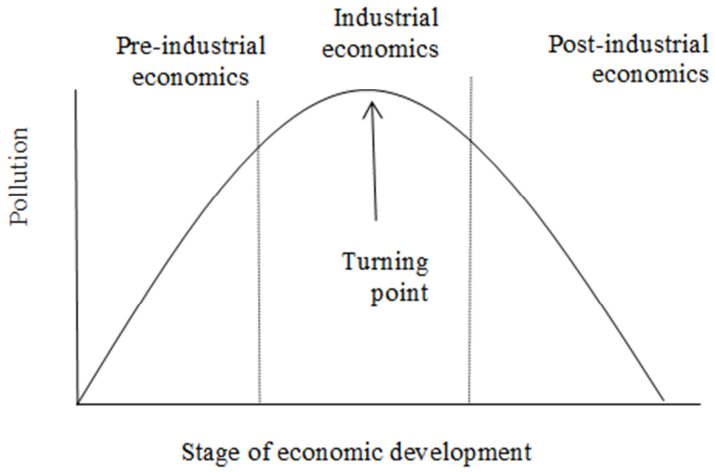

Figure 1: The Environmental Kuznets Curve

After that up to now, investigation of the relationship between trade, globalization and pollution generation has become the focus of much interest, with a boom in the literature occurring in the last 15 years.

Copeland and Taylor (1994) argued that free trade increases world pollution, because increased world income and its skewed distribution means that for a given set of endowments and degree of trade frictions, a country can import clean goods if its income is sufficiently high.

Nordstrom and Vaughan (1999) reported that even the World Trade Organization acknowledges the negative effect of free trade on the quality of the environment (pollution harms and natural resource management mistakes) in the absence of appropriate environmental policy.

Beghin et al., (2000) constructed an empirical simulation model to consider relationships between trade liberalization and pollution in Chile. Trade policies examined included Chile's accession to NAFTA, MERCOSUR, and unilateral free trade. In their CGE model, unilateral liberalization generated substantial worsening of air pollution by providing cheaper and dirtier energy sources. However, if this trade policy were combined with an appropriate tax on emissions there would be significant welfare gains for Chile. This insight underscores an important observation about the nexus between trade policy and environmental policy. In general, if environmental distortions are internalized efficiently, open trade is a welfare-enhancing policy.

Antweiler et al. (2001) brought a substantial improvement to the work of Grossman and Krueger (1993). They developed a theoretical model to decompose the impact of trade on pollution into scale, technique and composition effects, and used a consistent dataset on sulfur dioxide concentrations to estimate jointly the three effects using a single equation reduced form model. They found that, when combining the estimates of the three effects, trade liberalization appeared to be beneficial to the environment.

Dean (2002) analyzed the impacts of trade liberalization on water pollution in Chinese provinces from 1987 to 1995, a period in which there were both an extensive pollution levy system and significant opening to trade. She adapted the Copeland-Taylor framework to a setting with endogenous environmental policy, estimating a two-equation model in which trade openness both directly affects environmental use through a composition effect and indirectly through an induced technique effect. She found that China has a comparative advantage in pollution-intensive goods, so that trade liberalization has aggravated environmental damage. However, openness also generated higher per-capita incomes, mitigating the environmental costs through stronger regulation. She ran counterfactual simulations and discovered that emissions per unit of industrial output in China would have been much higher in the absence of trade reform, so that China's opening to trade was beneficial for the environment overall.

Frankel and Rose (2002, 2005) similarly test whether the impacts of openness on the environment are stronger when a country has a capital-labor ratio that is above the global average, or per capita income that is below average. They test the impact of openness on concentrations of NO2, SO2 and Particulate Matter, CO2

emissions, deforestation, energy depletion and rural clean water access. They include an interaction term between relative capital abundance and openness to see whether capital-abundant countries have a comparative advantage in dirty goods, and find the signs are mixed and the large standard errors render the interaction term statistically insignificant.

3. Conceptual background of the environmental Kuznets curve

As Grossman (1995) suggested, it is possible to distinguish three main channels whereby income growth affects the quality of the environment. In the first place, growth exhibits a scale effect on the environment: a larger scale of economic activity leads per se to increased environmental degradation. This occurs because increasing output requires that more inputs and thus more natural resources are used up in the production process. In addition, more output also implies increased wastes and emissions as by-product of the economic activity, which contributes to worsen the environmental quality. In the second place, income growth can have a positive impact on the environment through a composition effect: as income grows, the structure of the economy tends to change, gradually increasing the share of cleaner activities in the gross domestic product. In fact, as Panayotou (1993) has pointed out, environmental degradation tends to increase as the structure of the economy changes from rural to urban, from agricultural to industrial, but it starts falling with the second structural change from energy intensive heavy industry to services and technology-intensive industry. Finally, technological progress often occurs with economic growth since a wealthier country can afford to spend more on research and development. This generally leads to the substitution of obsolete and dirty technologies with cleaner ones, which also improves the quality of the environment. This is known as the technique effect of growth on the environment.

An inverted-U relationship between environmental degradation and per capita income suggests that the negative impact on the environment of the scale effect tends to prevail in the initial stages of growth, but that it will eventually be outweighed by the positive impact of the composition and technique effects that tend to lower the emission level.

4. Model and econometric results

Aiming at obtaining a better understanding of the pollution-globalization nexus and considering the above mentioned literature, the basic idea of this paper is to study the relationship between CO2 emission and trade. The standard approach consists of analyzing the impact of trade liberalization on environment by decomposing its environmental impact into scale, technique and composition effects. Since these three effects should play in opposite directions, empirical studies often attempted to assess the overall effects of trade liberalization on pollution. In line with the earlier discussion, and analyzing the effect of trade on environment degradation following proposed functional relationship is undertaken:

$$CO2_{i,t} = \alpha_0 + \alpha_1 GDP_{i,t} + \alpha_2 GDP^2_{i,t} + \alpha_3 Opn_{i,t} + \varepsilon_{i,t}$$

where CO2 is carbon dioxide per capita, and the symbols of explanatory variables are: GDP for per capita gross domestic product, Opn for openness as a proxy for trade and globalization, *i, t* and ε represent country, time and error term respectively.

To estimate the effect of trade on environmental quality, we observe its impact on CO2 emissions. We have chosen CO2 for many reasons. First, CO2 is produced at important levels by manufacturing industries. Second, CO2 is currently the most popular pollutant since it is the main greenhouse gas that is behind the principal concern of environmentalists and politicians, namely global warming. Finally, detailed data is available on CO2 emissions by activity for a large panel of developed, emerging, transition and developing countries from 1960 to today (Ben Kheder, 2010). With all these characteristics, CO2 as a proxy for environmental pollution is well suited to our study.

We use World Bank data for 21 years, from 1990 to 2010. The sample of this study comprises 21 countries from MENA region, namely Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Qatar, Saudi, Arabia, Syria, Tunisia, United Arab Emirates, West Bank and Gaza, Yemen.

The analyses start by testing the stability of the available data using the panel unit root test. The Levin, Lin and Chu (LLC), Im, Pesaran and Sin (IPS), ADF- Fisher and PP-Fisher tests are used which provide the best results in efficient testing power. The reported probability of all statistics and a 5% significance level are used for making a decision on whether to reject the null hypothesis or not. The results indicate that, probabilities are greater than the significance level which leads to a failure to reject the null hypothesis of existence of a unit root in the series, and the data are stationary after the first difference for all unit root tests. These results confirm that when the stationary of all data is detected the model meets the requirement to proceed with the panel cointegration test. The Pedroni cointegration test is used in order to test whether the dependent variable and the independent variables exhibit fundamental long-run relationships with each other. The results for the Pedroni test show that the values of statistics are under the 5% critical value. Therefore, we reject the null hypothesis of there being no cointegration vector found in the long run. This indicates that at least one cointegrationng vector exists

that offers a stable relationship among variables (Tables 1 and 2).

Table 1: Results for LLC, IPS, ADF and PP

Variable	LLC	IPS	ADF	PP
CO_2	-15.1622 (0.0000)	-7.60661 (0.0000)	139.188 (0.0000)	179.834 (0.0000)
GDP	-8.86903 (0.0000)	-5.91149 (0.0000)	114.640 (0.0000)	98.2233 (0.000)
GDP^2	-8.82981 (0.0000)	-5.98464 (0.0000)	118.655 (0.0000)	119.017 (0.0000)
Opn	-14.3045 (0.0000)	-7.58359 (0.0000)	129.379 (0.0000)	128.014 (0.0000)

- P values are in parentheses

Table 2: Results for Pedroni test

Statistic	Within dimension	
	Statistic	Prob.
Panel v-Statistic	0.657176	0.2555
Panel rho-Statistic	0.773019	0.7802
Panel pp-Statistic	-3.404923	0.0003
Panel ADF-Statistic	-3.398363	0.0003
	Between dimension	
	Statistic	Prob.
Group rho-Statistic	3.076711	0.9990
Group pp-Statistic	-10.85595	0.0000
Group ADF-Statistic	-8.098005	0.0000

Next, the study tests for choosing between a fixed effect and a random effect. In order to validate the results, the Hausman specification test is performed which has an asymptotic chi-square distribution. The resulting probability (0.000) is less than critical value of 5% which supports our view on the fixed effect model. In most regressions, the data suffer from heteroscedasticity. Using the Likelihood ratio test, the hypothesis based on the existence of homoscedasticity in variances is rejected and thus, the model has heteroscedasticity. Therefore we decided to use a remedy for this disturbance. We use the traditional GLS method in order to obtain efficient and robust standard results. Table 3 shows the results of the coefficients for each variable.

Table 3: Results for estimation by GLS

Variables	Coef.	Z	P>|z|
GDP	0.0011	10.82	0.000
GDP^2	-0.0000	-3.77	0.000
Opn	-12.15	-5.34	0.006
Prob= 0.000		Wald Chi2= 698.13	

From the probability and Wald statistic tests, we can see the model fits well. The results in Table 3 show that the positive coefficient of per capita GDP indicates that carbon dioxide emission increases with per capita GDP. This result suggests that in the selected countries the increase of income is accompanied by an increase of pollution.

In case of pollutant CO_2 the anticipated EKCs is found to exist. The coefficient of GDP is +0.0011 and GDP^2 is -0.0000 which follows the EKC theory. This theory shows an inverted-U relationship with income: environmental degradation gets worse in the early stages of growth, but eventually reaches a peak and starts declining as income exceeds a certain level. However, the main conclusion of most literature supply evidence on EKC but policy makers should avoid simplistic recommendations. More specifically, the possibility that environmental degradation may eventually fall as income grows, does not necessarily mean that growth will automatically solve the problems it causes in the early stages of development. Much work remains to be done to get a deeper understanding of the environment-income relationship. In the future, it would therefore be interesting to perform some more studies on this subject. Also, the authors conclude that globalization brings with it benefits.

5. Conclusion and policy recommendation

There is a fierce debate over the pollution consequences of economic policies that favor international trade in developing countries. Critics argue that adjusting countries have more comparative advantages in natural resource based activities, and the pressure to increase the level of trade represent an incentive to the

overexploitation of these assets. Since environmental legislation and control in these countries are less strict and this would favor the expansion of pollution. At the opposite side, defenders of international trade argue that trade openness brings more production efficiency to the economy. Higher competition would close down companies operating with old and inefficient equipment. Higher prices for energy are an incentive to reduce energy consumption and, therefore, emissions. Finally, the removal of subsidies to capital-intensive industries in developing countries would represent an incentive to labor intensive activities, which are less pollutant.

This paper set out to investigate whether or not the fears of environmentalists concerning the likely impact of trade on pollution had been confirmed by the experience of MENA countries during 1990-2010. Our results suggest that, trade and openness reduces the production of pollution. Globalization diffuses world product standards and, to the extent that environmental standards are higher in the dominant consumer markets, it creates a trend toward rising standards globally. Economic globalization changes the government-market interface; it constraints governments and enhances the role of the market in economic, social and environmental outcomes, it creates new imperatives for countries to co-operate both in managing the global commons and in coordinating domestic environmental policies.

By employing relevant econometrics analyses, our results are consistent with the existence of environmental Kuznets curve. The acceptance of the EKC hypothesis has important policy implications. First, the relationship implies a certain inevitability of environmental degradation along a country's development path. Second, the normal EKC suggests that, as the development process picks up, when a certain level of per capita income is reached, economic growth helps to undo the damage done in earlier years. If economic growth is good for the environment, policies that stimulate growth (trade liberalization, economic restructuring and price reform) ought to be good for the environment. However, income growth without institutional reform is not likely to be enough. Better policies, such as the removal of subsidies, and the introduction of more secure property rights over resources, and the imposition of pollution taxes to connect actions taken to prices paid will flatten the EKC and perhaps achieve an earlier turning point. Because market forces will ultimately determine the price of environmental quality, policies that allow market forces to operate are expected to be unambiguously positive. The search for meaningful environmental protection is a search for ways to enhance property rights and markets.

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