



Munich Personal RePEc Archive

# **The Dynamic effects of Time, Health and of Well-being on the Pollution after the earth summit of Johunburg**

FAKHRI, ISSAOUI and HASSEN, TOUMI and WASSIM,  
TOUILI and BILEL, AMMOURI

ESSECT TUNISIA, UNIVERSITE DE SFAX, ESC TUNISIA,  
ESSECT TUNISIA

8 February 2016

Online at <https://mpra.ub.uni-muenchen.de/80702/>  
MPRA Paper No. 80702, posted 09 Aug 2017 23:28 UTC

The Dynamic effects of Time, Health and Well-being on the Pollution after the earth summit of Johannesburg

**The Dynamic effects of Time, Health and of Well-being on the Pollution after the earth summit of Johunburg**

**ISSAOUI Fakhri**

[Ecole Supérieure de Sciences Economiques et Commerciales de Tunis](#)

[fakhriissaoui@yahoo.fr](mailto:fakhriissaoui@yahoo.fr) \_Tel.: 00216-98-207-208

**TOUMI Hassen**

University of Economics and Management of Sfax; Street of airport km 4.5; LP 1088, Sfax 3018; Tunisia. E-mail: [toumihass@gmail.com](mailto:toumihass@gmail.com) Tel : 0021696008081

**TOULI Wassim**

Ecole Supérieure de Commerce de Tunis ESCT , Campus universitaire de la Manouba, Tunis 2010, Tunisie. Email: [wassim.touili@gmail.com](mailto:wassim.touili@gmail.com)

**AMMOURI Bilel**

University of Carthage (UR MASE) and University of Tunis (ESSEC Tunis)  
[bilel.ammouri@gmail.com](mailto:bilel.ammouri@gmail.com)

**Abstract**

In This paper we try to investigate the impact of CO<sub>2</sub> emissions on a set of socioeconomic variables (GDP, health expectancy, life expectancy, urbanization, time, and a composite variable showing the effects post the earth summit of Johannesburg) in eight countries covering all world economic groups (Tunisia, Saudi Arabia, France, Norway, Brazil, USA, China and Australia). The empirical results have showed that the GDP continue to be the principal variable which is inciting to the CO<sub>2</sub> emission. Also we have demonstrated that it exists actually a voluntary act at the world scale to substitute pollutant energy sources by other sources more clean and pure.

**Keywords:** Environmental Kuznets Curve, CO<sub>2</sub>, energy consumption, growth

**JEL Classification:** Q43, Q53, Q56

## **I. Introduction**

Since the 70s, issues related to the economy and environment seems to be increasingly inseparable. Indeed, the focus on environmental issues (climate change, air pollution, deforestation, overexploitation of natural resources, etc.) is increasingly important, and continues to attract the interest of researchers and academics, and in different areas of economic knowledge. This interest stems from the importance of the effect of environmental degradation on human welfare as reflected in the different studies and research on this subject.

According to the Clean Air for Europe program of the EU, the European pollution causes 348,000 premature deaths each year and reduces average life expectancy by over 8 months. Other pollutants also have negative impacts on health: CO<sub>2</sub>, the main pollutant causing the global warming phenomenon.

Also, the World Health Organization (WHO) in its report "Air Quality Guidelines for Europe" concluded that breathing air is essential to the health and well-being of man while the air pollution is a global health threat.

According to Stern 2006 «the global warming, due to the accumulation of Greenhouse Gas (GHG) Emission, the one hand being carbon dioxide (CO<sub>2</sub>) is the main threat to humanity”.

Similarly, it is important to note that the current state of pollution is likely to become more dangerous, in the medium and long term. In fact, CO<sub>2</sub> emissions had grown from 1.7 billion tons in 1950 to over 18 billion tons in 2000. The CO<sub>2</sub> concentration in the

atmosphere has increased by 20% since 1950 and 40% since the beginning of the industrial revolution. By the end of the 21st century if nothing is done to limit CO<sub>2</sub> emissions, CO<sub>2</sub> levels may have increased by 250% compared to 1950, resulting in an increase in global temperature of 10 °, would have catastrophic effects for the survival of humanity.

At this level of analysis, it is important to point out that the convergence of researchers and economists, to study the effects of pollution (explained by CO<sub>2</sub> emissions) on macroeconomic and socio-economic variables is explained by two basic reasons.

The fundamental reason underlying such an interest is the fact that CO<sub>2</sub> was, until then, doubly valued and subjected to two distinct approaches: an economic approach and an environmental approach. The economic approach considers the CO<sub>2</sub> emissions as the logical consequence of industrial activities which, although they are polluting, they are creating added values, and therefore they are a guarantee of strong economic growth.

The environmental approach often deviates from the first considering that sustainable development can not in any case be based on polluting industries as long as the realized growth was offset by a loss of social welfare. However, it is noted that an alternative approach was submerged in recent years, and has undermined the positive relationship established between CO<sub>2</sub> and economic growth.

The second reason is that limiting only to CO<sub>2</sub> effects on economic growth and well-being may be insufficient the time that another aspect is hitherto veiled. This aspect is the economic liberalization. Indeed, many studies have converged to the reality that economic liberalization allows, in long term, to reduce pollution and increase economic growth.

The underlying reasons for this causality are explained mainly by two factors. First, the economic opening can be seen as a constraint which requires from the exporters to produce goods that are subject to international environmental standards. Second, the

so-called economic opening allows encourage exporters to change their energy strategies by substituting the most polluting goods by the more pure.

Therefore, in this context we develop our paper which will try to treat within the same theoretical model and empirical the both approaches mentioned above. Indeed, we will try to explain the relationship that develops between the emission of CO<sub>2</sub> on one side and a vector of variables involving economic growth, trade liberalization (first approach), urbanization, and the life expectancy (second approach). So to respond to this problematic we will see in the second section, the literature review explaining the main links between pollution and the set of our variables. The third section presents the model and the data. The fourth will conclude the paper.

## II. Literature review

Our literature review is divided into three parts. The first covers the work that tried to establish a relationship between economic growth and environmental quality. The second will look at the work that has studied the relationship established between economic liberalization and environmental quality. The third and final component will exhibit works that are trying to study the effect of environmental quality on wellbeing

### II.1 Literature Review (economic growth/environmental quality)<sup>1</sup>

This first section provides a literature review on the theoretical and empirical literature on the relationship established between economic growth and environmental quality.

The theoretical relationship between economic growth and environmental quality is the one of the most debated subject during the year 70. Indeed, Georgescu-Roegen (1971), had applied the theme of entropy to the economy. That conclusion has economic activity causes an accumulation of pollution causing environmental degradation

---

<sup>1</sup> For more details refer to « <sup>1</sup> Sebri, M. (2009). *The Mediterranean Zone in front of Air pollution: an Econometric Investigation* (No. 32382). MPRA Working Paper.

The report of the Club of Rome (1972) asserted that the environment will collapse under the negative impact exerted by the economic growth on environmental quality. He recommended that we must stabilize global output, to escape the disaster.

Cleveland et al (1984) studied the correlation between economic growth and environmental quality, from 1909 to 1981 in the US industry. The results confirm the existence of a positive and significant relationship between economic growth and environmental quality.

In the early 90s, the availability of environmental data had encouraged researchers to investigate more the relationship established between economic growth - environmental quality. At this time, many studies have empirically tested the effects of economic growth on various environmental indicators (SO<sub>2</sub>, NO<sub>x</sub>, CO, CO<sub>2</sub>, waste, etc.).

The empirical relationship between economic growth and environmental quality is essentially based on the EKC (Environmental Kuznets Curve). In this section, we present a review of empirical work on the EKC (panel data, time series and cross section).

Following the literature review of Sebri M (2009), Shafik and Bandyopadhyay (1992), used a polynomial regression model for a sample of 149 countries between 1960 and 1990. The results indicate that the environmental Kuznets curve EKC "was validated only for SO<sub>2</sub>, deforestation and emissions carbon of which turning points are respectively 3000, 2000 and 4000.

Panayotou (1993) studied a sample of 55 countries between 1987-1988. The results indicate that the EKC is validated only for SO<sub>2</sub>, deforestation whose turning point is \$ 3,137.

Galeotti and Ianza (2005), "have considered the two functions Gamma and Weibull as alternatives to the polynomial function which analyzes the increase in CO<sub>2</sub> based economic growth in a sample of three groups of countries (OECD, non-OECD members and the two groups jointly ) between 1960 and 1995. the results of the

analysis indicate that the EKC is validated for the three groups with turning points of \$ 15,000 for the first group, \$ 17,000 for second and \$ 13,000 for the third group”<sup>2</sup>.

Azomahou and Van PN (2006) have used the kernel regression with polynomial function for analyzing CO2 emissions for a sample of 100 countries from 1960 to 1996. The results indicate that the EKC is obtained with polynomial function while the curve growing is obtained with the recourse to kernel regression.

According to Sebri M (2009), Richmond and Kaufmann (2006) have analysed the evolution of energy consumption and CO2 considering a sample of 36 countries from 1973 to 1997. The authors made a comparison between the fixed effects model, the random effects model and the random coefficient model. The authors have concluded that the random coefficient model is the more efficient. The energy consumption and CO2 were verifying the EKC for the entire country.

Huang et al. (2007) “have studied the causality between energy consumption per capita and GDP per head, using the VAR model in panel data for a sample of 82 countries between 1972 and 2002. The results of the study are two in number. The first is the absence of a causal link between the consumption of energy per capita and GDP per head in the case of low-income countries, the second is the presence of causality in the case of other countries”<sup>3</sup>.

Aslanidis and Xepapadeas (2008) “Have used the regime switching model on panel data as an alternative of polynomial specification considering SO2 as indicator of environmental degradation. The results indicate What EKC is Validated With turning point of 10345 for SO2”<sup>4</sup>.

---

<sup>2</sup> Sebri, M. (2009). *The Mediterranean Zone in front of Air pollution: an Econometric Investigation* (No. 32382). MPRA Working Paper.

<sup>3</sup> Sebri, M. (2009). *The Mediterranean Zone in front of Air pollution: an Econometric Investigation* (No. 32382). MPRA Working Paper.

<sup>4</sup> Ibid

## **II.2 Literature review (Trade liberalization and environmental quality)**

The second sub-section presents an overview of the theoretical and empirical literature on the relationship between trade liberalization and environmental quality. To

Pethig (1976) used the Ricardian model to show that countries in which environmental regulations were relatively low tend to export goods intensive in environmental resources. Nevertheless, in countries where there exist strict laws tend to export goods less intensive on environmental resources

Siebert (1977) had noted that when the country exports highly polluting products, the gains from trade can compensate the environmental degradation. Yohe (1979) studied the relationship between trade liberalization and the environmental quality. They concluded that countries with less stringent environmental standards have a comparative advantage for the production of polluting goods, increasing exports and decreasing imports of this type of product.

McGuire (1982) included the concept of foreign direct investment to demonstrate that a firm that works in a hazardous area and facing stricter environmental standards will relocate its operations in a less regulated country.

Grossman and Krueger (1993) studied the relationship between the costs of reducing pollution and the structure of trade and investment in Mexico and the United States from 1977 to 1988. The results indicate that liberalization of trade in Mexico may increase specialization in less polluting sectors.

Copeland et al. (1994, 1995) have tried to make a distinction between the return on scale effects and, the technical effect caused by the international exchange through SO<sub>2</sub> for a sample of more than 100 cities worldwide. Three results were developed:

The first: a trade liberalization increases the scale of the economic activity of 1%. The second: that liberalization increases pollution from 0.25 to 0.5% via the scale effect. The latest: the rise in per capita income grows these pollution down from 1.25 to 1.5% via the technical effect.

Gale and Mendez (1998) estimated the technical effects and the return on scale through the GDP / capita. The results indicate that the technical effect is not a function

of EKC but show a decreasing linear function. An increase in the per capita GDP would be related to a decrease in the level of pollution whatever the country's income level and no significant relation is found between trade openness and SO<sub>2</sub> concentrations.

Antweiler et al (1998) have divided the impact of trade on environmental quality on three effects : scale effect, composition effect and technical effect for a sample of 44 countries taking into account two variables SO<sub>2</sub> and the GDP/capita. The results of the study cover two aspects. The first is that there is a negative relationship between the degree of openness of a country and the concentration of SO<sub>2</sub>. The second is that trade openness is favorable to the environment, that is to say that if trade increases the GDP and the GDP per capita by 1%, then the trade reduces pollution concentrations by approximately 1 %.

Dean (1998) had estimated a simultaneous equations model to study the relationship between GDP and CO<sub>2</sub> emissions. It concludes that trade openness has a negative effect on the environment through the specialization.

Cole et al. (1998) have studied the impact of the Uruguay Round on the environment for a sample of 9 trading blocs between 1990 and 2000 (forecasting data from UNEP). They concluded that all the studied nations will experience an increase in their nitrogen dioxide (NO<sub>2</sub>) and emissions are increasing in developing countries and are decreasing in developed countries for the other pollutants.

Tobey (1990) had analyzed the relationship between environmental regulation and the trade for a sample of five industries. The results indicate that environmental regulation has no significant impact on the structure of international trade.

Frankel et Rose (2005) have studied the effect of international trade on the environment for a sample of countries via the dependent variables, SO<sub>2</sub>, NO<sub>2</sub> and other pollutant particles. The explained variables are GDP / capita and the rate of opening and two other non-economic variables: the political regime and the land surface per capita. The results indicate that trade is favourable to the environment Il (2006) concluded that FDI inflows are destroying the quality of the environment in China. Liang (2006) examined the link between FDI and the pollution in China. He

found a positive impact of FDI on the environment in China. Khalil & Inam (2006) confirmed through time series data, that trade and FDI are increasing the CO<sub>2</sub> emission in Pakistan.

Jorgenson (2007) studied the effect of FDI on environmental quality in the least developed countries. The results of the analysis of fixed effects panel data confirmed that FDI in manufacturing sectors increased CO<sub>2</sub> emissions.

Baek and Koo (2009) used VECM techniques to analyze the relationship between FDI, economic growth and the environment in China and India. The results show that FDI has a short and long-term negative impact on the quality of the environment in both economies.

Acharya (2009) examined the relationship between economic growth, foreign direct investment and carbon emissions in India. The results indicate that there is a positive effect of FDI entry on CO<sub>2</sub> emissions. Mahmood & Chaudhary (2012) have analysed the effects of FDI on CO<sub>2</sub> emissions in Pakistan. The results show that FDI has a short and long-term negative impact on the quality of the environment in Pakistan.

Jayanthakumaran, et al. (2012) and Baoutabba (2013) concluded that trade openness increases CO<sub>2</sub> emissions in India. Shahbaz et al. (2012) concluded that trade liberalization has a positive and significant impact on the environment in Indonesia. Shahbaz, Lean, and Shabbir, (2012) concluded that trade openness reduces long-term CO<sub>2</sub> emissions in Pakistan, but short the effect is not significant.

Hassaballa (2013) used a dynamic panel model to examine the impact of FDI on CO<sub>2</sub> emissions in developing countries. The results show that FDI does not have a significant impact on environmental quality. Gu, Gao and Li, 2013 have found a sense of two-way causality between CO<sub>2</sub> emissions and FDI in China.

Tiwari, Shahbaz, and Hye, (2013) have reported an increase in trade openness leads to an increase in carbon emissions in India

### **II.3 Literature Review (environmental quality/well-being (health))**

In this third subsection we present an overview of the theoretical and empirical literature on the relationship between environmental quality and the well-being (health). Indeed, according to WHO, the environment is defined as “the set of natural and artificial elements in which human life unfolds” Health is "a state of complete physical, mental and social, and not merely the absence of disease or infirmity. "

In the Same line of conduct Georgescu-Roegen (1971), showed that economic activity which leads to the accumulation of emissions (CO<sub>2</sub>) are causing the environmental degradation and decreased social welfare.

Eric Lambin (2009) in his book “ecology of happiness" has studied the interactions between human well-being and environmental degradation on the basis of numerous publications. The author concluded that environmental problems can threaten the happiness of the people. WA Brock and Taylor MS, (2005) concluded that the impact of the environment on the welfare of present and future generations depends on the quality of the environment and its evolution as well as the sensibility that society at 'environment.

Christophe Declerck et al (2011), in a recent study (Aphekom) performed for all European countries, showed that life expectancy would increase up to 22 months if the major European cities reduced air pollution. Yuyu Chenaet et al (2013) showed that life expectancy decreases by 5 and half years in northern China due to pollution since 1950. Amjad Ali and Khalil Ahmad (2014) studied the impact of CO<sub>2</sub> emissions on the life expectancy for Oman between 1970 and 2012. The results indicate the existence of a positive relationship and not significant in the long term, but short term the relationship becomes negative and significant. Assadzadeh Ahmad & al. (2014) studied the impact of CO<sub>2</sub> emissions on life expectancy in 8 oil exporting countries between 2000 and 2010. The short-term elasticities revealed that the per capita GDP and CO<sub>2</sub> emissions have a negative effect and significant on life expectancy. Mehrara Masoumi M and MR (2014) studied the relationship between life expectancy, CO<sub>2</sub> and GDP to 108 developing countries between 1995 and 2012. The results

indicate the absence of EKC. The authors added emissions of CO<sub>2</sub> as an endogenous variable in the model, they found an increase in the effect of CO<sub>2</sub> on health. Also an increase in GDP will result in an improvement in life expectancy, and environmental degradation has negative externalities on economic growth and reduces the benefits of improved health.

Shashi Bhushan Kumar Ray & Awadhesh (2015) examined the causal link between CO<sub>2</sub> emissions, GDP per capita and life expectancy in countries with high, medium and low income in 1961-2010. The results indicate that in: -the high-income countries have a sense of significant and unidirectional causality of CO<sub>2</sub> emissions per capita GDP. -The middle-income countries have a significant and unidirectional causal direction of CO<sub>2</sub> emissions per capita GDP and GDP per capita in life expectancy. - The low-income countries have a sense of unidirectional causality and significant emissions of CO<sub>2</sub> in life expectancy and GDP per capita in life expectancy by. UNEP's report on the future of the global environment "Environment for Development" (GEO-4) showed that air pollution affects in a negative way the human welfare in almost all regions of world and OM estimates that over one billion people in Asian countries are exposed to air pollutants.

### III. Methodology

To determine the methodology of our thesis, we must clarify both the overall methodology as empirical. In other words, Will is to look at a holistic methodology or individualistic thinking? So are we going to follow us a static or dynamic empirical methodology? If we choose the dynamic, another question arises: what dynamics model will we use?

To answer these questions we can say that solving this type of problem requires us to be situated at a holistic level as long as we will refer to global macroeconomic data. Also, to address the problems associated with static models which are limited to the immediate and instantaneous effects we will, as part of our paper parry audit problem when trying to detect dynamic effects of environmental quality on the well - being, economic liberalization and growth (more details will be provided in the next section). Modeling the effect

### III.1 Description of variables

The database is chosen to cover the 1995-2013 period for only 8 countries in every continent of the world: Tunisia, United States, France, Norway, Australia, Saudi Arabia, China and Brazil. The data is extracted from database of World bank

### III.2 Methodology of Estimation

Given that we interest to time and individuals we construct a panel model which will be presents as following:

$$\log CO2_{it} = \alpha_0 + \alpha_1 \log gdp_{it} + \alpha_2 \log openness_{it} + \alpha_3 \log lexp_{it} + \alpha_4 \log healthexp_{it} + \alpha_5 \log agr\_add\_value_{it} + \alpha_6 \log urb_{it} + \alpha_7 time_{it} + \alpha_8 johan_{it} + \alpha_9 time \times johan_{it} + \gamma_i + \varepsilon_{it} \quad (1)$$

The dependent variable (endogenous) is CO2 emissions measured in metric tonnes per capita. The explanatory variables are:

- Gdp: GDP per capita measured in US dollars which captures the impact of economic growth on environmental quality.
- Urb: The urban population (URB) measured as a percentage of the overall population is also an important determinant of environmental quality.
- healthexp: the number of years a person could expect to live independently, live without any functional limitation requiring the assistance of another person or complex assistive device. Hence it is also described as independent life expectancy. The measure uses information from the 1996, 2001 and 2006 Disability Surveys to calculate disability-adjusted life expectancy estimates. Health expenditure per capita, (% of GDP) is the sum of public and private health spending .

- agradd-value : The added value of the agricultural sector which captures the effects of farming on CO2 emissions. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources

- Openness: The degree of trade openness which determines the effects of international trade on environmental quality (imports+exports)/100.

- lexp: Life expectancy at birth indicates the number of years a new born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life..

- Time (TIME): is a discrete variable which takes the value 1 in the first year to 15 (the final year)

- johan: The Johannesburg Summit 2002 (JOHAN) held in Johannesburg from 26 August to 4 September brought together representatives of over 190 countries. The general theme of the summit is the fight against environmental degradation.

- txjohan : is a composite variable which determines the dynamic effect of Johannesburg summit on the CO2 emissions.

**Tableau 1 : corrélation entre les variables :**

Colonne1	co2	Gdp	openess	lexp	healthexp	agradd-value	urb	t	johan	txjohan
co2	1									
Gdp	0,7	1								
openess	-0,02	-0,068	1							
Lexp	0,6	0,81	0,12	1						
healthexp	0,63	0,95	-0,2	0,84	1					
agradd-value	-0,7	-0,93	0,22	-0,72	-0,94	1				
Urb	0,42	0,72	-0,18	0,41	0,7	-0,68	1			
T	0,097	0,11	0,17	0,35	0,27	-0,2	0,15	1		
Johan	0,086	0,08	0,16	0,31	0,22	-0,18	0,13	0,83	1	
Txjohan	0,094	0,09	0,17	0,34	0,26	-0,2	0,15	0,965	0,92	1

Thus, we are in the presence of a Panel Data model, and in consequence we confront the problem of specification individual effects (fixed or random). In this context, we test the presence and the nature of these individual effects. We recourse then to Hausman test (following Chi2 at k degree of freedom). The null hypothesis of this test is the presence of the random effect, which will be accepted when the value calculated of Chi2 is less than the tabulated value.

Test de Hausman :

$$\begin{cases} H_0: E(\gamma_i \setminus X_i) = 0 \\ H_1: E(\gamma_i \setminus X_i) \neq 0 \end{cases}$$

with,

$X_i =$

$\{\text{loggdpt}, \text{logopeness}_t, \text{loglexp}_{it}, \text{loghealthexp}_t, \text{logagraddedvalue}_t, \text{logurb}_t, \text{time}_t, \text{johan}_t, \text{time} \times \text{johan}_t\}$

**Tableau 2 : Hausman Test:**

	Coefficients			Sqrt (diag (V_b-V_B)) S.E.
	(b)	(B)	(b-B)	
	Fe	re	Difference	
Lngdp	.4867752	.462324	.0244513	.0512542
Lnopennes	.1526629	.1572788	-.004616	.015863
Lnlexp	-.1651929	-.3763618	.2111689	.4983429
lnhealth_exp	.1072716	.1084962	-.0012246	.009925
lnagr_add_~e	-.1902436	-.1903175	.0000739	.0074843
Lnurb	.2964721	.3515131	-.055041	.127902
T	-.0102871	-.0093971	-.0008899	.0020095
Johan	.0725794	.07339	-.0008106	.0085916
t_johan	-.0090954	-.0092379	.0001425	.0012419

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\text{chi2}(9) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 0.42$$

$$\text{Prob}>\text{chi2} = 1.0000$$

We have  $\text{Prob}>\text{chi2} = 1.0000$  sup 5%

According to the Hausman test result, the value of Calculated Chi2 is strictly Inferior to its Tabulated value, at the level of 5% ( $P > \text{chi2} = 1.000$ ). Actually, we accept the null hypothesis stipulating That We Are in the presence of random effect.

Therefore, since we are in the case of random effects, we check if the model residuals are auto correlated. We proceed to testing the Homoscedasticity and correlation. First, to test the serial correlation we will use to Wooldridge test. The null hypothesis of this test is the absence of serial autocorrelation of the first order. We accept the null hypothesis if the value of the calculated Fisher is strictly less than the tabulated value (Prob> F above 5%) with a threshold of 5%. So long as the value of Fisher test  $F(1, 7) = 16,350$  (Prob> F = 0.0049) then we reject the null hypothesis and we conclude that there is a first-order autocorrelation.

Second, to test the homoscedasticity, we will recourse to the test of Breush-Pagan (LR test). It is a statistical of Chi2. The null hypothesis of this test is homoscedasticity against the alternative hypothesis of Heteroscedasticity. We reject the null hypothesis if the calculated value of Chi2 is strictly greater than its tabulated value (Prob> F is less than 5%) in the level of 5%.

According to our data the value of the calculated test is 765.89, it is strictly greater than the tabulated value at the level of 5% (Prob> F = 0.000). Therefore, we accept the alternative hypothesis meaning the residues are heteroscedastics. We are in the presence of heteroskedasticity and serial autocorrelation, so we apply the FGLS estimation method to estimate our model.

### III.3 Analyse of Estimation (all countries)

Cross-sectional time-series FGLS regression

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoscedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 152
Estimated covariances = 1	Number of groups = 8
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 10	Wald chi2(9) = 392.78
Log likelihood = -96.90201	Prob > chi2 = 0.0000

**Table2 : Estimation of the model**

<b>lnco2_emiss</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>z</b>	<b>P&gt; z </b>	<b>[95% Conf. Interval]</b>	
<b>Lngdp</b>	1.68***	.2041735	8.24	0.000	1.281411	2.081757
<b>Lnopennes</b>	-.7262***	.1254061	-5.79	0.000	-.9720823	-.4804994
<b>Lnlexp</b>	6.391**	2.541351	2.51	0.012	1.410402	11.37231
<b>lnhealth_exp</b>	-1.34***	.1517946	-8.83	0.000	-1.637754	-1.042731
<b>lnagr_add_value</b>	-.462**	.1991962	-2.32	0.020	-.8528741	-.0720395

<b>Lnurb</b>	-.649**	.3171483	-2.05	0.041	-1.270755	-.0275561
<b>T</b>	-.0116606	.032348	-0.36	0.718	-.0750615	.0517402
<b>Johan</b>	-.581**	.249414	-2.33	0.020	-1.070359	-.0926746
<b>t_johan</b>	.0923***	.0355893	2.59	0.009	.0225925	.1621001
<b>_cons</b>	-26.6**	10.35387	-2.57	0.010	-46.90912	-6.322701

According to the table we can note that the growth has a positive and significant effect in the CO2 emission. So, this can lead us to say that while the succession of earth summits (Rio, Johannesburg etc.) and the implication of the majority of countries to apply its recommendations, these countries have continued always in the same strategy of growth based on pollutant industries. Nevertheless, the openness has a negative and significant effect on the CO2 emission. This can be explained by the fact that the developed countries become more and more exigent and, they import only products whose are issued through non pollutant industries.

The health expectancy, the agriculture value added and the urbanism have all a negative and significant effects on CO2 emission at the levels of 1% and 5%. First, concerning the health expectancy we judge that this result is logic since the CO2 emission can destruct the health and contribute to the appearing of several diseases. Second, it seems that agriculture sector is also threatened by CO2 emission because the plants need a clean and pure air. Third the negative relation between urbanism and CO2 emission appears strange and diverge from the economic logic. The time has a negative and non-significant effect on CO2 while the dummy variable has a negative and significant effect at the level of 5%. This means that several countries become more and more conscious of negative effects of environmental degradation and they work to reduce the maximum as possible the CO2 emission. Our composite variable ( $time \times johan_{it}$ ) is negative and significant at the level of 5% which means that in all the period post-Johannesburg summit all countries will try to contribute in the world effort to reduce their emission of CO2. This needs to reflect on new development strategies less pollutant or no pollutant.

## Indivuel estimation

### Saudi Arabia

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoscedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 19
Estimated covariances = 1	Number of groups = 1
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 9	Wald chi2(9) = 37600.81

Log likelihood	= 26.09651	Prob > chi2	= 0.0000
----------------	------------	-------------	----------

Inco2_emiss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lngdp	-2.035493	1.390601	-1.46	0.143	-4.76102	.6900337
Lnopennes	.2370528	.3846428	0.62	0.538	-.5168333	.9909388
lnlexp	-97.55664	68.09459	-1.43	0.152	-231.0196	35.90631
lnhealth_exp	.2381062	.2149634	1.11	0.268	-.1832143	.6594266
lnagr_add_value	-.1314827	.376809	-0.35	0.727	-.8700147	.6070493
lnurb	99.75801	65.12723	1.53	0.126	-27.88901	227.405
t	.1223316	.1112241	1.10	0.271	-.0956635	.3403268
johan	.174674	.7563814	0.23	0.817	-1.307806	1.657154
t_johan	-.0300068	.0923765	-0.32	0.745	-.2110613	.1510477

In the case of Saudi Arabia we note that all coefficients are non-significant. This is due to two main factors. The first is that this country is petroleum exporter, and has not a developed industry sector. The second is that its area is much extended and not feels the negative effects of CO2 emissions

### Australia

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoscedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 19
Estimated covariances = 1	Number of groups = 1
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 9	Wald chi2(9) = 1215119
Log likelihood = 58.41219	Prob > chi2 = 0.0000

Inco2_emiss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Lngdp	2.024***	.3728823	5.43	0.000	1.293223	2.754895
Lnopennes	.1692*	.0882841	1.92	0.055	-.0037385	.342329
lnlexp	-4.284	3.523452	-1.22	0.224	-11.1901	2.621574
lnhealth_exp	-.0063381	.0572242	-0.11	0.912	-.1184955	.1058193
lnagr_add_value	.064187	.0471771	1.36	0.174	-.0282784	.1566524
Lnurb	.0450356	3.244914	0.01	0.989	-6.314879	6.40495
T	-.0331***	.008646	-3.84	0.000	-.0501436	-.0162519
Johan	-.0805524	.0718345	-1.12	0.262	-.2213454	.0602405
t_johan	.0132583	.0091095	1.46	0.146	-.004596	.0311126

In the case of Australia we note that the GDP has a positive effect on CO2 at the level of 1%. The openness rate has a negative and significant effect at the level of 5%. This result, consolidates the idea that the international trade can be one of the political tools to oblige the most pollutant country to reduce their pollution through export and import (otherwise the country will be excluded). Also, the time is negative and significant at the level of 1%. This means that Australia will adopt and develop an economic strategy based on non-pollutant natural resources. This strategy is not influenced by all earth summits (Johannesburg for example) but is a strategy developed by the conscious of individuals that the pollution is not a good but should be treated as a “evil”

## Brazil

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoscedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 19
Estimated covariances = 1	Number of groups = 1
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 10	Wald chi2(9) = 413.57
Log likelihood = 48.82135	Prob > chi2 = 0.0000

<b>lnco2_emiss</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>z</b>	<b>P&gt; z </b>	<b>[95% Conf. Interval]</b>	
<b>Lngdp</b>	3.045***	.5676426	5.36	0.000	1.932638	4.157756
<b>Lnopennes</b>	-.1314	.0828817	-1.59	0.113	-.2938583	.031032
<b>Lnlexp</b>	85.83**	34.65263	2.48	0.013	17.91709	153.7529
<b>lnhealth_exp</b>	-.2919***	.0975321	-2.99	0.003	-.4831403	-.1008216
<b>lnagr_add_value</b>	-.1382932	.1326339	-1.04	0.297	-.398251	.1216645
<b>Lnurb</b>	-11.26867	8.934958	-1.26	0.207	-28.78086	6.243529
<b>T</b>	-.329**	.1281354	-2.57	0.010	-.5804127	-.078131
<b>Johan</b>	-.3206668	.245322	-1.31	0.191	-.8014892	.1601556
<b>t_johan</b>	.0265889	.0340903	0.78	0.435	-.040227	.0934047

Us usual the coefficient of the GDP is positive and significant at the level of 1%. The life expectancy is also positive and significant at the level of 5%; this is explained by the fact the majority of population works in pollutant industries and a part of their salary will be spent in

medical care. But while the life expectancy increases following an increase in CO2 emission we can question here on the quality of this life. The response is derived from the coefficient of health expectancy which is negative and significant at the level of 1%. This means that in the adult or the old age the Brazilian can-not has an independent Life (because he has functional limitation requiring the assistance of another person or complex assistive device)

## China

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoskedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 19
Estimated covariances = 1	Number of groups = 1
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 10	Wald chi2(9) = 8130.89
Log likelihood = 50.04216	Prob > chi2 = 0.0000

Inco2_emiss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Lngdp	-.9645922	.598867	-1.61	0.107	-2.13835	.2091655
Lnopennes	.2277***	.0816836	2.79	0.005	.067703	.3878968
Lnlexp	-2.270157	8.448163	-0.27	0.788	-18.82825	14.28794
lnhealth_exp	.2250732	.1706262	1.32	0.187	-.1093481	.5594944
lnagr_add_value	-.0622507	.2358271	-0.26	0.792	-.5244633	.3999619
Lnurb	12.88076	3.135492	4.11	0.000	6.735312	19.02621
T	-.3470***	.0474446	-7.31	0.000	-.4400301	-.2540508
Johan	-.7793***	.1451233	-5.37	0.000	-1.063789	-.4949155
t_johan	.0969***	.0174705	5.55	0.000	.062724	.1312072

In the case of China the coefficient of GDP is negative and slightly significant (10,7%). This result is strange because we wait a positive and significant coefficient. The trade openness has

a positive and significant effect on CO2 emission. This means that the China continues to export pollutant goods or goods produced on pollutant industries. Also, the urbanism seems to have a positive effect on CO2 emission at the level of 1%. These signify that individuals are grouped in the areas in which they can work and find a job (industrial sector, service sector etc.). The time has a negative and significant effect, on CO2 emission, meaning that china reduces more and more their emissions of dioxide of Carbone. The dummy variable has a negative and significant effect on CO2 emission showing that China is constrained by the Johannesburg obligations and recommendations. Nevertheless in the period post-Johannesburg, china will continue to contribute in the emission of CO2 but in little quantities (the coefficient is 0.0969)

## Norway

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoskedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 19
Estimated covariances = 1	Number of groups = 1
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 10	Wald chi2(9) = 91.06
Log likelihood = 29.87618	Prob > chi2 = 0.0000

Inco2_emiss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Lngdp	2.377855	1.488998	1.60	0.110	-.5405284	5.296238
Lnopennes	-1.850*	.8517064	-2.17	0.030	-3.519675	-.1810476
Lnlexp	2.675897	9.278087	0.29	0.773	-15.50882	20.86061
lnhealth_exp	1.294***	.3946115	3.28	0.001	.5205868	2.067435
lnagr_add_value	.4200**	.1792257	2.34	0.019	.0687711	.771323
Lnurb	15.25**	7.633588	2.00	0.046	.295198	30.21831
T	-.11573	.0737408	-1.57	0.117	-.2602644	.0287943
Johan	-.1912	.3635202	-0.53	0.599	-.903765	.5212082
t_johan	-.0404645	.0446828	-0.91	0.365	-.1280412	.0471121

In the Norway case we note that the GDP is not dependent to CO2 emission. This is a logical result because the Scandinavian countries were the first to substitute the pollutant energy by clean and pure energy. The trade openness has a negative and significant effect on CO2. In

absolute value, the coefficient of "openness variable" was the greater relatively to the other countries. This means that this country had developed his commercial strategy in the export and the import of clean goods. The health expectancy is positive and significant at the level of 1%. This result is strange while we can explain it by the fact that the transition to another development model based on clean industry can reduce the total amount of revenue per capita. Nevertheless, in the old strategy based on pollutant industries, the revenue per capita was more important and used, in part, to medical care. The coefficients of the agriculture added value and urbanism were in both cases positive and significant at the level of 5%, meaning that in ancient development strategy model the CO2 emission is necessary for agriculture sector and facilitate the life in urban area.

## France

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoskedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 19
Estimated covariances = 1	Number of groups = 1
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 10	Wald chi2(9) = 246.80
Log likelihood = 49.6277	Prob > chi2 = 0.0000

Inco2_emiss	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Lngdp	.4680085	.8823245	0.53	0.596	-1.261316	2.197333
Lnopennes	-.1026255	.2671276	-0.38	0.701	-.626186	.420935
Lnlexp	-2.714452	1.987457	-1.37	0.172	-6.609797	1.180893
lnhealth_exp**	.2205344	.1098543	2.01	0.045	.0052239	.435845
lnagr_add_value	.0355548	.0837905	0.42	0.671	-.1286716	.1997812
Lnurb	-17.19705	12.99942	-1.32	0.186	-42.67544	8.281337
T	.0605*	.0361261	1.68	0.094	-.0102593	.1313526
Johan	.2017152	.1393128	1.45	0.148	-.0713329	.4747633
t_johan	-.0288394	.0205059	1.41	0.160	-.0690302	.0113515
_cons	81.56036	56.52504	1.44	0.149	-29.22668	192.3474

In this case it seems that France all variables are not significant except the variable of health expectancy which had a positive and significant effect at the level of 10%

## Tunisia

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoskedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 19
Estimated covariances = 1	Number of groups = 1
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 10	Wald chi2(9) = 1177.47
Log likelihood = 55.03873	Prob > chi2 = 0.0000

<b>lnco2_emiss</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>z</b>	<b>P&gt; z </b>	<b>[95% Conf. Interval]</b>	
<b>Lngdp</b>	.3920927	.3541934	1.11	0.268	-.3021136	1.086299
<b>Lnopennes</b>	.1278447**	.0585485	2.18	0.029	.0130918	.2425977
<b>Lnlexp</b>	.4150932	1.763802	0.24	0.814	-3.041895	3.872081
<b>lnhealth_exp</b>	.0675813	.0943118	0.72	0.474	-.1172664	.2524289
<b>lnagr_add_value</b>	-.00090	.0657689	-0.01	0.989	-.1298048	.1280046
<b>Lnurb</b>	-.8217602	4.589846	-0.18	0.858	-9.817692	8.174172
<b>T</b>	.0222726	.0272581	0.82	0.414	-.0311523	.0756975
<b>Johan</b>	.2067296	.1763057	1.17	0.241	-.1388232	.5522824
<b>t_johan</b>	-.0285679	.0213299	-1.34	0.180	-.0703738	.013238
<b>_cons</b>	-1.771734	19.79929	-0.09	0.929	-40.57763	37.03417

In this case it seems that the emission of CO2 is independent of all variables of the model except the variable of openness which implies that Tunisia import and export goods that are produced from pollutant industries.

## USA

Coefficients: generalized least squares	panel variable: id (strongly balanced)
Panels: homoskedastic	time variable: year, 1995 to 2013
Correlation: no autocorrelation	Number of obs = 19
Estimated covariances = 1	Number of groups = 1
Estimated autocorrelations = 0	Time periods = 19
Estimated coefficients = 10	Wald chi2(9) = 1876.53
Log likelihood = 70.38933	Prob > chi2 = 0.0000

<b>lnco2_emiss</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>z</b>	<b>P&gt; z </b>	<b>[95% Conf. Interval]</b>	
<b>Lngdp</b>	.9904***	.1486354	6.66	0.000	.6991415	1.281782
<b>Lnopennes</b>	.0369	.0416543	0.89	0.374	-.0446461	.1186355
<b>Lnlexp</b>	.5035219	1.180825	0.43	0.670	-1.810853	2.817897
<b>lnhealth_exp</b>	-.1435197	.1106401	-1.30	0.195	-.3603703	.0733309
<b>lnagr_add_value</b>	.0385*	.0229383	1.68	0.093	-.0064531	.0834633
<b>Lnurb</b>	-5.876604	4.378912	-1.34	0.180	-14.45911	2.705906
<b>T</b>	.0090514	.0185781	0.49	0.626	-.0273611	.0454639
<b>Johan</b>	.1396**	.0621597	2.25	0.025	.0177717	.2614333
<b>t_johan</b>	-.0162103	.0086959	-1.86	0.062	-.0332539	.0008332

In the case of the USA the model strategy of development is mainly based on pollutant industrial sector. This is proved here by the coefficient positive and significant at the level of 1% of GDP. The capitalization of the agriculture sector by an intensive use of tractors and machinery has positive effects on CO2 emission at the level of 10%. The effect of the dummy variable is positive and significant at the level of 5%. This implies that in this earth summit USA had given some concession and engaged itself to reduce their CO2 emissions

### Recapitulation of results

	lngdp	openness	lexp	Health exp	time	johan	urbanism	Agri value added	txjohan
<b>Panel</b>	(+) et Sign	(-) et Sign	(+) et Sign	(-) et Sign	NS	(-) et Sign	(-) et Sign	(-) et Sign	(+) et Sign
<b>Saudu Arabia</b>	NS	NS							
<b>Australia</b>	(+) et Sign	(+) et Sign	NS	NS	(-) et Sign	NS	NS	NS	NS
<b>Brasil</b>	(+) et Sign	NS	(+) et Sign	(-) et Sign	(-) et Sign	NS	NS	NS	NS
<b>China</b>	NS	(+) et Sign	NS	NS	(-) et Sign	(-) et Sign	NS	NS	(+) et Sign
<b>Norway</b>	NS	(-) et	NS	(+) et	NS	NS	(+) et	(+) et	NS

		Sign		Sign			Sign	Sign	
<b>France</b>	NS	NS	NS	NS	(+) et Sign	NS	NS	NS	NS
<b>Tunisia</b>	NS	(+) et Sign	NS	NS	NS	NS	NS	NS	NS
<b>usa</b>	(+) et Sign	NS	NS	NS	NS	(+) et Sign	NS	(+) et Sign	NS

\* (+) et Sign: positive and significant effects

\*(-) et Sign: negative and significant effects

\* NS: non-significant

## Conclusion

In this paper we have tried to know the effects of growth, trade liberalization, the time and the implication of countries in the protection of environment on the CO2 emissions. The results showed at the level of the entire group that GDP and life expectancy have a positive effect on CO2 emission. The urbanism, health expectancy and agriculture value added have negative effects. The dummy variable had a negative effect which means that the world conscious become more and greater to reduce CO2 emission. The composite variable has a negative effect which means that in the period post-johunsbourg the CO2 emission is effectively less.

## References

Antweiler, W., Copeland, B. R., & Taylor, M. S. (1998). *Is free trade good for the environment?* (No. w6707). National bureau of economic research.

Alcántara, R., Jiménez-Mateos, J. M., Lavela, P., & Tirado, J. L. (2001). Carbon black: a promising electrode material for sodium-ion batteries. *Electrochemistry Communications*, 3(11), 639-642.

Aslanidis, N., & Xepapadeas, A. (2008). Regime switching and the shape of the emission–income relationship. *Economic Modelling*, 25(4), 731-739.

Azomahou, T., Laisney, F., & Van, P. N. (2006). Economic development and CO 2 emissions: a nonparametric panel approach. *Journal of Public Economics*, 90(6), 1347-1363.

Bagliani, M., Bravo, G., & Dalmazzone, S. (2008). A consumption-based approach to environmental Kuznets curves using the ecological footprint indicator. *Ecological Economics*, 65(3), 650-661.

Baek, J., Cho, Y., & Koo, W. W. (2009). The environmental consequences of globalization: A country-specific time-series analysis. *Ecological Economics*, 68(8), 2255-2264.

Boutabba, M. A. (2013). The Impact of Financial Development. Income, Energy, and Trade on Carbon Emissions: Evidence from the Indian Economy. University of d'Evry Val d'Essonne, France, Retrieved from <http://epee.univ-evry.fr/RePEc/2013/13-05.pdf>.

Cleveland, C. J., Kaufmann, R. K., & Stern, D. I. (2000). Aggregation and the role of energy in the economy. *Ecological Economics*, 32(2), 301-317.

Cropper, M., & Griffiths, C. (1994). The interaction of population growth and environmental quality. *The American Economic Review*, 84(2), 250-254.

Coondoo, D., & Dinda, S. (2008). Carbon dioxide emission and income: A temporal analysis of cross-country distributional patterns. *Ecological Economics*, 65(2), 375-385.

Del Giorgio, P. A., & Cole, J. J. (1998). Bacterial growth efficiency in natural aquatic systems. *Annual Review of Ecology and Systematics*, 503-541.

Frankel, J. A., & Rose, A. K. (2005). Is trade good or bad for the environment? Sorting out the causality. *Review of Economics and Statistics*, 87(1), 85-91.

Gale, L. R., & Mendez, J. A. (1998). The empirical relationship between trade, growth and the environment. *International Review of Economics & Finance*, 7(1), 53-61.

Galeotti, M., & Lanza, A. (2005). Desperately seeking environmental Kuznets. *Environmental Modelling & Software*, 20(11), 1379-1388.

Georgescu-Roegen, N. (1993). The entropy law and the economic problem. *Valuing the earth: Economics, ecology, ethics*, 75-88.

Grossman, G. M., & Krueger, A. B. (1996). The inverted-U: what does it mean?. *Environment and Development Economics*, 1(01), 119-122.

Grossman, G. M., & Krueger, A. B. (1994). *Economic growth and the environment* (No. w4634). National Bureau of Economic Research.

Huang, D., Knyazikhin, Y., Dickinson, R. E., Rautiainen, M., Stenberg, P., Disney, M., et al. (2007). Canopy spectral invariants for remote sensing and model applications. *Remote Sensing of Environment*, 106, 106-122.

Hassaballa, H. (2013). Environment and foreign direct investment: policy implications for developing countries. *Journal of Emerging Issues in Economics, Finance and Banking*, 1(2), 76.

Halkos, G. E., & Tsionas, E. G. (2001). Environmental Kuznets curves: Bayesian evidence from switching regime models. *Energy Economics*, 23(2), 191-210.

Hill, R. J., & Magnani, E. (2002). An exploration of the conceptual and empirical basis of the environmental Kuznets curve. *Australian Economic Papers*, 41(2), 239-254.

Jorgenson, D. W., Ho, M. S., & Stiroh, K. J. (2007). A retrospective look at the US productivity growth resurgence. *FRB of New York Staff Report*, (277).

Jayanthakumaran, K., Verma, R., & Liu, Y. (2012). CO 2 emissions, energy consumption, trade and income: a comparative analysis of China and India. *Energy Policy*, 42, 450-460.

Kriström, B., & Lundgren, T. (2005). Swedish CO 2-emissions 1900–2010: an exploratory note. *Energy Policy*, 33(9), 1223-1230.

Neumayer, E. (2002). Do democracies exhibit stronger international environmental commitment? A cross-country analysis. *Journal of peace research*, 39(2), 139-164.

Pethig, R. (1976). Pollution, welfare, and environmental policy in the theory of comparative advantage. *Journal of environmental economics and management*, 2(3), 160-169.

Panayotou, T. (1993). *Empirical tests and policy analysis of environmental degradation at different stages of economic development* (No. 292778). International Labour Organization.

Rafique, E., Mahmood-ul-Hassan, M., Rashid, A., & Chaudhary, M. F. (2012). Nutrient balances as affected by integrated nutrient and crop residue management in cotton-wheat system in Aridisols. I. Nitrogen. *Journal of plant nutrition*, 35(4), 591-616.

Richmond, A. K., & Kaufmann, R. K. (2006). Is there a turning point in the relationship between income and energy use and/or carbon emissions?. *Ecological economics*, 56(2), 176-189.

Roy, N., & van Kooten, G. C. (2004). Another look at the income elasticity of non-point source air pollutants: a semiparametric approach. *Economics Letters*, 85(1), 17-22.

Sebri, M. (2009). *The Mediterranean Zone in front of Air pollution: an Econometric Investigation* (No. 32382). MPRA Working Paper.

Shafik, N., & Bandyopadhyay, S. (1992). *Economic growth and environmental quality: time-series and cross-country evidence* (Vol. 904). World Bank Publications.

Selden, T. M., & Song, D. (1994). Environmental quality and development: is there a Kuznets curve for air pollution emissions?. *Journal of Environmental Economics and management*, 27(2), 147-162.

Soytas, U., Sari, R., & Ewing, B. T. (2007). Energy consumption, income, and carbon emissions in the United States. *Ecological Economics*, 62(3), 482-489.

Shahbaz, M., Hye, Q. M. A., Tiwari, A. K., & Leitão, N. C. (2013). Economic growth, energy consumption, financial development, international trade and CO 2 emissions in Indonesia. *Renewable and Sustainable Energy Reviews*, 25, 109-121.

Tobey, J. A. (1990). The effects of domestic environmental policies on patterns of world trade: an empirical test. *Kyklos*, 43(2), 191-209.