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Abstract

In This paper we try to investigate the impact of CO2 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 johansburg) in eight countries covering all world economic groups (Tunisia, Saudi Arabia, France, Norway, Bresil, USA, China and Australia). The empirical results have showed that the GDP continue to be the principal variable which is inciting to the CO2 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, CO2, 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_2, 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_2) 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_2 emissions had grown from 1.7 billion tons in 1950 to over 18 billion tons in 2000. The CO_2 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_2 emissions, CO_2 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 CO2 emissions) on macroeconomic and socio-economic variables is explained by two basic reasons.

The fundamental reason underlying such an interest is the fact that CO2 was, until then, doubly valued and subjected to two distinct approaches: an economic approach and an environmental approach. The economic approach considers the CO2 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 CO2 and economic growth.

The second reason is that limiting only to CO2 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 CO2 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)

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

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 (SO2, NOx, CO, CO2, 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).

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 SO2, 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 SO2, deforestation whose turning point is $ 3,137.

Grossman and Krueger (1993) and (1996) used a random effects model to analyze the evolution of some environmental indicators for several countries. The sample consists of a variety of developed and developing countries, which are selected so that the aggregate sample is representative and comprehensive. The EKC has been obtained only for the water pollution, SO2 and SPM. The value of GDP / head for the S02 and SPM to have positive effects on the environment (turning points) is between 4,000 and 5,000 dollars.

Selden and Song (1994) used four pollutants (SO2, SPM, NOx and CO) and, have recourse to the same data of Grossman and Krueger (1993, 1995). An inverted U-shaped curve was observed for the four pollutants. However, the turning points are high and exceed $ 8000 in 1985 for SO2 and SPM. Cropper and Griffith (1994) used a polynomial regression model for a sample of 64 countries from 1961 to the end 1991. to study the phenomenon of deforestation. The results of the analysis indicate that the EKC is validated only for countries in Africa and Latin America with turning points between 4760 and 5420. For the majority of countries turning points are larger than their GDP / capita.

Galeotti and lanza (2005), have considered the two functions Gamma and Weibull as alternatives to the polynomial function which analyzes the increase in CO2 based economic growth in a sample of three groups of countries (OECD, non-OECD membres 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.

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 plynomiale function while the curve growing is obtained with the recourse to kernel regression.

Richmond and Kaufmann (2006) analyzed 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 been verify 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.

Coondoo and Dina (2008) Have Studied the effect of inequality inter-country on the inequality of CO2 Emissions Through technical analysis of the cointegration Johansen for a sample of 88 countries from 1960 to1990. The authors have concluded that inter-countriesincome inequality has a significant effect on the medium level of emissions and and on emissions inequality.

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.

Roca and Alcántara (2001) studied the role of energy in the evolution of CO2 emissions in the case of Spain from 1972 to1997. The results indicate that the EKC is not validated.

Kriström and Lundgren (2005) have analyzed the increase of CO2 in Sweden from 1900 to 1999 and from 2000 to 2010 (forecast). The results of the authors are two in number. One is that the strongly positive relationship between CO2 emissions and GDP per capita took place primarily during the years of wars and in the years of oil crises. The second is a gradual reduction of CO2 emissions will occur between 2000 and 2010 (forecast).

Focassi (2005) had analyzed the evolution of CO2 emissions and consumption of energy for the case of Brazil, China and India from1969 to 1997 and from1960 to1997. The author had concluded that the said relationship decreases in the case of Chin and, increases in the case of India and Brazil.

Soytas et al. (2007) have studied the causality link between GDP, energy consumption and CO2 emissions in the United States between 1960 and 2004. They concluded that economic growth alone does not counteract environmental degradation since income does not cause, according to Granger, CO2 emissions while it exists a causal link between the consumption of energy and CO2 emissions.

Behrens et al. (1997) adopted the generalized gamma function as an alternative to the polynomial function, to study the municipal waste to the United States. The advantage of the Gamma function is that it is more flexible and its parameters are easier to interpret. The results indicate that the EKC is validated with a $ 20,000 turning point.

Halkos and Tsionas (2001) tested the KEC for deforestation and the CO2 with a non-linear approach and a regime switching model for a sample of 61 countries. The results indicate that the EKC is not validated.

Hill and Magnani (2002) tested the EKC for CO2 for a sample of 156 countries during the three years 1970, 1980 and 1990. The results of the study are twofold. The first is that the EKC is validated for three years. The second is that turning points are very high.

Neumayer (2002) studied the econometric significance of climatic conditions, availability of renewable resources for a sample of 148 countries and a logarithmic model. The results indicate that the EKC is validated with a turning point, greater than the values of the income of all countries.

Roy and Van Kooten (2004) have analyzed the evolution of CO2, and NOx? in the US for 1990, with a semi-parametric approach. The authors' conclusions are twofold. The first, the EKC is not validated. The second is that the parametric quadratic specification was rejected in favor of the non-parametric approach.

Bagliani et al. (2008), have used the ordinary least squares and the weighted least square on the linear, quadratic and cubic specifications on level and on logarithm and a nonparametric approach to study the ecological effects for a sample of 141 countries during 2001. the results indicate that the EKC is not validated in all cases of methods.

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 understand this relationship, it is helpful to explain the three effects influencing the level of pollution following trade liberalization:

A scale effect: mass production following the specialization in the sectors where it has a comparative advantage, and which conducts therefore to an evolution of pollution.

A composition effect: the liberalization will lead to the use of factors (labor and capital) the most abundant and in which the effect on pollution depends on the situation of the intensive activities on pollution in the countries that have strict environmental regulations.

A technical effect: liberalization may lead to transfer of technology and increased revenues in developing countries, and thereby induce more demand for a cleaner environment.

Pethig (1976) used the Ricardien model to show that countries in which environmental regulations was relatively low tend to export goods intensive, in environmental resources. Neverless, in countries where exists a 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 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 countries.

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 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 SO2 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 SO2 concentrations.

Antweiler et al (1998) have divided the impact of trade on environmental quality on three effets : scale effect, composition effect and technical effect for a sample of 44 countries takinh into account two variables SO2 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 SO2. 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 CO2 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 (NO2) 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, SO2, NO2 and other polluant 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 favorable 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 CO2 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 CO2 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 CO2 emissions. Mahmood & Chaudhary (2012) analyzed the effects of FDI on CO2 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 CO2 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 CO2 emissions in Pakistan, but short the effect is not significant.

Hassaballa (2013) used a dynamic panel model to examine the impact of FDI on CO2 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 CO2 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 (CO2) are causing the environmental degradation and decreased social welfare.

Eric Lambin (2009) in his book "an 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 CO2 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 CO2 emissions on life expectancy in 8 oil exporting countries between 2000 and 2010. The short-term elasticities revealed that the per capita GDP and CO2 emissions have a negative effect and significant on life expectancy.
Mehrara Masoumi M and MR (2014) studied the relationship between life expectancy, CO2 and GDP to 108 developing countries between 1995 and 2012. The results

indicate the absence of EKC. The authors added emissions of CO2 as an endogenous variable in the model, they found an increase in the effect of CO2 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 CO2 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 CO2 emissions per capita GDP. -The middle-income countries have a significant and unidirectional causal direction of CO2 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 CO2 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:

$$logCO2_{it} = \alpha_0 + \alpha_1 loggdp_{it} + \alpha_2 logopeness_{it} + \alpha_3 loglexp_{it} + \alpha_4 loghealthexp_{it} + \alpha_5 logagr\_add\_value_{it} + \alpha_6 logurb_{it} + \alpha_7 time_{it} + \alpha_8 johan_{it} + \alpha_9 time \times johan_{it} + \gamma_i + \varepsilon_{it} \qquad \textbf{(1)}$$

- $CO2$: Carbon dioxide emissions, measured on metric tons per capita, are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring.

- gdp: Gross domestic product

$openess$: Degree of openness of the economy

$lexp$: life expectancy

Johan : is a dummy variable which take the value 1 if the country submits to the demands and exigencies of earth summit of johansburg conference and 0 otherxise

$time$: represents the number of year of variables values, t=0 to 19

$healthexp$: 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.

agr_add_value : africulture added value

urb : urbanization rate

To specify the model it is significant to examine, first, the correlation entre les variables in the model through the correlation matrix and to detect correlations That can skew the results Eventually.

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

with,

$X_i =$ $\mathrm{loggdp_t, logopeness_t, loglexp_{it}, loghealthexp_t, logagraddedvalue_t, logurb_t, time_t, johan_t, time \times johan_t\}}$

Tableau 2 : Hausman Test:

	Coefficients			
	(b)	(B)	(b-B)	Sqrt (diag (V_b-V_B))
	Fe	re	Difference	S.E.
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

chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 0.42
Prob>chi2 = 1.0000
We have Prob>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> 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 autocorrelated. 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 conclud that there is a first-order autocorrelation.

Second, to test the homoscedasticity, we will recoursin 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 the residues are heteroscedastiques.

Nous sommes en présence d'hétérocédasticité et d'autocorrélation sérielle, donc nous appliquons la méthode d'estimation FGLS pour estimer notre modèle.

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

lnco2_emiss	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
Lngdp	1.68***	.2041735	8.24	0.000	1.281411	2.081757
Lnopennes	-.7262***	.1254061	-5.79	0.000	-.9720823	-.4804994
Lnlexp	6.391**	2.541351	2.51	0.012	1.410402	11.37231
lnhealth_exp	-1.34***	.1517946	-8.83	0.000	-1.637754	-1.042731
lnagr_add_value	-.462**	.1991962	-2.32	0.020	-.8528741	-.0720395
Lnurb	-.649**	.3171483	-2.05	0.041	-1.270755	-.0275561
T	-.0116606	.032348	-0.36	0.718	-.0750615	.0517402
Johan	-.581**	.249414	-2.33	0.020	-1.070359	-.0926746
t_johan	.0923***	.0355893	2.59	0.009	.0225925	.1621001
_cons	-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 leads us to say that while the succession of earth summits (Rio, Johansburg etc.) and the implication of the majority of countries to apply its recommandations, these countries have continu always in the same strategy of growth based on pollutant industries. Nevertheless, the openess has a negative and significant effet on ehe 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 indutries.

The health expectancy, the agriculture value added and the urbanism have all a negative and significant effects on CO_2 emission at the levels of 1% and 5%. First, concerning the health expectancy we judge that this result is logic since the CO_2 emission, can destruct the health and contribute to the appearing of several diseases. Second, it seems that agriculture sector is also threeted by CO_2 emission because the palnts need a clean and pure air. Third the negative relation between urbanism and CO_2 emission appears strange and diverge from the economic logic. The time has a negative and non significant effect on CO_2 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 CO_2 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-johunsburg summit all countries will try to contribute in the world effort to reduce their emission of CO_2. This needs to reflect on new development strategies less pollutant or no pollutant.

Individuel 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

lnco2_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 signifatives. 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 very extended and not feel 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

lnco2_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”

Brésil

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

lnco2_emiss	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
lngdp	3.045***	.5676426	5.36	0.000	1.932638	4.157756
Lnopennes	-.1314	.0828817	-1.59	0.113	-.2938583	.031032
lnlexp	85.83**	34.65263	2.48	0.013	17.91709	153.7529
lnhealth_exp	-.2919***	.0975321	-2.99	0.003	-.4831403	-.1008216
lnagr_add_value	-.1382932	.1326339	-1.04	0.297	-.398251	.1216645
lnurb	-11.26867	8.934958	-1.26	0.207	-28.78086	6.243529
t	-.329**	.1281354	-2.57	0.010	-.5804127	-.078131
johan	-.3206668	.245322	-1.31	0.191	-.8014892	.1601556
t_johan	.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 questioned 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 bresilien can-not has an independent Life (because he has functional limitation requiring the assistance of another person or complex assistive device)

Chine

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

lnco2_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

lnco2_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 effet 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 tne 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

lnco2_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

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

lnco2_emiss	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Lngdp	.9904***	.1486354	6.66	0.000	.6991415	1.281782
Lnopennes	.0369	.0416543	0.89	0.374	-.0446461	.1186355
Lnlexp	.5035219	1.180825	0.43	0.670	-1.810853	2.817897
lnhealth_exp	-.1435197	.1106401	-1.30	0.195	-.3603703	.0733309
lnagr_add_value	.0385*	.0229383	1.68	0.093	-.0064531	.0834633
Lnurb	-5.876604	4.378912	-1.34	0.180	-14.45911	2.705906
T	.0090514	.0185781	0.49	0.626	-.0273611	.0454639
Johan	.1396**	.0621597	2.25	0.025	.0177717	.2614333
t_johan	-.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 CO_2 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 CO_2 emissions

Recapitulation of results

	lngdp	openness	lexp	Health exp	time	johan	urbanism	Agri value added	txjohan
Panel	(+) et Sign	**(-) et** Sign	(+) et Sign	**(-) et** Sign	**NS**	**(-) et** Sign	**(-) et** Sign	**(-) et** Sign	(+) et Sign
Saudu Arabia	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Australia	(+) et Sign	(+) et Sign	**NS**	**NS**	**(-) et** Sign	**NS**	**NS**	**NS**	**NS**
Brasil	(+) et Sign	**NS**	(+) et Sign	**(-) et** Sign	**(-) et** Sign	**NS**	**NS**	**NS**	**NS**
China	**NS**	(+) et Sign	**NS**	**NS**	**(-) et** Sign	**(-) et** Sign	**NS**	**NS**	(+) et Sign
Norway	**NS**	**(-) et** Sign	**NS**	**(+) et** Sign	**NS**	**NS**	**(+) et** Sign	**(+) et** Sign	**NS**
France	**NS**	**NS**	**NS**	**NS**	**(+) et** Sign	**NS**	**NS**	**NS**	**NS**
Tunisia	**NS**	**(+) et** Sign	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
usa	**(+) 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.

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