Trade liberalization, FDI inflows, Environmental quality and Economic growth: A comparative analysis between Tunisia and Morocco

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Abstract

The aim of this research is to investigate the economic impacts of the trade liberalization on the environmental quality in Tunisia and Morocco**.** Specifically, the paper inspects whether liberalization of the trade sector has harmed the quality of the environment in both countries. To this end, we conduct various econometric models: a VECM and cointegration techniques for single country case study and a Panel VECM and Panel cointegration when using data of both country as a group. We also include a dummy variable in each model to see the real impact of trade liberalization for both countries. In the empirical section, we found bidirectional causality between FDI and CO2. This implies that the nature of FDI inflows to Morocco and Tunisia are not clean FDI. These results show that trade liberalization has a negative impact on environmental. The paper concludes that although trade liberalization boosted the economies of both countries by creating new employment opportunities, liberalization has harmed the environment.

1. Introduction

Recently, the effect of trade on the environmental quality has received a special attention by scholars and policymakers. In fact, the liberalization of trade sector has led to an expansion of the international exchange activities and the surge of FDI in manufacturing and energy-consuming sectors. As a result, the use of energy increased drastically, pollutant emissions surged and the environmental quality degenerated. All these factors have increased the vulnerability of the ecosystem especially in developing countries.

To investigate the real impact of trade on environment, various studies have analyzed the dynamic relationship between trade liberalization, energy usage and economic growth. Most of the researches agreed first that trade liberalization has improved allocation of domestic resources. However, when introducing the energy sector in their models, the results are conflicting. In fact, some studies found that liberalization of trade reduced pollution and decreased the use of energy efficiency. For example, the study by Sbia *et al.* (2014) found that liberalization of trade increased the flows of new technology which replaced the old technology heavily consuming of energy. In another paper by Brack (1998), show that trade liberalization opened the doors to international companies specializing in green and clean energy and concludes that liberalization benefits the environment. Similarly, the study by Vona and Nicolli (2013) investigated the effect of energy liberalizations on policies that support renewable energy in a panel of 28 OECD countries observed over 28 years. They found that energy market liberalization has a positive and perhaps unintended impact on renewable energy policies and that energy liberalization increases the public support to renewable energy. In this case, literature shows that trade liberalization promoted green energy. In another type of literature, some studies found that liberalization of trade has deteriorated the environmental quality. For example, the study by Lopez (1992) shows that trade liberalization was followed by an increase in energy-based-activities such as manufacturing and transportation that consume high energy product and produce pollution.

In this paper we will contribute in the existing literature by focusing our attention to Tunisia and Morocco. The two neighboring countries have been considered as the new gate of Europe to Africa and *vice versa*. The choice of these two countries among others is justified by several reasons. First, both countries present common characteristics regarding geographical context and natural wealth. Second, the commercial policy undertaken by both countries shows similarity at different levels: the framework in which was begun, the objective and the consequences of this commercial liberalization policy. Third, both countries have ratified most important trade agreements in the same period. For Tunisia, trade liberalization policy was gradually implemented under the so called Structural Adjustment Programs (SAPs) adopted in 1986. The objective of this Program is to stabilize the economy and to restore the structural equilibrium. In November, 1959, Tunisia was temporarily admitted to the general agreements on tariffs and trade (GATT) and officially became a member in July 1990. Few years later, in April 15th 1994, Tunisia became a member of the World Trade Organization (WTO henceforth). In 1995, Tunisia was the first country of the South Mediterranean Sea to sign an agreement of trade cooperation with the EU and on March 1st 1998 the agreement established a free trade area between both parts.

The commercial liberalization policy in Morocco was also established within the (SAPs) to put the country into a globalized economy and to benefits the international economic relations. The adoption of the (SAPs) was also implemented after a period of fiscal imbalances and an underdeveloped financial sector. Like Tunisia, the trade liberalization was launched in some steps. Firstly, Morocco was admitted as a membership in the GATT in May, 1987. Second, it signed its membership in the World Trade Organization in April, 1994. Third, it ratified the agreement of association with the European Union in 1996 and that of free trade with the European association in 1999. Finally, Morocco signed the agreement of Agadir and the decision of the free trade agreement with the United States and Turkey in 2004.

Since the date of their trade liberalizations, the use of energy, notably carbon dioxide (CO_2 Henceforth) exploded. According to the indicators of the World Bank, CO_2 emission in Tunisia was 1.62 in 1990 against 0.95 for Morocco. In 1995, the CO_2 emission jumped to 1.75 for Tunisia and 1.13 for Morocco. That value continues to record a high level to reach 2.45 for Tunisia and 1.59 for Morocco in 2010.

Given the progress and the performance of the two countries, they are now competing to provide the most attractive environment for foreign investors and they are also competing to ensure better political stability, sound economic policies, a modern and well developed infrastructure and a highly qualified workforce (Hamdi, 2013). However, what are the spillovers effects of trade liberalization on the quality of environment?

The aim of this research is to investigate the economic impacts of the trade liberalization on the environmental quality in Tunisia and Morocco**.** Specifically, the paper inspects whether liberalization of the trade sector has harmed the quality of the environment in both countries.

In this paper, we conduct various models: a VECM and cointegration techniques for single country case study and a Panel VECM and Panel cointegration when using data of both country as a group. We also include a dummy variable in each model to see the real impact of trade liberalization for both countries. The most important result found in the empirical section is the bidirectional causality between FDI and CO2. This implies that the nature of FDI inflows to Morocco and Tunisia are not clean FDI. Unfortunately, foreign investors did not bring with them their own advanced technology while investing in Morocco and Tunisia to maximize the profits.

The remainder of the paper is organized as follows. Section 2 presents a literature review on trade liberalization, economic growth and environment quality. Section 3 describes the data and methodology. Empirical results are presented in section 4 while the concluding remarks and policy implications are reported in Section 5.

2. Literature review

The relationship between trade liberalization, economic growth and the environmental quality has received a great interest by scholars and policy makers during the past few years. Both theoretical and empirical researches have provided mixed and conflicting evidences on the effect of trade on economic growth and environment. The effect of trade openness differs from the point of view of environmental and ecological economists.

Environmental economists assume a positive relationship between free trade, economic growth and environmental policies. Most of the literature considers that trade liberalization leads to an increase in welfare derived from an improved allocation of domestic resources. According to the theory of the comparative advantage (Ricardo1817), the trade openness is determined by the level of productivity or by the technological advance. Also and according to the model of Heckscher and Ohlin (1933), the level of commercial openness is explained by its relative subsidy in factors of production. In another opinion, ecological economists criticize the assumptions developed by environmental economists. The effect of trade liberalization on the environment quality can divided in three types. The first type is the scale effect in which trade openness is supposed to stimulate the domestic consumption and the level of production and thus accelerate the economic activity. The second type is the technical effect and it is associated with a positive effect on environment. Trade liberalization offers the opportunities of the transfer of advanced technology generally less polluting and strengthens the environmental regulation. The third effect is the composition effect; it appears when trade is seemed to have an impact on the modification of the economic structure of the host-country.

In the following section, we present the association between trade and growth and the environmental effects of trade. Also, we provide a survey on the positive and negative effect of trade on both growth and environment.

2.1. Trade liberalization and economic growth

While literature on trade openness and growth is huge (Dollar, 1992; Sachs and Warner, 1995; and Frankel and Romer (1999)), studies on trade liberalization -economic growth nexus is still limited. The available researches have provided conflicting results on the real effect of trade liberalization on economic growth since some studies have found positive impacts and some other negative impacts. However, as Greenaway (1998) opined, empirical studies have found more cases of positive than negative impacts. For example, Little et *al* (1970), Krueger (1978), Bhagwati (1978) and Papageorgiou, Michaely, and Choksi (1991) have found that trade liberalization leads to more rapid growth of exports and consequently GDP, without significant transitional costs of unemployment. In other studies, trade liberalization leads to growth in exports and improvement in the current account. This result explains while some countries have in-creased investment following liberalization, while some others suffered an investment slump.

The effect of trade liberalization on economic growth varies from a study to another and from a country to another. For example, the study of Wacziarg and Welch (2008) witch updates the Sachs and Warner (1995) indicator of liberalization shows that the difference in growth between a liberalized and non-liberalized country is 1.53% points while it varies between 1% and 4% according to Salinas and Aksoy (2006).

By incorporating the dynamic adjustments of business and households to changes in trade policy, Ho and Jorgenson, (1994) have found that the multilateral elimination of tariffs alone in the beginning of 1980 raised long-run consumption by 0.82 percent, compared to an initial gain of only 0.16 percent. When both tariffs and major quotas are lifted, the long-run gain in consumption is estimated to be 1.08 percent. For a panel of 100 developed and developing countries observed during the period 1970 to 1997, Yanikkaya (2003) investigated the link between trade openness and economic growth. The author conducted an OLS regression then a Seemingly Unrelated Regression (SUR) and finally the 3SLS estimation to test the trade-growth relationship: All methods have provided similar results implying a weaker relationship between trade liberalization and economic growth. In another study using 42 developing countries from Asia, Africa and Latin America; Parikh and Stirbu. (2004) investigated the link between trade liberalization, economic growth and trade balance. Econometric approach based on panel data analysis reveals that trade liberalization acts positively on the domestic economic growth.

In a more extended study, Wacziarg and Welch (2008) have analyzed the relationship between trade liberalization and growth for a sample of 118 countries during the period 1950-1998. The dataset included the Sachs-Warner sample and new data on 23 Eastern European countries and former Soviet republics. The empirical results indicate that countries which have liberalized their trade regimes recorded average annual growth rates about 1.5 % higher than before liberalization. Findings indicate also that post-liberalization, investment rates increase 1.5–2.0% points.

The long run causality between trade liberalization and economic growth in Mexico was investigated by Oladipo (2011). The sample covers the period 1980 Q1 to 2008 Q4 and the econometric method used in this study is based on the error correction model (ECM). The empirical finding indicates that in the long run, economic growth is dependent to trade liberalization and investment. However, the labor force and human capital do not exert a significant effect. The policy implication of those results is that Mexico is encouraged to intensify trade and to give more incentive for investment to promote sustainable long run economic growth.

Falvey and *al.* (2012) have used annual data for a panel of 75 countries within the period 1960–2003 and have found that trade liberalization increases economic growth in the long-run. To test the long-run effect of trade openness on economic growth in Pakistan, Shahbaz (2012) has used the ARDL bounds testing approach and the augmented production function. Results show that in the long run, trade openness promotes economic growth through spillover effects and diffusion of advanced technology brought from the developed world.

Eris and Ulasan (2013) conducted Bayesian Model Averaging techniques (BMA) to check for the type of the relationship between trade openness and long-run economic growth. Their results indicate that trade openness is not directly correlated with the economic growth in the long run. They have also found that economic growth is explained by economic institutions and macroeconomic uncertainties such as those induced by high inflation and excess government consumption. Those results are similar to the findings of more recent empirical research such as, Easterly and Levine (2003), Dollar and Kraay (2003), Alcalá and Ciccone (2004) and Rodrik et al. (2004).

The study of Tash and Sheidaei (2012) aims at analyzing the effect of trade liberalization and financial development on economic growth for the case of Iran during the period of 1966-2010. Empirical results based on the cointegration analysis indicate a positive relationship between financial development, trade liberalization and economic growth.

The trade liberalization-economic growth association in Bangladesh has been analyzed by Manni and Afzal (2012). Based on dataset during the period of 1980-2012 and applying the Ordinary Least Square (OLS) method, results indicated that there is a positive relation between GDP growth and trade liberalization. Liberalization leads to improve export which affects positively economic growth. However, liberalization does not exert any effect on the inflation variable.

2.2 Trade liberalization and environmental effects

The effect of trade openness on environment has been one of the most important questions in trade policy for the last two decades. Literature on the topic remains inconclusive and the result varies from one country to another one. For example, the study by Taskin and Zaim (2000) have used a sample of more than 50 countries during the period of 1970-1990 to investigate the effect of international trade on the environment efficiency. The econometric approach used in this study is based on the non-parametric and non-stochastic production frontier approach. The result shows that the degree of openness has a significant effect on the environment efficiency. This effect is higher especially when the export is oriented to the service product rather than the export of other products. Using data related to 43 countries observed over the period 1971-1996, Antweiller et al (2001) have investigated the impact of trade liberalization on the pollution concentration. The result of regression of the trade-induced technique and scale effects reveals a net reduction in pollution from these sources. They find that freer trade is beneficial for the environment.

The relationship between trade, corruption and environment quality has been tested by Damania. *et al* (2003). To this end they have used a panel data from a mix of developed and developing countries over the period 1982-1992. The empirical strategy used in study is based on the random effect regression. The results of this research are consistent with the theoretical prediction. Findings indicate that countries with freer trade have stricter environmental regulations. Also, results indicate that the effect of trade liberalization on the environment quality is depended to the level of corruption.

Mete *et al* (2006) have used data on Nigerian economy and have applied the generalized least squares (GLS) approach to analyze the effect of trade on the environmental quality. Empirical findings indicate that pollution is positively related to trade intensity and real GDP per square kilometer, while capital to labor ratio and GNP are negatively related to pollution.

Naranpanawa (2011) has analyzed the link between trade openness and carbon emissions in the case of Sri Lanka during the period of 1960-2006. To this end, the Autoregressive Distributed Lag (ARDL) bounds testing approach and the Johansen Juselius are applying to detect the cointegration relationship between trade and environment. The result of this study indicates that there is a relationship between trade and carbon emissions in the short run only. Nevertheless, there is no association between those two indicators in the long run.

In a more recent study, Managi *et al* (2013) have used sulfur dioxide (SO2) and carbon dioxide (CO2) emissions of 88 countries from 1973 to 2000 and the biochemical oxygen demand emissions (BOD) of 83 countries from 1980 to 2000 to analyze the effect of trade on environment quality,. In this study, the dynamic generalized method of moments (GMM) estimation is applied. Empirical results indicate that the effect of trade on environment differs from OECD to non-OECD countries. Trade reduces emissions of pollution only in OECD countries for both short and long terms. Contrary to OCDE countries, findings reveal that in the long term, a 1% increase in trade openness causes an increase of 0.920% and 0.883% in SO2 and CO2 emissions for the non-OCDE countries.

3. Empirical analysis
3.1 Data and Statistics

In this study, we use the following variables: carbon dioxide (CO2) emissions, income, trade openness (OP), FDI and stock of capital (K) for the case of Tunisia and Morocco. The per capita CO2 emissions (measured in metric ton) are used as a proxy for environmental quality. The real GDP is used as a proxy for income. The degree of openness of an economy is constructed by dividing the sum of total exports and imports of goods and services by the GDP. Level of openness is considered as an indicator to measure the level of trade liberalization, trade openness and integration's level to the World economy. We also use the FDI inflow to GDP.

The yearly time series covers the period from 1971 to 2013. The main source of our data is the World Development Indicators (WDI) provided by the World Bank and all the variables are transformed into log form. The descriptive statistics and correlation coefficients for the major variables are summarized in Table 1. Lower part of Table 1 shows the correlation matrix of the five selected variables. It shows that GDP and CO2 and GDP and OP are found to be positively correlated. These results could give a light on the possible relationships between these variables. Regarding the coefficients, they are considered as low[1] which reflect absence of autocorrelation between the variables of the study.

Table 1: Descriptive statistics

	LCO2	LGDP	LK	LOP	LFDI
Mean	0.263431	23.76759	3.190972	4.244426	-0.195728
Median	0.384245	23.79770	3.192857	4.247988	0.280580
Maximum	0.900161	25.37125	3.527281	4.748371	2.243286
Minimum	-0.780343	22.19497	2.605615	3.787136	-5.734803
Std. Dev.	0.431486	0.809161	0.193193	0.246351	1.560830
Jarque-Bera	4.523951	1.970306	19.39500	4.470655	38.81810
Probability	0.104145	0.373382	0.000061	0.106957	0.000000
Observations	80	80	80	80	80
LCO2	1				
LGDP	0.424517	1			
LK	0.402784	0.206906	1		
LOP	0.020164	0.532842	0.137127	1	
LFDI	0.621517	0.165266	0.338431	-0.032570	1

Following literature on energy economics (Kneller *et al.* (2008), Calderona and Poggio (2010) and Ghani (2011)), we can consider the long-run relationship between CO2 emissions,

[1] Except for the association between LFDI/LCO2

economic growth, foreign direct investment, trade openness and capital in linear logarithmic form.

$$LnCO2_t = \alpha_0 + \alpha_1 LnGDP_t + \alpha_2 LnK_t + \alpha_3 LnOP + \alpha_4 LnFDI + \mu_t \qquad (1)$$

Where, Co2, GDP, OP stand respectively for CO2 emissions per capita, real gross domestic product per capita, trade openness and K is the stock of capital (K) that represents real gross fixed capital formation in billions of constant 2005 U.S. dollars. μ_t is the error term

This study aims at analyzing the possible dynamic relationships that could exist between trade openness, CO2 emission and economic growth in the long-run and short-run as well. The basic testing procedure requires three steps. The first step is to test whether the variables contain a unit root to confirm the stationarity of each variable (Engle and Granger, 1987). This is done by using the Augmented Dickey–Fuller tests (F-ADF) and Philips–Perron (PP) tests (1998). We also check the presence for an unknown structural break in the time series by using the Clemente-Montanes-Reyes (1998) unit root test.

The second step is to test whether there is a long-run cointegrating relationship between the variables. This is conducted by the use of the Johansen-Fisher methods for single country case study and Pedroni, Kao and Fisher tests for panel study. Finally, the last step, if all variables are integrated of order one I (1) and cointegrated short-run elasticities can be computed using the vector error correction model (VECM) method and Panel VECM suggested by Engle and Granger (1987). In this case, an error correction mechanism exists by which changes in the dependent variables are modeled as a function of the level of disequilibrium in the cointegrating relationship, captured by the error-correction term (ECT), as well as changes in the other explanatory variables to capture all short-term relations among variables.

3.2 Cointegration and Error Correction Model

We conduct a cointegration and ECM techniques to investigate the dynamic relationship between trade liberalization and the environmental quality for both countries as a panel analysis and then by single country study. The use of VECM allows the examination of the relationship between all the variables employed in the study in the long-run and short-run as well. For that purpose we employ the procedure by Engle-Granger (1987) two-step cointegration. In empirical literature, the Johansen (1988) and Johansen and Juselius (1990) maximum-likelihood test procedure are the two common tests used for determining cointegrating relationships. This approach is based on two principal statistic tests: Trace test and Max-Eigen value. The Likelihood Ratio (LR) test is based on the trace statistics (λ trace) which tests the H$_0$: $r \leq q$ against H$_1$: $q = r$ is calculated thus: $\lambda_{trace}(r) = -T\sum_{l+1}^{p}\ln(1-\hat{\lambda}i)$ where $\lambda r + i \ldots . \lambda n$, are the least value of eigenvectors $(p - r)$. The second test is the maximal Eigen value test ($\lambda_{\max}$) which tests the H$_0$: there are r cointegrating vectors against the H$_1$: there are $r+1$ cointegrating vectors, and is calculated as follows:

$\lambda_{\max}(r, r+1) = -T\ln(1-\hat{\lambda}r+1)$.

In this paper, we use multivariate procedure by the mean of a VECM which is specified as follows:

$$\Delta LCO2_t = \alpha_1 + \sum_{i=1}^{p}\beta_{1i}\Delta LCO2_{t-i} + \sum_{i=1}^{q}\beta_{1i}\Delta LGDP_{t-i} + \sum_{i=1}^{r}\beta_{1i}\Delta LOP._{t-i} + \sum_{i=1}^{s}\beta_{1i}\Delta LFDI._{t-i} + \sum_{i=1}^{s}\beta_{1i}\Delta LK._{t-i} + \lambda_1 ect_{t-1} + \mu_{1t} \quad (2)$$

$$\Delta LGDP_t = \alpha_2 + \sum_{i=1}^{p}\beta_{1i}\Delta LCO2_{t-i} + \sum_{i=1}^{q}\beta_{2i}\Delta LGDP_{t-i} + \sum_{i=1}^{r}\beta_{2i}\Delta LOP._{t-i} + \sum_{i=1}^{s}\beta_{2i}\Delta LFDI._{t-i} + \sum_{i=1}^{s}\beta_{21i}\Delta LK. + \lambda_2 ect_{t-1} + \mu_{2t} \quad (3)$$

$$\Delta LFDI._t = \alpha_3 + \sum_{i=1}^{p}\beta_{3i}\Delta LCO2_{t-i} + \sum_{i=1}^{q}\beta_{3i}\Delta LGDP_{t-i} + \sum_{i=1}^{r}\beta_{3i}\Delta LOP._{t-i} + \sum_{i=1}^{s}\beta_{3i}\Delta LFDI._{t-i} + \sum_{i=1}^{s}\beta_{3i}\Delta LK. + \lambda_3 ect_{t-1} + \mu_{3t} \quad (4)$$

$$\Delta LOP_t = \alpha_4 + \sum_{i=1}^{p}\beta_{1i}\Delta LCO2_{t-i} + \sum_{i=1}^{q}\beta_{4i}\Delta LGDPpc_{t-i} + \sum_{i=1}^{r}\beta_{4i}\Delta LOP._{t-i} + \sum_{i=1}^{s}\beta_{4i}\Delta LFDI._{t-i} + \sum_{i=1}^{s}\beta_{4i}\Delta LK + \lambda_4 ect_{t-1} + \mu_{4t} \quad (5)$$

$$\Delta LK_t = \alpha_4 + \sum_{i=1}^{p}\beta_{5i}\Delta LCO2_{t-i} + \sum_{i=1}^{q}\beta_{5i}\Delta LGDPpc_{t-i} + \sum_{i=1}^{r}\beta_{5i}\Delta LOP_{t-i} + \sum_{i=1}^{s}\beta_{5i}\Delta LFDI._{t-i} + \sum_{i=1}^{s}\beta_{5i}\Delta LK. + \lambda_4 ect_{t-1} + \mu_{4t} \quad (6)$$

Where ECT, the error correction term, is expressed as follows:

$$ECT_t = LCO2_t - \alpha_1 - \beta_{1i}LGDPpc - \beta_2 LOP._{t-i} - \beta_3 LFDI_{t-i}. - \beta_4 LK \quad (7)$$

Helmi pourquoi LOP $_{t-i}$ et LFDI $_{t-i}$

Where $t=1...T$, denotes the time period.

For the disaggregated analysis we add a dummy variable which reflects the trade liberalization date which is expressed as follows:

$$\text{Dummy}_{\text{Morocco}} = \begin{cases} 0 \text{ for } 1971\text{-}1987 \\ \text{and} \\ 1 \text{ for } 1988\text{-}2013 \end{cases} \qquad \text{Dummy}_{\text{Tunisia}} = \begin{cases} 0 \text{ for } 1971\text{-}1988 \\ \text{and} \\ 1 \text{ for } 1989\text{-}2013 \end{cases}$$

In cases where liberalization makes entry easy, we expect higher growth as a result of a huge inflow of foreign capital and acceleration of trade activities (Hamdi 2013).

4. Results

4.1Unit root tests

4.1.1 *Single Country Unit root testing and Structural Break*

We employ the Augmented Dickey–Fuller (F-ADF) and the Phillips-Perron (PP) (1988) unit root tests to conclude whether the variables contain a unit root and confirm the stationarity of each variable. The results are presented in Table 2 below which reveals that the test statistics for the log levels of CO2 emissions, trade openness, FDI and growth are statistically insignificant. However, when we apply the unit root tests to the first difference of the five variables, DF and PP tests reject the joint null hypothesis for each variable at the 1 per cent level.

Table 2. Unit root tests

	ADF		PP		Order of Integration
	Tunisia				
	Level	1st diff,	Level	1st diff,	
LCo2	-1.115	-6.1457***	-1.6281	-7.1408***	I(1)
LGDP	-2.585	-6.5530***	-2.7071	-7.5158***	I(1)
LK	-2.885	-7.1474***	-2.3501	-6.980***	I(1)
LOP	-3.12	-5.6815***	-2.7928*	-4.8031***	I(1)
LFDI	-2.985	-6.7441***	-2.2723	-7.3540***	I(1)
	Morocco				
LCo2	-1.686	-6.4907***	-1.1201	-7.885***	I(1)
LGDP	-2.012	-7.0289***	-2.7077	-7.015***	I(1)
LK	-1.099	-7.0125***	-2.546	-7.5124***	I(1)
LOP	-3.558	-4.4450***	-2.9928*	-4.0772***	I(1)
LFDI	-2.0210	-6.3764***	-2. 8423	-6.8892***	I(1)

Note: The regressions in first difference include intercept.
*** Denotes the rejection of the null hypothesis at 1%level of significance

It is well known that ADF and PP tests did not include any structural breaks. However, as Tunisia and Morocco have experienced several boom and burst during the past three decades and have also implemented various policy reform, hence we fear that PP and ADF tests could not provide reliable results. To overcome this problem we include an unknown breakpoint that can be determined endogenously from the data. This could be achieved through the Clemente-Montanes-Reyes (1998) unit root test that allows for two unknown structural breaks.

Table-3 reports the results of Clemente *et al.* (1998) unit root test. The results from the Additive Outlier (AO) model clearly show that the null of at least one unit root cannot be rejected for all of the series under study. The AO approach reveals that all the variables have quite diverse structural breaks that depend on key policy changes. The results reveal that all the variables have unit root at level but to found to be stationary at 1st difference in the presence of various structural breaks.

Table-3: Clemente-Montanes-Reyes Structural Break Unit Root Test

	Innovative Outliers			Additive Outlier		
	Tunisia					
	t-statistic	*TB1*	*TB2*	*t-statistic*	*TB1*	*TB2*
LCo2	-4.110 (4)	1981	1988	-7.772 (3)*	1986	1991
LGDP	-4.215 (3)	1990	1992	-8.524 (6)*	1997	1997
LK	-4.609 (3)	1995	1997	-6.410 (2)**	1993	1999
LOP	-4.882 (3)	1994	2000	-7.14 (4)*	1999	1994
LFDI	-3.891 (4)	1989	1996	-8.519(2)*	1995	1995
	Morocco					
LCo2	-3.120 (3)	1988	1990	-7.442 (3)*	1974	1992
LGDP	-4.552 (4)	1991	1995	-9.447 (5)*	1989	1997
LK	-4.408 (4)	1999	2002	-6.801 (4)**	1992	1999
LOP	-3.992 (4)	1995	1999	-7.213 (4)*	1998	1994
LFDI	-4.258 (3)	1990	1995	-6.127 (3)*	1994	1995

* Denotes the rejection of the null hypothesis at 10%level of significance
Changes in Innovational Outlier model occur progressively over the time, allowing for a break in both the intercept and slope while changes Additive Outlier models occur suddenly allowing for a break in the mean (the crash model).

After checking the integration of our four variables at order one, I(1), we selected the optimal lag length of underlying Vector Auto Regression (VAR henceforth) using the conventional model selection criteria. These criteria established that the optimal lag length is two.

4.1.2 Evidence from a Panel unit root test

In this study we also employ the panel unit root tests using Levin-Lin-Chu [LLC. (2002)], Im, Pesaran and Shin [IPS. (2003)] the Augmented Dickey–Fuller and Philips–Perron [PP

(1998)]. The results are displayed in Table 2. Here again, it appears that he test statistics for the log levels of CO2 emissions, trade openness, FDI and growth are statistically insignificant. However, when we apply the panel unit root tests to the first difference of the four variables, all four tests reject the joint null hypothesis for each variable at the 1 per cent level. Thus, from all of the tests, the panel unit roots tests indicate that each variable is integrated of order one.

Table 4: Results of the unbalances Panel Unit Roots Tests for Tunisia and Morocco

	LLC		IPS		F-ADF		PP		Order of Integration
	Level	1st diff	Level	1st diff,	Level	1st diff,	Level	1st diff,	
LCo2	-0.9325	-3.5562***	-0.8391	-5.2216***	5.4819	30.1075***	8.1569	64.0752***	I(1)
LGDP	3.8921	-4.1310***	0.3575	-2.5630***	8.8450	13.3579***	6.5548	26.2689***	I(1)
LK	-2.2219	-3.3175***	-1.9323	-3.0468***	10.146	16.0620***	3.1297	28.2638***	I(1)
LTO	-1.3542	-3.7943***	-1.4144	-4.7945***	7.7627	26.8708***	7.1815	54.2634***	I(1)
LFDI	-1.6440	-3.7553***	-1.9595	-3.9689***	6.5213	21.6633***	14.455	245.040***	I(1)

*** Denotes the rejection of the null hypothesis at 1% level of significance

As our five variables are integrated at order one I(1), then we can proceed in the next step to test for the panel cointegration relationship between LCo2 and the other explanatory variables using the Pedroni (1999, 2003), Kao (1999) and Fisher tests for balanced panel date.

The procedures proposed by Pedroni (1999, 2004) employs two tests for cointegration namely the between and the within dimensions. The first set includes the following four statistics: panel v-statistic, panel r-statistic, panel PP-statistic, and panel ADF-statistic. According to Pedroni (2003), these statistics group the autoregressive coefficients across different countries for the unit root tests on the estimated residuals taking into account common time factors and heterogeneity across countries. The second set of tests includes the following three statistics: group r-statistic, group PP-statistic, and group ADF-statistic. According to Pedroni (2003) these statistics are based on averages of the individual autoregressive coefficients associated with the unit root tests of the residuals for each country.

The Table 5 displays the results of the cointegration test using Pedroni's procedure. It reveals the rejections of the null of no cointegration for all tests at 5 % level of significance except the group ADF statistics. Hence, one may conclude that our model is in fact panel cointegrated.

The result of the Kao (1999)[2] test supports Pedroni tests since the coefficient is significant at 1% level of significance suggesting panel cointegration relationship.

Table 5: Results of the balanced Panel Cointegration tests

Pedroni Residual Cointegration Test	***Statistics***
Panel v-Statistic *Weighted Statistic*	2.418819***
Panel rho-Statistic *Weighted Statistic*	-2.563256***
Panel PP-Statistic *Weighted Statistic*	-1.988869**
Panel ADF-Statistic *Weighted Statistic*	-1.316823*
Group rho-Statistic	-1.827116**
Group PP-Statistic	-1.901341**
Group ADF-Statistic	-1.164449

Kao Test.

ADF	-2.211936 (0.0135)***

Johansen Fisher Panel Cointegration Test

Null Hypo.	**Max-Eigen.**	**Trace**
None	49.03770 (0.0004)***	90.76637 (0.0005)***
At most 1	25.44294 (0.0917)	41.72868 (0.1665)
At most 2	11.22086 (0.6253)	16.28574 (0.6920)
At most 3	4.822065 (0.6222)	5.064880 (0.8019)

Max-eigenvalue test & Trace test indicates indicate 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
*, ** and *** Denotes the rejection of the null hypothesis at 10%, 5% and 1% level of significance

The result of Johansen Fisher test shows the existence one cointegrating vectors at 1% of significance. To conclude, we confirm the existence of strong statistical evidence in favor of panel cointegration among CO2 emissions, trade openness, FDI and growth for the two neighboring countries.

4.2 Long run and short run

Since Pedroni test approved the existence of cointegration relationship between Co2 and the other explanatory variables, hence a long-run equilibrium relationship should exist between

[2] Kao (1999) suggests a new framework by the use of residual-based DF and ADF tests. Unlike Pedroni's procedure, Kao test takes into account the initial regression with individual intercepts (fixed effects) only. Otherwise, there is no deterministic trend and homogeneous regression coefficients in the tests steps (Hamdi and Sbia 2013a).

the variables (Engle and Granger 1987). In this paper, the long-run equilibrium is determined by the mean of a VECM approach. The results presented in table 6 below. As the model is expressed in log-linear form then the coefficients can be assumed as elasticities.

For a panel approach, the results reveal that the coefficient of real income (LGDP) is 0.80 which is positive and significant at the level of 1%. It means that a 1% increase in real income will increase per capita emissions by 0.8% in the long-run. This reveals that Co2 emissions increase at the initial stage of economic growth. More growth leads to more carbon dioxide emissions and hence more environment degradation. This result joint the ones found by Pao and Tsai (2010) for the case of BRIICS countries, Ang (2007) and Apergis and Payne J-E. (2009) for the cases of France and output in Central America respectively. The sign capital (LK) is positive and significant indicating that capital contributes to carbon emissions in the long-run.

The sign of trade openness is positive and significant at 1% level of significance suggesting that free trade damages the environmental quality. Here it is worth recalling that both countries are net importers of oil and fossil energy. This result is supported by the coefficient of the FDI which is positive and significant suggesting that FDI inflows in both countries are pollutant in nature. This result is absolutely true as Tunisia and Morocco have become the first destination of industrial Europeans companies. For a single country approach, the results show exactly the same statements of the panel output especially the same signs of the coefficients of the variables.

Table 6: CO2 Emission long-run elasticities

Dependent Variable: LCO2

	Tunisia		**Morocco**		**Panel**	
	coef	*t-value*	*coef*	*t-value*	*coef*	*t-value*
LGDP	0.0954	1.1577	0.9091	-5.519***	0.8042	-6.377***
LK	1.2185	4.1436***	1.3124	2.7299**	0.8346	4.131**
LTO	0.3009	-1.247*	2.1830	2.6362**	3.1405	7.503***
LFDI	0.1953	-3.970**	0.0576	-1.3225*	0.0716	-2.000**
Intercept	5.4450		8.0110		7.1217	

*, ** and *** Denotes the rejection of the null hypothesis at 10%, 5% and 1% level of significance

Table 7 shows the results where ΔLCo2 is the dependent variable. Following, the sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ), it was shown that the optimal lag length was two. Hence the short-run results are also presented for two lags of each variable.

The panel results show that the real GDP acts positively and significantly at the level of 10% to Co2 emission. This means that real GDP affects the level of carbon dioxide emission in both countries. This result is in line with the various case studies Ang, 2007; Jalil and Mahmud, 2009; Change, 2010; Ghosh, 2010; Menyah and Wold-Rufael, 2010, Lee *et al*., 2009; Bhattacharyya and Ghoshal, 2010; Narayan and Narayan, 2010.

Regarding trade openness, it exerts positive but non-significant effects on Co2. This results is in line with the one found by Grossman and Elhanan 1991, Grossman and Krueger, 1993; Antweiler *et al*., 2001; Frankel, 2009. As for FDI, it exerts a positive and non-significant impact on CO2 emission. Unfortunately, foreign direct investment could not yet be considered as incentives to implement energy-efficient technology that decrease energy consumption in Morocco and Tunisia

Another important results that could be drawn from Table 7 is that the dummy variable (date of trade liberalization) is positive and significant for both countries. This shows that since the trade agreement CO2 emission accelerated in Tunisia and Morocco. It is also evident from Table 7 that the panel error correction term, is statistically significant. The coefficient of the error-correction term is -0.056, suggesting that when per capita emission is above or below its equilibrium level, it adjusts by almost 7.8% within the first year. Regarding single country study, similar result has been found for ECT.

Table 7: CO2 emissions short-run elasticities

Dependent Variable: LCO2

	Tunisia		**Morocco**		**Panel**	
Regressors	*Coefficient*	*t-value*	*Coefficient*	*t-value*	***Coefficient***	***t-value***
ΔLGDP(-1))	0.2306	1.7562*	0.0663	0.9229*	0.1155	1.7717*
ΔLGDP(-2)	0.0625	-0.5057	0.0382	0.4996	0.031	-0.4632
ΔLK(-1)	0.3765	2.2287**	0.0861	-1.4638*	0.0444	0.7741
ΔLK(-2)	0.2782	1.8045*	0.0977	1.6242*	0.1378	2.4093**
ΔLOP(-1)	0.0446	-0.5344	0.0460	0.4040	0.0494	0.735
ΔLOP(-2)	-0.0548	-0.6024	0.0529	0.5519	0.0272	-0.4313
ΔLFDI(-1)	-0.0418	-2.2316**	0.0076	1.5517*	0.0050	1.065
ΔLFDI(-2)	-0.0278	-1.7359*	0.0085	1.7188*	0.0075	1.552
TLIB	0.0101	-1.4892*	0.0294	-2.556**	-	-

Intercept	0.0286	1.4531	0.0596	4.0039***	0.0459	3.5712***
ECT	-0.1974	-1.8312	-0.0873	-3.8115***	-0.078	-3.481***
	Stability & Diagnostic tests					
	t-stats	*p-value*	*t-stats*	*p-value*		
White Test	0.3715	0.6928	1.369	0.2391		
Normality	0.0156	0.992	3.40.	0.18		
Serial Correlation	0.1931	0.8260	1.718	0.2022		
ARCH	0.6864	0.4135	0.2171	0.859		
R2	**0.668**		**0.743**			

*, ** and *** Denotes the rejection of the null hypothesis at 10%, 5% and 1% level of significance

We conducted several tests to identify whether the ECM model for individual country level is stable or not. The lower level of the Table 7 summarizes the output of these tests. It was shown that that the model is fit with a correct functional form and the model's residuals are serially uncorrelated, normally distributed and homoskedastic. Moreover, R2 shows that the model is a relatively good fit. Overall, we can conclude that the output of the ECM model is valid for reliable interpretation.

Regarding the stability of the model; the trend of the Cumulative Sum of Recursive Residual (CUSUM) and Cumulative Sum of Squares of Recursive Residual (CUSUMQ) show that the model is stable as it is located in the upper and lower bounds for the two countries (see Fig3 &4).

Figure3. CUSUM and CUSUMSQ forTunisia

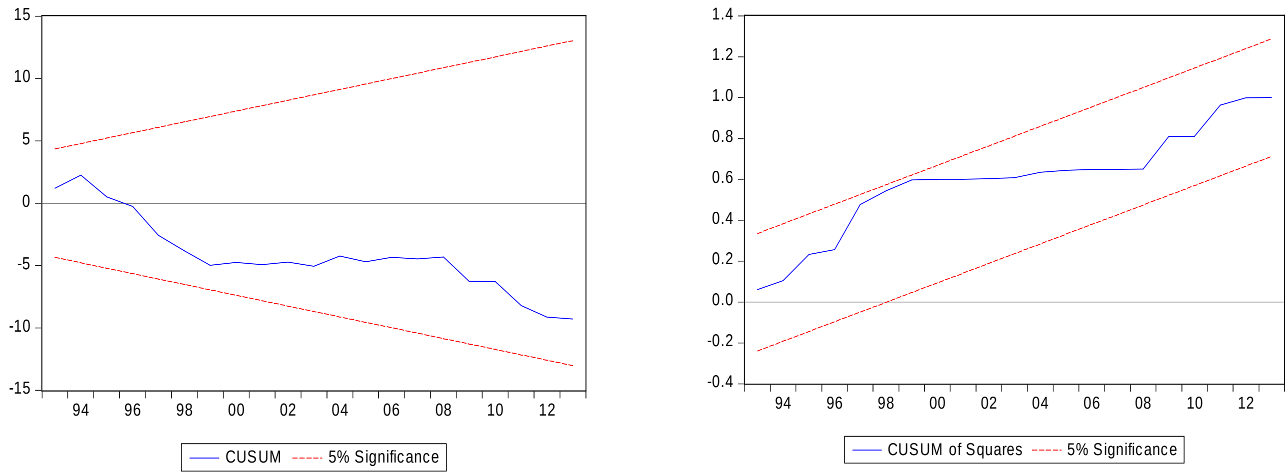
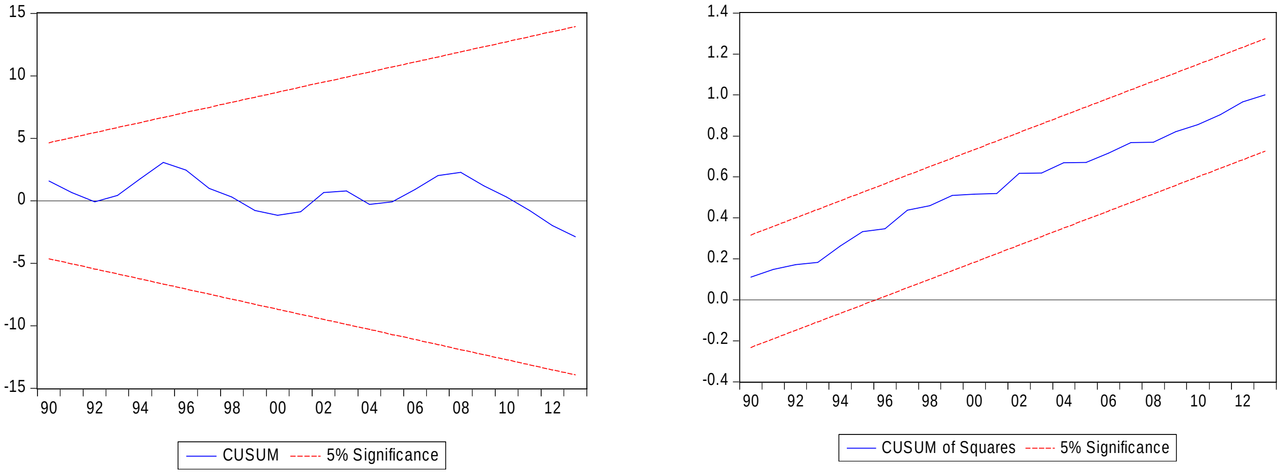


Figure4. CUSUM and CUSUMSQ for Morocco



The presence of a cointegration relationship between the variables of the model in the long-run indicates that Granger causality should exist in at least one way. Thus, the next concern is to inspect the direction of causality amongst the variables of the model. The results of causality tests based on the Vector Error Correction model are reported in Table 8. The table has three major blocks illustrating the short-run effects, the long-run effects represented by the error correction coefficients, and the joint short-run and long run effects, respectively.

Table 8: Results of the Panel causality tests

Variable	*Short run (F-stats)*					***ECT*** *(t-stat)*	*Joint short and long run (F-stats)*				
	ΔLCO2	ΔLGDP	ΔLK	ΔLTO	ΔLFDI		ΔLCO2 & ECT	ΔLGDP & ECT	ΔLK& ECT	ΔLTO & ECT	ΔLFDI& ECT
ΔLCO2	-	3.345**	0.801	2.189*	2.403*	-3.488**	-	2.557**	0.841	2.8871**	2.521*
ΔGDP	2.789**	-	1.940*	3.084**	2.698**	-2.37**	2.5621*	-	0.632	0.381	0.9621
ΔLFK	1.16	0.224	-	2.253*	0.886	- 3.379***	1.06	0.885	-	0.365	0.755
ΔLTO	4.121***	3.784***	0.523	-	2.611**	- 3.845***	2.9106**	3.112	1.179	-	1.824*
ΔLFDI	3.26**	3.854**	0.998	4.253***	-	0.332	4..921***	4.660***	1.31	2.21**	-

We can draw several important conclusions from the table above: First the F-statistics for the short-run dynamics reveals a bidirectional causality running between CO2 and GDP. This conclusion is important as it reveals the importance of energy emission in the process of economic development for both North African countries and our results seem to significantly reject the neo-classical assumption that energy is neutral to growth [Belloumi, M (2009). The feedback hypothesis has been revealed in some works such as in Jumbe, (2004) for Malawi; Zachariadis and Pashouortidou, (2007) for Cyprus and Tang, (2008) for the case of Malaysia.

Second, bidirectional causality is found between FDI and CO2. This implies that the nature of FDI inflows to Morocco and Tunisia are not clean FDI. Unfortunately, foreign investors did not bring with them their own advanced technology while investing in Morocco and Tunisia to maximize the profits. Alternatively, they bring capital that harms the environmental quality. This result is in line with the study by Antweiler *et al.* (2001) who show that foreign direct investment affects domestic production of host country but does not affect the energy intensity and the result by Sadorsky, (2010) who concludes that foreign direct investment boosts energy consumption as the increase of liquidity will encourages the proliferation of new plants and factories which in turn raises energy demand.

Third, we also found a Bidirectional relationship running between trade and GDP. Here it is very important to state that trade liberalization boosted the economies of both countries by creating new employment opportunities. Today, both countries are major trading partners to European Union. This result is supported the bidirectional relationship between FDI and growth. This could be explained by the fact that following the liberalization of trade, foreign investor notably European companies have been attracted by the economic and social situation of both countries; their proximity to Europe and their language and high skilled workers for a weak labor costs as compared to Europe. Therefore, we may conclude that the more open the economy is, the more FDI is in flowed and the more growth.

Regarding error correction results, their coefficients are significant in energy consumption, and emission equations, which indicate that both variables dynamically interact to reestablish long-run equilibrium whenever there is a deviation from the cointegrating relationship. This shows that deviation from the long-run equilibrium is principally corrected by carbon dioxide emissions Trade openness and FDI, while capital appears to be weakly exogenous.

5. Conclusion

The purpose of this research study is to investigate whether the various reforms in the trade sector undertaken by Tunisia and Morocco have increased the level of FDI and boosted growth or not. We are particularly interested to see the effects of the trade liberalization on the quality of the environment of those neighboring countries. Tunisia and Morocco are a very interesting case study as they share multiple socioeconomic criteria and they also liberalized their economies in the same period of time. These countries have also been considered as the best students in MENA region in terms of the implementation of structural reforms since the eighties (Hamdi 2013). In the empirical section, we used annual time series data from 1971to 2013 and we performed different econometric models based on the cointegration analysis and error-correction model using single country study and then panel study. The aim of this method is to compare the effects of trade liberalization and to get a comprehensive analysis. The estimations were made to obtain both short and long-run results. The time series diagnostics were investigated before the estimation and the stability tests were conducted to confirm the robustness of results. The Johansen method of cointegration confirmed the existence of a unique long-run relationship among the variables. In the VECM estimations, we found bidirectional causality between FDI and CO2. This implies that the nature of FDI inflows to Morocco and Tunisia are unfortunately not clean FDI. Hence, the result supports that trade liberalization have a negative impact on environmental. Therefore, we recommend to policy makers of these countries to give more attention to the dramatic consequences of trade liberalization on the welfare of their citizens and to promote green trade liberalization instead. To get full benefits of liberalization and to achieve a sustained growth, both countries have to invest in clean and green energy which in turn will attract foreign investments.

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