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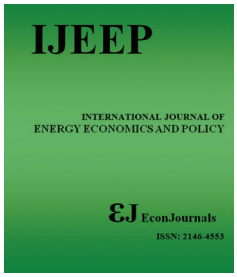

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Testing the Environmental Kuznets Curve in Egypt: Role of Foreign Investment and Trade

Haider Mahmood[1]*, Maham Furqan[2], Tarek Tawfik Yousef Alkhateeb[3], Mahmoud Mohamad Fawaz[4]

[1]Department of Finance, College of Business Administration, Prince Sattam Bin Abdulaziz University, Alkharj, Saudi Arabia, [2]Energy Associate, S&P Global Market Intelligence, Islamabad, Pakistan, [3]Department of Marketing, College of Business Administration, Prince Sattam Bin Abdulaziz University, Alkharj, Saudi Arabia & Kafr Elsheikh University, Egypt, [4]Kafr Elsheikh University, Egypt. *Email: h.farooqi@psau.edu.sa

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ABSTRACT

We test the Environmental Kuznets Curve (EKC) augmenting CO_2 emissions model for Egypt using cointegration technique for period 1990–2014. Cointegration is found in the hypothesized model and EKC hypothesis validates from empirical testing as well. Further, energy consumption seems to be accelerating CO_2 emissions per capita while Foreign Direct Investment is found helpful in reducing CO_2 emissions per capita. However, the effect of trade is found insignificant. We recommend Egyptian government to attract further foreign investment to support a cleaner environment.

Keywords: Environmental Kuznets Curve Hypothesis, Foreign Direct Investment, Trade Openness, Egypt
JEL Classifications: F18, O13, F21

1. INTRODUCTION

Several factors can be regarded as determinants for CO_2 emissions. It is true because numerous multidimensional aspects gather into play when it comes how and why the emissions in a region increase or decrease. There has been a never-ending debate on how emissions in a region can be controlled using various micro, macro and financial factors. Some of the most frequently discussed determinants include gross domestic product (GDP), Foreign Direct Investment (FDI), trade openness (TO), public spending, energy prices, and many more. All these factors lead the discussion towards the idea of Environmental Kuznets Curve (EKC) hypothesis (Grossman and Krueger, 1995). Kuznets curve has its theoretical and practical implications as it suggests that when a country is economically growing, an increasing trend in emissions is observed but as the journey of growth goes on, emissions and pollution start decreasing, making the environment better off eventually.

In an empirical model, Mahmood and Alkhateeb (2017) investigate the EKC hypothesis by augmenting trade in the CO_2 emissions model of Saudi Arabia. They corroborate the existence of EKC hypothesis with positive effects of income and adverse effect of income square on the CO_2 emissions. Additionally, trade seems to have a negative environmental impact in short and long runs. Shahbaz et al. (2013) report that financial development and trade help in reducing pollution but energy consumption and GDP are found responsible for environmental degradation in Malaysia. An argument makes practical sense but leaves space for further analysis because income most likely leads to financial development and trade increases income as well. Therefore, if a country is experiencing an improvement in income, there is a chance that financial development or trade have some role in that, making it implausible that income increases emissions and financial development and trade do not.

In contrast, Alkhateeb et al. (2018) find that financial market has contributed in CO_2 emissions of Saudi Arabia. Another stream

of literature argues that increasing oil prices and revenues may accelerate investments, employment and economic growth in oil abundant countries (Alkhateeb et al., 2017b; Mahmood and Alkhateeb, 2018; Alkhateeb et al., 2017ba) and a resultant is increasing economic growth that may raise environmental issues. However, environmental effect of oil market is more dominant in the oil-based economies. Discussing the implications of economic growth and its effects on emissions in oil-based economies, there is a need to study how this discussion unfolds in oil-rich economies like Egypt. Also, since some studies have linked trade to economic growth and consequential environmental degradation, incorporating that aspect would be helpful in the case of Egypt because of its movement towards liberalization.

Egypt has gone through many structural changes throughout the history. With these structural alterations, perceptions about some significant economy-wide ideas like poverty, inequality and productivity, etc. have seen notable transformations as well. It was noticed that the country promoted liberalization in the early-1990's after some ups and downs which affected its overall growth and FDI. Rising liberalization, economic growth and FDI may accelerate the energy consumption which can contribute in higher emissions. While this trend supports the literature that better macroeconomic performance lead to higher emissions, it also leaves a space to scrutinize influence of income, FDI and openness on the CO_2 emissions of Egypt, especially during liberalization policy regime. Hence, the purpose comprises to test EKC along with other environmental determinants using Egypt's data of post-liberalization period from 1990 to 2014. The results would be supportive for Egyptian government, economists and environmentalists in order to determine the changes required in improving the overall economic and environmental sustainability of the country and these inferences can provide as a pathway for further policy restructuring.

2. LITERATURE REVIEW

In the income and environment causal relationship, Saidi and Hammami (2017) argued a two-way connection between environmental degradation and income in high-income countries while the effect was not seen to be as strong for others. Moreover, there is a wide variety of literature available on the applicability of EKC hypothesis in many global locations. Not a lot of them are primarily conducted in the context of Egypt. It is something that leaves space to analyze how the factors mentioned above would interplay in the country. Additionally, since post-liberalization period is analyzed in this study, the findings would provide insights into how liberalization can change the environmental profile of a country and what sort of sustainable policies might be relevant for the country to get the best out of its growth.

While analyzing MENA countries, Abdouli and Hammami (2017) mentioned that FDI seems to have a strong influence on the environmental situation in the region. Using data from 1990 to 2012 for seventeen MENA economies, relationship of FDI, pollution and income were scrutinized and found two-relationship in emissions and GDP. This bi-directional relationship indicated that while FDI and GDP influence emissions in the MENA region, the same relationship run the other way around as well and emissions can put an impact on FDI and GDP of these countries. The findings show strong practical implication of EKC in the region and illustrate how macroeconomic and environmental factors can go hand in hand. Omri et al. (2015) investigate the correlation between macroeconomic performance and environmental quality in 12 MENA countries and advocated that income and emissions share a bi-directional relationship while TO and CO_2 emissions seem to share a neutral association. Both studies were conducted on the same region and led to proving a two-way association between instruments under analysis.

A dynamic analysis conducted on 54 countries including Egypt indicates a two-way connection in FDI and income. A similar relationship is shown in FDI and pollution. A unidirectional link is seen to exist in income and pollution as well. Authors provide implication for governments to focus on FDI to make changes to the energy profile of country and also provide a framework for other nations to investigate the ways this discussion relates to their economic and environmental frameworks (Omri et al., 2014). In the study on multiple countries including Egypt, Onafowora and Owoye (2014) N-shaped relationship instead of U-shaped. Additionally, energy consumption influences pollution and income in the economies while TO did not show any influence on the environment in the group.

Ibrahiem (2015) found that there exist long-term connections in model of Egypt and higher energy usage promotes FDI and economic growth. The study provides policy recommendations for the Egyptian government to focus on renewable energy so that financial and economic growth can be ensured while keeping the environmental sustainable. While many research piece talk about the strong correlation between macroeconomic variables and environment in a variety of regions, some also go in the opposite direction and suggest otherwise. Ben et al. (2015) used panel cointegration techniques to investigate the short- and long-run relationship between CO_2 emissions, GDP, renewable energy consumption and international trade for a panel of 24 sub-Saharan Africa countries over the period 1980–2010. Short-run Granger causality results reveal that there is a bidirectional causality between emissions and economic growth; bidirectional causality between emissions and real exports; unidirectional causality from real imports to emissions; and unidirectional causality runs from trade (exports or imports) to renewable energy consumption. The long-run estimates suggest that the inverted U-shaped EKC hypothesis is not supported for these countries; exports have a positive impact on CO_2 emissions, whereas imports have a negative impact on CO_2 emissions. A study was conducted on the GCC region by Salahuddin and Gow (2014) and an additional variable of energy consumption was added. The study came up with different results, and it was mentioned that although energy usage, income and emissions are connected but no link found in income and pollution. These results deliver inferences different than the previously mentioned studies and leave room for further analysis.

3. METHODOLOGY

Following the theoretical expected determinants of CO_2 emissions, we hypothesize the following model:

$$CO_t = \alpha_0 + \alpha_1 GDPC_t + \alpha_2 GDPC_t^2 + \alpha_3 ECPC_t + \alpha_4 FDI_t + \alpha_5 TO_t + u \quad (1)$$

All variables in equation 1 are of natural logarithm transformation. CO_t, $GDPC_t$, $ECPC_t$ are per capita CO_2 emissions, GDP and energy usage respectively. FDI_t is natural log of percentage of FDI to GDP and TO_t is natural logarithm of percentage of trade (export+imports) to GDP. A square term of is a whole square of natural logarithm of GDP per capita and is regressed to confirm the EKC hypothesis. A positive influence of $GDPC_t$ and negative influence of would be sufficient to confirm the presence of EKC hypothesis. t is showing a period of 1990–2014. A starting year 1990 is selected to consider the liberalized economic regime and period is closed at year 2014 due to maximum data availability of energy and emissions variables. All series are sourced from WDI. Energy consumption is expected to be contribute in the environmental degradation. FDI would have either positive or negative environmental effects, and these effects depend on the nature of technology utilized by foreign investors. Further, TO would also have positive or negative environmental effects as it depends on energy consumption, content of exports and imports and technology to produce the exported items. The series of hypothesized equation 1 should be tested for the unit root, but we may ignore this step as we are using the auto-regressive distributive lag (ARDL) technique of Pesaran et al. (2001) to regress hypothesized model. Upper and lower bound of ARDL are provided on an assumption of AR(1) and AR(0) respectively. Therefore, we may ignore integration analysis before cointegration. The ARDL model may be presented as follows:

$$\Delta CO_t = o_0 + o_1 CO_{t-1} + o_2 GDPC_{t-1} + o_3 GDPC_{t-1}^2 + o_4 ECPC_{t-1} + o_5 FDI_{t-1} + o_6 TO_{t-1} + \sum_{j=1}^{p} \varphi_{1j} \Delta CO_{t-j} + \sum_{j=0}^{q} \varphi_{2j} \Delta GDPC_{t-j} + \sum_{j=0}^{q} \varphi_{3j} \Delta GDPC_{t-i}^2 + \sum_{j=0}^{q} \varphi_{4j} \Delta ECPC_{t-j} + \sum_{j=0}^{q} \varphi_{5j} \Delta FDI_{t-j} + \sum_{j=0}^{q} \varphi_{6j} \Delta TO_{t-j} + \psi_{it} \quad (2)$$

Equation 2 may be regressed and tested for a null hypothesis of $o_1=o_2=o_3=o_4=o_5=o_6=0$ to verify the cointegration. Long run estimate may be counted with normalizing procedure, and short-run results may be achieved with estimated coefficients of equation 3 below. An evidence of short-run relationship may be argued with negative coefficient τ in equation 3.

$$\Delta CO_t = \sum_{j=1}^{p} \vartheta_{1j} \Delta CO_{t-j} + \sum_{j=0}^{q} \vartheta_{2j} \Delta GDPC_{t-j} + \sum_{j=0}^{q} \vartheta_{3j} \Delta GDPC_{t-i}^2 + \sum_{j=0}^{q} \vartheta_{4j} \Delta ECPC_{t-j} + \sum_{j=0}^{q} \vartheta_{4j} \Delta FDI_{t-j} + \sum_{j=0}^{q} \vartheta_{4j} \Delta TO_{t-j} + \tau ECT_{t-1} + \omega_{it} \quad (3)$$

4. DATA ANALYSES

Table 1 present the ARDL estimates of hypothesized CO_2 emissions per capita model. Bound test F = 10.6138 which corroborates the cointegration at 1% level. Short relationship would also be corroborated with coefficient of ECT_{t-1} (−1.2856) with a higher speed of convergence. In long-run results, GDP per capita has positive, but its square has adverse effect on the CO_2 emissions per capita. So, inverted U-shape relationship is found which an evidence of the presence of EKC hypothesis; indicting environmental effects of income growth. The turning point may be claimed at 14,861 per capita income at constant local currency which is achieved in year 2003. Therefore, we may claim that Egypt is on the second phase of EKC since 2003 and further economic may have pleasant environmental effects in Egypt.

Table 1: CO_2 emissions per capita model

Regressor	Parameters	S.E.	t-Stat	P value
$GDPC_t$	25.3478	12.0529	2.1031	0.0648
$GDPC_t^2$	−1.3193	0.6375	−2.0694	0.0684
$ECPC_t$	1.2015	0.4437	2.7081	0.0241
FDI_t	−0.0896	0.0390	−2.3005	0.0470
TO_t	−0.0053	0.0744	−0.0705	0.9453
C	−128.9380	57.8998	−2.2269	0.0530
$\Delta GDPC_t$	32.5869	17.5851	1.8531	0.0969
$\Delta GDPC_t^2$	−1.5746	0.1436	−10.9657	0.0000
$\Delta GDPC_{t-1}^2$	0.18036	0.0255	7.0713	0.0001
$\Delta ECPC_t$	0.1103	0.1291	0.8542	0.4152
$\Delta ECPC_{t-1}$	−0.6207	0.1606	−3.8661	0.0038
$\Delta FDIt$	−0.0273	0.0094	−2.9117	0.0173
ΔFDI_{t-1}	0.0568	0.0090	6.2845	0.0001
ΔTOt	−0.0067	0.0959	−0.0703	0.9455
ECT_{t-1}	−1.2856	0.1155	−11.1278	0.0000
Diagnostics				
Bound assessment	F-value=10.6138 At 10% (2.087–3.00) At 5% (2.39–3.38) At 1% (3.06–4.15)			
Heteroscedasticity	F-value=0.6542 (0.7576)			
Serial correlation	F-value=2.4277 (0.1582)			
Normality	F-value=2.0516 (0.3585)			
Functional form	F-value=0.0903 (0.7715)			

The effect of ECPC is found positive with higher elasticity which explains that 1% energy usage is responsible for 1.2% approximately increase in per capita emissions. FDI in Egypt is showing negative impact on the emissions per capita though with a minute elasticity. We may conclude that FDI is helping in reducing the environmental degradation which may be due to a fact that foreign investors are using clean technology. Further, 1% increase in percentage of FDI to GDP ratio is decreasing emissions per capita approximately by 0.09%. TO has insignificant effect and we may conclude that trade is neither harmful nor beneficial for the environment.

Table 1 shows short-run results, and it is seen that EKC hypothesis is validated. However, lag effect of GDP per capita square term is showing negative environmental effects. The current year effect of energy consumption is insignificant but is showing adverse effect on CO_2 emissions. FDI again has positive environmental effects but its lag term is minutely degrading the environment. The trade effect is found insignificant in short run as well, indicating that trade has no influence over emissions even.

5. CONCLUSIONS

The testing of EKC is pertinent to investigate the environmental effects of macroeconomic performance of any country. We test the EKC hypothesis in Egypt using an economically liberalized period of 1990–2014 through ARDL Cointegration test. We find an evidence of cointegration along with existence of short-run relationship in the hypothesized model. Moreover, we corroborate the existence of EKC hypothesis in Egypt with turning point of 14,861 per capita constant income. Egypt is found on the second stage of EKC with her present economic growth. Therefore, we may conclude a clean economic ground in Egypt at present period.

Further, FDI inflows have positive environmental effects with an evidence of depressing emissions per capita in the country. The effect of TO is insignificant. Therefore, trade at least does not seem to be harmful for the country. The short-run estimates also corroborate the significant finding of long run estimates. Based on our finding, we may recommend the government of Egypt to further liberalize in foreign trade. Moreover, FDI inflows should be attracted even more by quantitative and qualitative incentives which, in turn, may promote a cleaner environment.

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