MEASURING THE IMPACT OF ECO DIMENSION ON ECONOMIC GROWTH IN SYRIA

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Abstract

Our paper aims to clarify the impact of eco dimension on economic growth in Syria. For achieving this aim, we apply cointegration methodology (ARDL) method. We focus on five main indicators (Economic growth rate, Carbon dioxide, Alternative and nuclear energy, Electricity consumption, Agricultural land). The results clear that both electricity consumption and CO_2 emissions have positive significant effect on economic growth in long run. Also, the results support for feedback hypothesis between economic growth and alternative-nuclear energy in both short-run and long-run. On the other side, Agricultural land effected negatively on the economic growth at 1 percent level of significance.

Key words: Economic Growth, Eco Perspective, ARDL method, Sustainability, CO_2 emissions, Alternative and Nuclear Energy, Electricity Consumption, Agricultural Land.

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قياس أثر البعد البيئي في النمو الاقتصادي في سورية

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الملخص

تهدف هذه الدراسة إلى توضيح أثر البعد البيئي في النمو الاقتصادي في سورية. لإنجاز ذلك الهدف؛ وظّفت منهجية التكامل المشترك (باستخدام طريقة نماذج الانحدار الذاتي ذات المتباطئات الموزعة– ARDL). حيث تم التركيز على خمسة مؤشرات رئيسة (معدل النمو الاقتصادي، انبعاثات الكربون، الطاقة البديلة والمتجددة، استهلاك الكهرباء، مساحة الأراضي الزراعية). أوضحت النتائج أن كلاً من استهلاك الكهرباء وانبعاثات غاز ثنائي أكسيد الكربون له أثر موجب ومعنوي إحصائياً في النمو الاقتصادي على المدى الطويل. كذلك أكدت النتائج الفرضيات الخاصة بوجود علاقة تغذية استرجاعية (باتجاهين) بين النمو الاقتصادي والطاقة البديلة والمتجددة على المديين القصير والطويل. من جهة أخرى، أثرت مساحة الأراضي الزراعية سلباً في النمو الاقتصادي عند مستوى دلالة 1%.

الكلمات المفتاحية: النمو الاقتصادي، البعد البيئي، طريقة نماذج الانحدار الذاتي ذات المتباطئات الموزعة، الاستدامة، انبعاثات غاز ثنائي أكسيد الكربون، استهلاك الكهرباء، الأراضي الزراعية.

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1. INTRODUCTION

Countries' Prosperity and progress are measured by economic growth levels. Over time, this measure flatly fails where this growth is found to be unrealistic due to the increased damage in the ecosystem, represented by multi negative aspects such as the depletion of non-renewable natural resources, high rates of pollution around the world, the accelerated extinction of species, the breakdown of biogeochemical cycles, etc. The new environmental problems and economics issues related to, entered the agenda of policy makers and became the center of worldwide debate and a massive diplomatic effort.

It is surprisingly that some people supposed economic growth at odds with the environment. At the contrary, environmental policy contributes to economic performance, productivity growth and economic prosperity as well as protecting environment; this is the basic motif of sustainable economy in the long term. At the same context Kumar[1] referred that we need a new effective metrics for our 21st century far from 20th century metric (Gross Domestic Product- GDP) to measure wellbeing and economic growth. New metrics should take in consider sustainability from eco perspective. Hence, most countries have embarked on applying eco practices in economies as a rectifying procedure, which will guarantee high levels of both economic and environmental efficiency. Wide range of eco-economics standards has been adopted by countries depends on the economic privacy of each country and environmental climate, which cope at the end with the sustainable aim. Nowadays, many economists around the world conceive sustainability as an essential orientation for countries, sustainability (by taking the eco dimension in economy) ensure the rational use of resources to meet the needs of present without violating the rights of the future.

The previous lines coined the next question: Is there any Effect of Eco Dimension on Economic Growth in Syria?

[1] Pushpam Kumar is Senior Economic Advisor for the UN Environment. 13 Nov 2018 world economic forum

By answering this question, we will have a depth perception about the environmental impact on economic growth in general, and its contribution in Syrian economic particularly.

This study is an attempt to have a closer view of how eco dimension affects the Syrian economic growth, we determine five main factors: (a) Economic Growth rate, (b) Carbon Dioxide emissions, (c) Alternative and nuclear energy, (d) Electricity Consumption, (e) Agricultural land. All data are extracted from the websites of some official governmental organization which are: World Bank and OICStat[2].

2. LITERATURE REVIEW

Mubarak and Goud's paper (2018) studies many issues related to Islamic finance, but the most important points that are consistent with our study are: Positive environmental footmarks are dramatically important for compatible with national and international laws, principles and guidelines. Moreover, embodiment the environmental awareness in banking practices by taking sustainable view will upgrade the level of Islamic banking work, and play a critical role in providing immunity against any financial crises.

In parallel, Kirikkaleli, et al (2018) investigated the relationship between electricity consumption, internet demand and economic growth. This study takes place in 35 OECD countries in period 1993-2014. The findings from the Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) models indicate a positive relation between electricity, internet demand and economic growth in the long-run. Results from the Dumitrescu-Hurlin causality confirm feedback causality between electricity consumption and internet demand and unilateral causality running from economic growth to electricity consumption.

According to Özokcu & Özdemir paper (2017) that focused on the mutual relationship between economic growth and Environmental Kuznets Curve (EKC), implies that environmental disruption cannot be solved by the present economic system which ignore the eco perspective. In other words,

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[2] Statistics Database for Organization of Islamic Cooperation available: http://www.sesric.org/oicstat.php

the present economic system contributes to increase the damage in environment, as well as magnify the big lie of economic growth.

Hu (2017) studies the link between economic growth and pollution, the data which employed are related to province Sichuan, China. The author divided pollution into three different types: Industrial wastewater, industrial solid wastes, and industrial gas waste, and so on coined the next question: Whether the industrial pollution – industrial gas waste, industrial solid waste and industrial wastewater – will affect economic growth. In order to answer this question, the author used Johansen cointegration test and the Granger causality test. The results clarify that both industrial solid waste and industrial wastewater would have a negative effect with economic growth, at the opposite way gas waste has a positive effect with economic growth. Anyway, last result does not mean that we can support the industries with high rate of gas waste. In the real life, Sichuan considers as high levels gas pollution province in China, and this problem has attracted government's attention to announce new regulations in order to enhance the environment's condition.

Furthermore, Sébastien Sauvé, et al (2016) insist on the glamour of circular economy, and its remarkable effects on the efficiency of resources usage, which will reflect on both improvement economy and protecting environment, and will have significant effects on different aspects of economy which will translate by good level of well-being in the society.

At the same context, Sama & Tah (2016) studied the effect of energy consumption on economic growth in Cameroon from the period of 1980 to 2014. The scholars choose two energy to build their study on, Petroleum and electricity. The study used secondary time-series data, depending on the Generalized Method of Moments technique. The results revealed that Gross Domestic Product (GDP), population growth rate and petroleum prices, have a positive relationship with petroleum consumption. Also, there was an established positive relationship between (GDP), population growth rate, electricity prices and electricity consumption. Again, the study found a positive and significant relationship between petroleum consumption, electricity consumption, Gross domestic investment (GDI) and population growth rate and economic growth. Furthermore, the empirical result revealed that the rate of inflation and economic growth are positively related.

Another research which focuses on the positive relationship between green economy and economic growth in Nigerian economy is Okonkwo (2015), this paper insisted on the benefits of green economy and the useful opportunities it has on the studied sector which are: agricultural sector, fisheries, forestry, manufacturing, and renewable energy. The results that relate to agricultural Sector are: the continuous damage in the agricultural sector cause to the mal practices, will lead to have a seriously hazardous on the food safety and the share of food per capita, and will cause a permanent damage to both economic system and environmental sector. At the contrary adopt a participatory approach between economic and environment (green economy) will support the sustainable farming which in turn can increase productivity and ensure high level of quality and ease the enter to international supply chains.

Kumar, et al. (2015) examined the effect of population pressure on India's environment by focusing on the degradation of natural endowments, as land and water resources and the eco pollution come from. The results show that the high rate of population in India is accompanying with low rate of education toward environment causes. From the other hand the paper indicates that there is a positive impact of high rate of population on the rate of environmental degradation.

Also, Bhattacharya, et al. (2015) studied the effects of renewable energy consumption on economic growth. Results from long-run output elasticities indicate that renewable energy consumption has significant positive impact on the economic output for 57% of the selected countries.

Harrington (2013) the main goal of this paper is to determine the degree of harmonious between economic growth and environmental sustainability. Ghana was the case study in order to determine if economic development and eco sustainability are proper in practice. Finally, this paper shows that: (a) the economic development which does not flow at the same rhythm with environmental dimension is false, after a while this development will collapse; (b) the secret of sustainable growth is not about adaptation environmental policies and strategies, but it is about having successful implementation.

Yusuff, et. al, (2013) emphasized that: the current industrial practices around the world contribute to increase the damage in the eco system, and restrain the economic growth. The vision which dominated according to the current industrial practices is, focus on the short term, while in order to ensure sustainability and achieving real economic growth we need to focus on long term, by evolve all environmental aspects in our industrial practices. From the other hand this paper centers on having immensely corporate responsibility toward environment.

Everett, et al. (2010) study the relationship between economic growth and the eco-system, and the role of eco-economic policy in managing the protection and usage of natural assets. This paper implies several results, ones of which: the direct impact of environmental degradation on the prices in the market, which will represent as an extra burden on the economy, that will put the economy on a contrary path of eco sustainable growth path.

OECD and IEA (2010)

The OECD and IEA Secretariat prepared this study to clarify the best practices example of low carbon development. This paper reveals that those practices enhance the level of economic growth and help countries to have a healthy economic growth, those countries have magnificent experience with sustainability, and environmental efficiency, they have a great awareness toward environment and successful eco actions which reflect on the economic growth.

AlRonaldo (2009) studies the relationship between an environmental policy and economic growth using an extension of the Neoclassical Growth Model. Ronaldo embodies a state equation to renewable natural resources, and conceives natural resources as a component of the aggregate productivity. This paper shows that the degradation in environmental aspects such as to renewable natural resources, will afford economic an extra cost, which in turn will reflect on the standard of living for individuals.

At the same context, Bing zhang, et al. (2008) found a positive relationship between GDP per capita and eco efficiency. this paper focused on the present industrial system in (30) different provinces in China and the level of eco inefficiency. The Results revealed that, provinces with higher level GDP per capita will have higher eco efficiency. Furthermore, this paper provides more implications on eco protection strategies in China.

Roumasset, et al. (2007) the main aim of this paper is to estimate the type and the level of environmental degradation and resource depletion in China and its link to economic practices and eco polices. This paper studied many factors related to environment such as, air pollution, water pollution, percentage of forestry. The results show that the: air pollution -represented by the emissions of polluted gases i.e. (carbon dioxide) – gets decreased in some Chinese major cities. The most remarkable things about this improvement in air pollution that it does not affect on economic growth, at the contrary, the economic growth record good level in those cities. In other words, the eco practices support economic growth positively.

Paper of Verbeke, et al. (2002) employed 5-year non-overlapping emissions growth equations for sulphur and carbon dioxide to assess the influence of economic growth on environmental quality. The results elucidate that the influence of economic growth on emissions incremental rely on the level of income. In other words, soon a country records a specific level of income the economic growth reduces emissions. This paper also put up an idea that the need of environmental quality increase as the level of environmental damage getting high.

Shafik and Bandyopadhyay (1992) focused on the linkage between economic growth and environmental quality, through analyzing norms of eco transformation for countries at various income levels. Authors found out that emissions of sulfur dioxide (SO_2) first of all, grow and then decrease as income per capital rises, confirming the EKC hypothesis.

3. DATA DESCRIPTION

This paper uses annual data series for a thirty five years period from 1980 to 2015. All variables' time series are extracted from World Bank Indicators (WBI Online database) and Organization of Islamic Cooperation (OICStat). Table 1 shows a detailed explanation, sources and codes of all variables. Summery statistic of the above variables is given in appendix (Table 1)

Table (1). Data description

Data	Code	Measure	Source
Economic growth rate	GR	Annual percentage growth rate of GDP at market prices based on constant local currency.	(1980-2006) from WBI (2007- 2015) from OICStat
Carbon dioxide	CO_2	CO_2 emissions (metric tons per capita)	WBI except last two years from OICStat
Alternative and nuclear energy	ALTP	Alternative and nuclear energy (% of total energy use)	(1980- 1984) from WBI (1985-2015) from OICStat
Electricity consumption	EC	Electric power consumption (KWh per capita)	(1980- 1984) from WBI (1985-2015) from OICStat
Agricultural land	AGL	Agricultural land (% of land area)	WBI

4. MODELSPECIFICATIONAND ECONOMETRIC METHODOLOGY

The model of this paper take the following functional form:

$$GR_t = \beta_0 + \beta_1 AGL_t + \beta_2 CO_{2t} + \beta_3 ALTP_t + \beta_4 EC_t + \varepsilon_t \qquad (1)$$

where β_0: intercept term, t: time subscript, ε_t: the random error term

This equation is used to test the following four hypotheses:

H1: Agricultural land effects on economic growth (Eklund et al., 2017)

H2: CO_2 emissions has a positive effect on economic growth. Theoretical and empirical literature has shown that higher levels of energy consumption are accompanied with higher levels of economic growth (Bento,2014) (Shahbaz, 2012) (Kirikkaleli et al., 2018) (Alam, 2013).

H3: Alternative and nuclear energy has a positive effect on economic growth (Wolde-Rufael and Menyah, 2010) (Bhattachary et al., 2016) (Dees and Vidican Auktor, 2016) (Apergis and Payne, 2010) (Apergis et al., 2010).

H4: Electricity Consumption has a positive effect on economic growth. We expect that a higher consumption of electricity is required for economic growth (Kirikkaleli et al., 2018) (Tiwari, 2011) (Sama and Tah, 2016).

Empirically, to analyze the long-run relationships and dynamic interactions among the respective variables, the model has been estimated by using Autoregressive Distributed Lag model -ARDL that depends on the bounds test cointegration procedure, developed by (Pesaran et al., 2001).

ARDL is a dynamic model that is consistently estimated by ordinary least squares and can be used with variables that are integrated of mixed order, i.e. zero or one. In addition, this cointegration procedure (ARDL) has three features: Firstly, the bounds test procedure is simple, conversely other multivariate cointegration techniques such as Johansen and Juselius (Johansen and Juselius, 1990). Secondly, It is applicable irrespective of whether the variables in the model are purely I(0), purely I(1) or mutually cointegrated (Nkoro and Uko, 2016) . Thirdly, the test is relatively more efficient in small or finite sample data sizes (Smyth and Narayan, 2005) as is the case in this study.

5. EMPERICAL RESULTS AND DISCUSSION

Our empirical estimation has two objectives. The first one is to examine how the environmental variables affected on economic growth in long-run and short run. And the second is to identify causal relationships between variables. To achieve these objectives, we must checking for the order of integration of the perspective variables with tests of unit roots to exclude I(2) variables. The present study employs both Augmented Dickey-Fuller ADF and Phillips-Perron PP stationarity test.

According to the results presented in Tables 2 and 3, we accept the null hypotheses (H0: variable has unit root) in level and reject it in first difference for all study's variables except economic growth rate (we reject null hypotheses in level), that means the order of integration of them is less or equal to one. Thus reflect to possibility for applying ARDL methodology.

Table(2). ADF Unit Root Test

	LEVEL			1ST DIFFERENCE			integrated
Variable	**N[a]**	**C [b]**	**C+T [d]**	**N**	**C**	**C+T**	**degree**
GR	**-3.39*** **	**-3.35** **	**-3.65** **				**I(0)**
AGL	**-0.33**	**-1.68**	**-2.97**	**-4.19*** **	**-2.23**	**-2.56**	**I(1)**
EC	**-0.13**	**-1.73**	**-1.76**	**-3.59*** **	**-3.59** **	**-3.72** **	**I(1)**
ALT	**-2.61** **	**-2.58**	**-1.43**	**-4.51*** **	**-4.51*** **	**-5.31*** **	**I(1)**
CO_2	**-0.58**	**-1.61**	**-2.57**	**-7.43*** **	**-7.40*** **	**-7.64*** **	**I(1)**

Note: *,** mean stationary at the 1% and 5% respectively. a, b, d indicates to type of test equation without intercept, with intercept and with intercept and trend respectively.**

Table (3). PP Unit Root Test

Variable	LEVEL			1ST DIFFERENCE			integrated degree
	N	C	C+T	N	C	C+T	
GR	-3.34***	-3.30**	-3.63**				I(0)
AGL	-0.28	-1.90	-1.70	-4.18***	-4.41***	-4.14***	I(1)
EC	0.09	-1.63	-0.86	-3.51***	-3.49**	-3.53*	I(1)
ALT	-2.43**	-3.54**	-1.63	-4.52***	-4.52***	-5.85***	I(1)
CO_2	-0.57	-1.49	-2.50	-7.63***	-7.71***	-15.19***	I(1)

Note: *,** mean stationary at the 1% and 5% respectively.**

After determining the order of integration for variables, we should select the best order of lag. Most of criteria employed in appendix (Table 2) select lag four as the best lag for ARDL model.

After testing the stationarity properties of the series and selecting the optimal lag length order, we apply ARDL bounds testing approach to investigate the presence of a long run equilibrium relationship between economic growth and other respective variables for Syrian economy, the following unrestricted autoregressive distributed lag models, ARDL (2, 4, 2, 4, 3) with Akaike information criterion, are estimated:

$$\Delta GR_t = \delta_0 + \beta_1 GR_{t-1} + \beta_2 AGL_{t-1} + \beta_3 CO2_{t-1} + \beta_4 EC_{t-1} + \sum_{i=1}^{2} \delta_1 GR_{t-i} + \sum_{i=0}^{4} \delta_2 AGL_{t-i} + \sum_{i=0}^{2} \delta_3 CO_{2t-i} + \sum_{i=0}^{4} \delta_4 ALTP_{t-i} + \sum_{i=1}^{3} \delta_5 EC_{t-i} + \mu_t \quad (2)$$

Where δ_0: intercept term, Δ: first difference operator, i: lag order, μ: white noise error term assumed to be normally distributed and white noise.

The calculated F-statistic of bounds test, presented in Table 4, is greater than the upper bound of the 99 percent critical value. Thus reflects to rejection the null hypothesis (H0: no cointegration relationship among the variable) and emphases the presentence of long run relationship between economic growth rate and others variables in case of Syria.

Table (4). The Result of Bound Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
F-statistic	6.655852	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

The results are reported in Table 5 indicate that electricity consumption has positive and statistically significant impact on economic growth at 5 percent level of significance. This shows that a 1 kWh per capita increase in electricity consumption leads to a very small increase (0.0006) in economic growth rate in the long run. Also, the impact of CO_2 emission is positive and it is statistically significant at 10 percent level of significance. It implies that each metric tons per capita increase in CO_2 emission leads to increase economic growth by 4 percent. Using alternative and nuclear energy affects positively in economic growth at 5 percent level of significance. That means a 1 percent increase in alternative and nuclear energy consumption raises economic growth by a 3 percent. Via versa, Agricultural land proportion has negative and statistically significant impact on economic growth at 1 percent level of significance. We can interpret that: arable lands are not fully invested, also the majority of agriculture in Syria is rain-fed, while irrigated one does not exceed 30%, besides that Syria suffered several severe droughts. Above all, in 2014 the terrorist groups represented by ISIS, occupied high rate of agricultural Syrian land. All these factors and another, contributed directly to weakness the agricultural production, resultant reduced the participation of agricultural sector in economic growth (Baraka, 2014).

Table (5): Long Run Estimate of Economic Growth

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EC	0.006311	0.002471	2.55374	0.0253
CO_2	4.149297	2.158437	1.922361	0.0786
ALTP	3.016502	1.352805	2.229812	0.0456
AGL	-4.49712	0.983007	-4.57486	0.0006
C	314.2298	73.8222	4.256577	0.0011

We can obtain on the coefficients for short run from estimating Error Correction Model (Narayan and Smyth, 2008) (Odhiambo, 2009). The short run results illustrated that alternative and nuclear energy consumption and CO_2 emissions have negative impact on economic growth and it is statistically significant at 5 percent level of significance. It is found that electricity consumption contributes to economic growth in different magnitude in short run (negatively but nonsignificant in first lag, positively and significant in others). The short run impact of agricultural land proportion is similar to its previous (electricity consumption).

Surprisingly, agricultural land proportion with lagged period has positive impact in short run comparing with its negative impact on long run due to the existing farming patterns that are often seasonal, and poor application of agriculture cycle which in turn lead to degradation the soil fertility in the long-run (Alkalil, 2009). The statistically highly significant estimate of lagged error term ($ECM_{t-1)}$ with negative sign corroborates our established long run relationship between economic growth, agricultural land proportion, electricity consumption, alternative and nuclear energy consumption and CO_2 emissions. The result reported in Table 6 pointed out that coefficient of ECM_{t-1} is -2.30907 which is statistically significant at 1 percent level of significance. This concludes that changes in economic growth are corrected by 231 percent every year in long run and proofs of the existence of stable long run relationship between the series (Banerjee et al., 1998). It reflects to high speed of adjustment and suggests that full convergence process will take less than six months to reach the stable path of equilibrium. In other words, this implies that adjustment process is very fast and significant for Syrian economy.

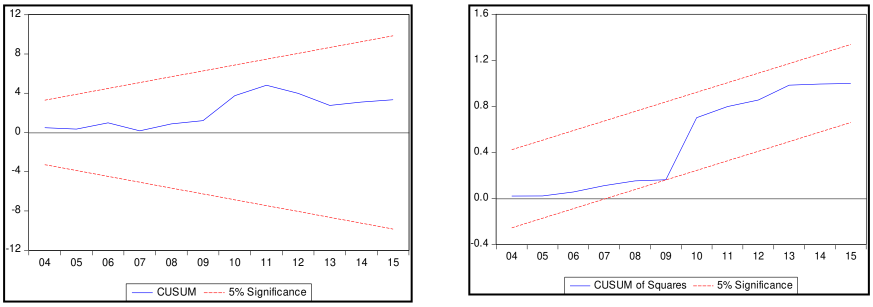
Table (6). Short Run Estimate and Error Correction Model for Growth Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GR(-1))	0.399311	0.136233	2.931081	0.0126
D(EC)	-0.00313	0.006673	-0.46919	0.6473
D(EC(-1))	0.014238	0.006635	2.145808	0.0530
D(EC(-2))	0.046786	0.007533	6.210462	0.0000
D(EC(-3))	0.026464	0.010916	2.424371	0.0321
D(CO_2)	-1.73342	2.204428	-0.78634	0.4469
D(CO_2(-1))	-5.43437	2.616165	-2.07723	0.0599
D(ALTP)	-8.18814	2.802915	-2.9213	0.0128
D(ALTP(-1))	-8.82785	3.347066	-2.63749	0.0217
D(ALTP(-2))	-12.0417	3.133356	-3.84306	0.0023
D(ALTP(-3))	3.204404	2.454529	1.305507	0.2162
D(AGL)	-3.23194	1.980835	-1.63161	0.1287
D(AGL(-1))	9.213317	2.143173	4.298913	0.0010
D(AGL(-2))	9.831117	2.632802	3.734089	0.0029
ECT(-1)	-2.30907	0.306991	-7.52162	0.0000
R-squared	0.941147	F-statistic	10.05159	
Adjusted R-squared	0.89268	Prob(F-statistic)	0.000107	
DW-static	1.930206			
RAMSEY Reset Test	4.607715	Prob.(F-statistic)	0.055	
Serial Correlation	3.748029	Prob.(F-statistic)	0.061	
Heteroskedasticity	21.73822	Prob.(Chi-Square)	0.2975	
Jarque-Bera	0.225403	Probabillity	0.8934	

Note: ECT_{t-1} is the one period lagged error-correction mechanism.

The estimated ARDL model has an overall satisfactory goodness of fit (adj.R^2 = 0.89) and the F statistic for the null hypothesis (all coefficients equal to zero) is rejected with high statistically significant at 1 percent level of significance. The empirical evidence for diagnostic tests is detailed in Table 8. The results show that short run model seems to pass most tests successfully such as test of normality, white heteroskedasticity, serial correlation and stability of model. This indicates that there is no problem of non-normality or out-correlation of error term, as well as no evidence is found for autoregressive conditional heteroskedasticity. The variables are homoscedastic and functional form of short run model is well organized.

Figure 1 shows that the cumulative sum of recursive residuals and squares residuals of the economic growth model has parameter constancy over the sample period (1985-2015) since plots of both CUSUM and CUSUM of squares statistics are always within the five percent critical bounds of parameter stability.



The straight lines represent critical bounds at 5% significance level

Figure (1). Plots of Cumulative Sum of Recursive Residuals and Squares Residuals

This study also investigates short run causal linkages. According to Granger representation theorem, if there is cointegration then we should be able to find Granger causality in at least one direction (Engle and Granger, 1987).

Table (7). Granger Causality Test

Null Hypothesis:	F-Statistic	Probability	Direction
D(EC) does not Granger Cause GR	12.9342	0.0001	EC→ GR
GR does not Granger Cause D(EC)	0.02839	0.972	
D(CO_2) does not Granger Cause GR	3.59573	0.0407	CO_2 →GR
GR does not Granger Cause D(CO_2)	0.03953	0.9613	
D(ALTP) does not Granger Cause GR	2.74599	0.0815	ALTP→GR
GR does not Granger Cause D(ALTP)	1.02688	0.3712	
D(AGL) does not Granger Cause GR	0.96539	0.3932	
GR does not Granger Cause D(AGL)	1.15068	0.3309	
D(CO_2) does not Granger Cause D(EC)	1.92144	0.1652	
D(EC) does not Granger Cause D(CO_2)	1.1712	0.3247	
D(ALTP) does not Granger Cause D(EC)	0.07213	0.9306	
D(EC) does not Granger Cause D(ALTP)	1.4132	0.2602	
D(AGL) does not Granger Cause D(EC)	0.0683	0.9341	
D(EC) does not Granger Cause D(AGL)	0.18997	0.828	
D(ALTP) does not Granger Cause D(CO_2)	6.47495	0.0049	CO_2 ↔ALTP
D(CO_2) does not Granger Cause D(ALTP)	7.67581	0.0022	
D(AGL) does not Granger Cause D(CO_2)	0.2369	0.7906	CO_2→AGL
D(CO_2) does not Granger Cause D(AGL)	4.83321	0.0157	
D(AGL) does not Granger Cause D(ALTP)	0.07828	0.9249	
D(ALTP) does not Granger Cause D(AGL)	1.58023	0.2237	

Based on results presented in Table 7, Granger causality is running from CO_2 emissions, electricity consumption and alternative and nuclear energy consumption to economic growth, but no evidence of reverse causality. While there is a bidirectional relationship between alternative and nuclear energy consumption and CO_2 emissions.

6. CONCLUSION

Our paper aims to clarify the impact of eco dimension on economic growth. For achieving this aim, we apply cointegration methodology (ARDL) method. The results clear that both electricity consumption and CO_2 emissions have positive significant effect on economic growth in long run which is in line with what were stated in the literature review. This indicates that the Syrian economy growth relies heavily on consumption electricity, generated by traditional, non-renewable sources, which is accompanied with high levels of CO_2 emissions. This requires that Syrian government should take reasonable steps towards alternative energy sources, and the transition to a green economy, and activate the initiatives of the research environmental conferences, i.e. the forth research environmental conference in 2017 called for the adoption of green economy strategy and the sustainable reconstruction in damaged areas and establishment of recycling stations for the remnants of war and increase investment in alternative energy sources (Ministry of Local Administration and Environment, 2017).

Also, the results support for feedback hypothesis between economic growth and alternative-nuclear energy in both the short-run and long-run. Although the limited of alternative-nuclear energy sources in Syria represented by hydropower energy, and the absenteeism of investment in solar and wind power, and the high costs of using these sources in some cases, their economic benefits exceed these costs and reflected positively on economic growth, without causing any environmental damages.

On the other side, Agricultural land effects negatively on the economic growth at 1 percent level of significance, this requires reconsidering the agricultural policies, and seeking to find optimal solutions for the various problems agricultural lands suffer in particular (overgrazing, deforestation, desertification, deterioration, etc.) and the agricultural sector in Syria in general.

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Appendix

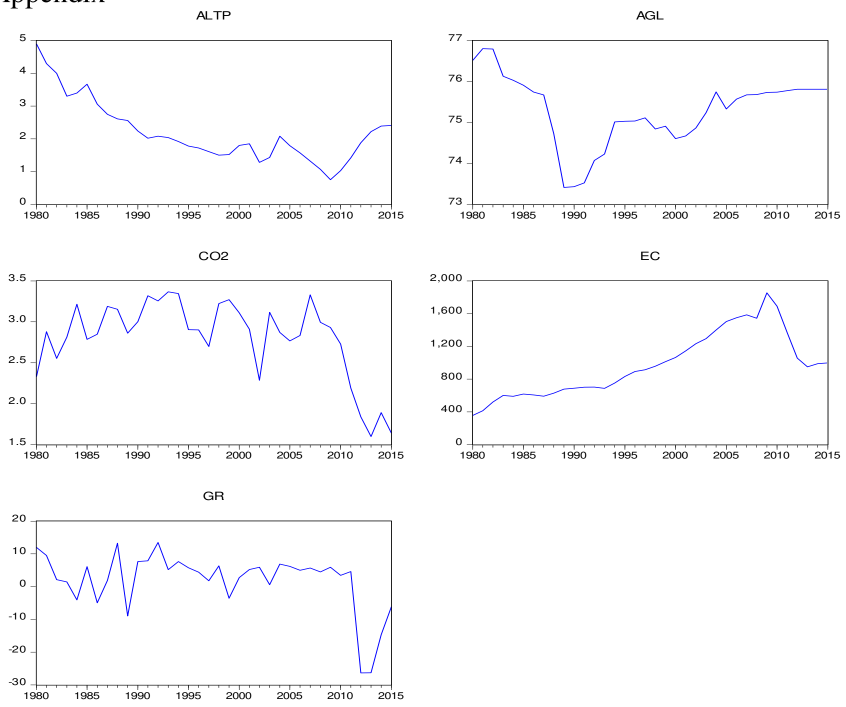

Figure (1). Plots of study's variables

Table (1). Summery statistic

	AGL	ALTP	EC	CO2	GR
Mean	**75.300**	**2.202**	**971.122**	**2.804**	**1.892**
Median	**75.621**	**1.970**	**931.820**	**2.890**	**4.796**
Maximum	**76.804**	**4.900**	**1853.433**	**3.367**	**13.470**
Minimum	**73.414**	**0.750**	**356.520**	**1.599**	**-26.339**
Std. Dev.	**0.845**	**0.950**	**390.650**	**0.479**	**9.081**

Table (2). VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-401.0890	NA	72495.34	25.38056	25.60958	25.45648
1	-302.3613	160.4325	739.2554	20.77258	22.14671*	21.22806
2	-274.5928	36.44609	703.4913	20.59955	23.11879	21.43461
3	-233.0201	41.57278*	353.3397	19.56375	23.22809	20.77838
4	-190.9784	28.90365	272.8024*	18.49865*	23.30810	20.09284*

Note: * indicates to selected order of lag

Table (3). Pair-wise correlation

	GR	ELC	CO2	ALTP	AGL
GR	**1**				
ELC	**-0.021**	**1**			
CO2	**0.629**	**-0.077**	**1**		
ALTP	**0.032**	**-0.798**	**-0.129**	**1**	
AGL	**-0.171**	**0.0519**	**-0.416**	**0.411**	**1**

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