Measuring The Reciprocity Mutual Relation Between the Green Economy and Indicators of Sustainable Development in Iraq for The Period 2004-2020

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Abstract:
Despite the expansion of the countries of the developed world towards the green economy for the purpose of achieving development that is friendly to the environment and does not harm it and depends on modern green technology. However, Iraq's attempts to green one of its sectors - the energy sector - are still weak and do not rise to the ranks of neighboring countries, despite the enormous potential it possesses in this field. The Iraqi economy is a rentier economy. Oil and gas play a pivotal role in the country. Most economic sectors depend on oil revenues to be the main engine of the economic wheel. It is not possible to fully replace fossil fuels with green energy sources in the short to medium term. It is likely that the time horizon for the transition to a green energy system In the case of Iraq, it takes a long time.

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1. Introduction

In recent years, there has been an increasing global interest in the environment and climate changes and their repercussions on the economic and social fields. In addition to the emergence of many international crises, which led the international community to encourage increased investment in the environment as a basic requirement in addition to the social and economic demands of sustainable development and the transition from a black economy to a sustainable economy that takes more environmental aspects into account. This type is called the green economy. And since the nominal goal that countries seek to achieve is sustainable development, the green economy represents the practical tool that helps to reach sustainable development

and is not considered a substitute for it. The United Nations Environment Program has developed an integrated scenario for greening their economies in accordance with their conditions and needs to reach sustainable development.

2. Research problem:

Here lies the research problem in the following questions

1-Has Iraq achieved positive indicators in the transition of the energy sector to a green economy.

2-Is there an intertwined interrelationship between indicators of sustainable development and the green economy that reflects an optimistic future vision for this new development model.

3. Research hypothesis:

The research attempts to test the hypothesis of a reciprocal relationship between the indicators of sustainable development and the green economy and its future implications for the growth of the green economy in Iraq.

Search target:

1- Analysis of concepts and indicators of sustainable development and the green economy in Iraq.
2- Measuring the interrelationship between the indicators of sustainable development and the green economy in Iraq.

The theoretical side:

First: the concept of green economy.

The current discussions have led to a common understanding of the green economy as "a concept that brings together a set of policies to promote investment in sectors of environmental importance while contributing to the pursuit of sustainable development and poverty eradication. Deriving from a set of economic approaches, concepts, ideas and principles, the green economy has historically been understood as An economic system compatible with the natural environment and therefore environmentally friendly.Today, the concept of green economy has evolved to also take into account social issues.Using clean technology and clean energy, the green economy is expected to provide safer and healthier environments, create alternative green jobs and sustain the development of societies The concept of a green

economy is often associated with ideas such as "low carbon growth" or "green growth" in the context of green economy.(1)

The United Nations Environment Program (UNEP) has defined a green economy as "an economy that improves human well-being and social equity, while significantly reducing environmental risks and environmental scarcity. In its simplest terms, a green economy can be thought of as a low-carbon, resource-efficient economy and socially inclusive. (2) The World Bank defined it as that growth that is effective in its use of natural resources, so that it reduces the impact of air pollution and environmental impacts, and takes into account natural risks, preventing physical disasters, and this growth must be comprehensive. (3) Chapple defined it as a clean energy economy and improving environmental quality by reducing greenhouse gas emissions, reducing environmental impact, and improving the use of natural resources. It consists of several economic sectors and is not limited only to the ability to produce clean energy, but also includes technologies that allow production processes. cleaner.(4)

Second: Principles of green economy.

One of the goals of the Rio+20 conference was to secure a renewed political commitment to sustainable development. Strengthen the political will to achieve the ambitious outcome of Rio+20, whereby the international community will have to agree on a common ethical framework of shared values and principles. This document provides state and non-state actors with an overview of the types of principles that might shape this framework. (5)

1- Equitable distribution of wealth. Within countries and between countries to reduce inequalities between rich and poor and achieve social and economic justice, within a sustainable and fair share of the world's resources and leaving enough space for terrestrial and marine life.

2- Economic equity and justice. Guided by the principle of common but differentiated responsibilities, create economic partnerships that will transfer significant financial and technological assistance to the least developed countries, to help reduce the gap between the developed and developing world and to support the environmental sustainability of both.

3- Equality between generations. Environmental resources and ecosystems must be carefully managed and protected in order to enhance the value of environmental assets for future generations, thereby meeting their needs fairly and allowing them to thrive.

4- The preventive approach. Science should be used to enhance social and environmental outcomes, by identifying environmental risks. Scientific uncertainty of environmental impacts should not preclude measures to prevent environmental degradation.

5- Right to development. Especially human development should be in harmony with the environment, and this is essential to achieving sustainable development, by enabling individuals and societies to achieve positive social and environmental results.

Third: the concept of sustainable development.

The concept of sustainable development is one of the most important topics that the world has taken care of in the economic, social and political arena, as sustainability has become a developmental thought that is spreading in most countries of the developing and developed world alike, where summits and conferences were held for it, which contributed since its inception , in the eighties of the last century in dealing with many serious environmental problems that threaten forms of life on the planet, and this was natural in light of the neglect of development of environmental aspects over the past decades, so it was necessary to find a new development philosophy that helps in overcoming these problems, and resulted in International efforts for a new concept of development known as sustainable development, and this concept was crystallized for the first time in the report of the World Commission for Environment and Development titled Our Common Future and published for the first time in 1987, and this committee was formed by a decision of the General Assembly of the United Nations in December / December In 1983, headed by "Brundtland" the Prime Minister of Norway and the membership of (22) personalities from the ruling political and economic elites in the world, with the aim of continuing growth The global economy without the need to make radical changes in the structure of the global economic system, as it is an attempt to link the issues of economic development and environmental stability. In doing so, this report provided the oft-cited definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" . Although this concept of sustainable development is somewhat vague, it aims to maintain economic progress and progress while protecting the long-term value of the environment; It "provides a framework for the integration of environmental policies and development strategies". (6)

Stoddart defines sustainability as the efficient and equitable distribution of resources between generations and between generations with the operation of social and economic activities within the confines of a limited ecosystem.(7)

On the other hand, (Ben-Eli) sees sustainability as a dynamic balance in the process of interaction between the population and the absorptive capacity of their environment so that the population evolves to express its full potential without irreversible negative effects on the absorptive capacity of the environment on which it depends. (8)

Fourth: The basic principles of sustainable development.

There is no single set of principles for sustainable development.

The National Strategy for Environmentally Sustainable Development lists seven principles of Agenda 21 that include specific principles for action. The following list of principles is based on our research, literature and experience on what is most applicable to local councils.

Integration - Effective integration of environmental, social and economic considerations into decision-making. An integrated approach means that decision-making processes at all levels must include consideration of a wide range of environmental, social and economic impacts. Separation of functions within the board can cause a decision-maker in one area to ignore effects that may be evident to people in other areas. Integration involves developing organizational processes that allow such impacts to be easily presented and considered across board departments before a decision is made. Integration also refers to effectively working closely and collaboratively with other organisations, including neighboring councils, other levels of government and most importantly all sectors of the local community.

Community Involvement - Recognition that sustainability cannot be achieved, nor significant progress made towards it, without the support and participation of the entire community. The community council's collaborative approach from early stages through to project implementation allows for sharing of resources, and a supportive, active community that sees itself as owning both the problems and the solutions. The effectiveness of this approach is already recognized in many local government programs such as reducing waste and reducing greenhouse gas emissions. Community involvement is also vital to monitoring the state of the environment.

Precautionary behavior - In the event of threats of serious or irreversible environmental damage, the lack of complete scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation, such as measures to reduce greenhouse gas

emissions. Precautionary behavior requires careful consideration of potential adverse environmental impacts in planning, policy and practice.

In the event of a threat of serious or irreversible environmental damage, it would be wise and inappropriate to wait for scientific certainty before acting. Precautionary behavior refers to conservation ethics within environmental planning boards and administrative frameworks to protect against environmental degradation.

Equality within and between generations - Equity and equal access to opportunities in our lifetime as well as for future generations. This concept of justice refers to the importance of preserving both the environmental integrity and the Earth's resources in order to provide a certain quality of life, both in the short and long term. As such, current activities should not impair the right of the current generation or future generations to healthy and dynamic environments or lose opportunities. It includes asking, "Is our quality of life at the expense of others or future generations. "

Continuous Improvement - The deteriorating environmental situation means that immediate action is required to become more sustainable and for continuous improvement. Change will not happen all at once; However, it is important to make continuous improvements, to make the most of advances in technology and scientific understanding of what is sustainable, and to raise society's awareness of sustainability issues.

Environmental integrity - to protect biodiversity and maintain essential ecological processes and life support systems. Realizing that we are part of the natural environment, and not separate from it, and protecting the natural environment in its many and varied forms is essential because we depend on it heavily. (9)

Applied side:

First: a description of the relationship

There is a wide disagreement between economists and researchers in the field of the environment about the relationship between economic growth and environmental deterioration, for a reason due to the existence of a mutual effect between economic growth and environmental policies. There are two effects, one of which is negative, which is represented in stopping or obstructing growth in the short term through spending on non-productive investments in the field of environmental protection. The second positive effect is the

technological development in protecting the environment, which carries with it economic growth. And do not forget the impact of spending on growth in the long term, as well as the fact that random and uncontrolled economic growth can lead to environmental pollution. Given the nature of the reciprocal relationship between the green economy and sustainable development, it is necessary to study the relationship between carbon dioxide emissions as an environmental dimension and each of the gross domestic product to reflect the economic dimension, as well as the human development index to express the social dimension. Therefore, to measure the relationship between the two research variables, it is necessary to determine the extent to which the transition to a green economy (an economy that reduces carbon dioxide emissions) and sustainable development is related to its three dimensions (environmental, economic, and social), depending on three basic variables, each of which reflects a dimension of the three dimensions that can Explain it as follows:

First: Co2 is the emission of carbon dioxide measured in kilo/ton, which is a variable that measures the quality of the environment (the environmental dimension of sustainable development).

Second: GDP Gross domestic product measured at constant prices (billion dollars).

Third: HDI is the human development index, which is a variable that reflects the social dimension of sustainable development.

Given the nature of the relationship between the above variables, which reflects any modification or response to the dependent variable due to changes in the independent or explanatory variable over time. If these periods between the response and the effect are relatively long, the explanatory variables must be written in the model with periods of time lag, and the equation below shows the direction of the relationship between the variable of carbon dioxide emission and each of the gross domestic product and the human development index, as follows:

$$\boldsymbol{co2_t} \uparrow = \boldsymbol{f}\left(\boldsymbol{co2_{t-p}}, \boldsymbol{Gdp_{t-q}} \downarrow\uparrow, \boldsymbol{Gdp^2_{t-q}} \downarrow, \boldsymbol{Hdi_{t-q}} \downarrow\right) \dots (\mathbf{1})$$

In light of the foregoing, the ARDL model was used, i.e. the methodology for combining the ARDL model, or the so-called Autoregressive Distributed Autoregressive Distributed model, with

the bounds test approach for integration. In order to estimate the reciprocal relationship between the variables for the period 2004-2020 annual data, the ARDL model was estimated, (p, q1, q2, q3)

Second: the unit root and determining the degree of cointegration.

In order to determine the degree of co-integration of the studied variables, the Augmented Dickey-Fuller Test was tested, and the results came in Table (1). It is of order one I (1), and therefore one of the solutions to the instability of the series is to take the first difference, and the co-integration refers to the method of obtaining a long-term balance or relationship between unstable variables, or it means the presence of an adjustment method that prevents the increase in error for the long-term relationship That is, they are stable as a group. The variable co2 is stable in the level i.e. the integral of zero order I (0).

Table (1) The results of the unit root tests

Variable	Level		1st Difference	Critical value			
	ADF test	Prob.	ADF test	Prob.	1%	5%	10%
lnco2	-3.104	0.441**	---	---	-3.920	-3.065	-2.673
lnGdp	-0.871	0.315	-3.211**	0.039	-3.920	-3.065	-2.673
lnHdi	-2.519	0.2251	-4.173**	0.029	-4.886	-3.828	-3.362

Source: E-views.12 results of the statistical program

%1 :* level of significance. **: level of significance 5%. ***: 10% level of significance

Third: Choose the standard model.

It should be noted that the unit root tests are what determine the form and nature of the model used. If the variables are stable in the level, the OLS, VAR method is used, but if all the variables are not stable in the level, the VECM method is used, or the causality test is used, but if some of them are stable in the level and others are at the first difference, in this case ARDL models are used . Table (2) shows the general model, and the optimal model ARDL was reached based on the AIC criterion with its lowest value, and the model was ARDL (1,0,0,1).

Table (2) ARDL general form for the first relationship

Dependent Variable: CO2
Method: ARDL
Date: 08/06/22 Time: 03:42
Sample (adjusted): 2005 2020
Included observations: 16 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): GDP GDP2 HDI
Fixed regressors: C
Number of models evaluated: 8
Selected Model: ARDL(1, 0, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
lnCO2(-1)	0.108982	0.284434	0.383155	0.7096
LnGDP	2.841989	1.038816	2.735795	0.0210
lnGDP2	-724.6894	253.2756	-2.861268	0.0169
LnHDI	-75.01350	321.1123	-0.233605	0.0200
lnHDI(-1)	696.6388	411.4287	1.693219	0.1213
C	-1330.550	406.7015	-3.271565	0.0084

R-squared	0.989894	Mean dependent var	132.2894
Adjusted R-squared	0.984840	S.D. dependent var	46.01397
S.E. of regression	5.665438	Akaike info criterion	6.586642
Sum squared resid	320.9719	Schwarz criterion	6.876363
Log likelihood	-46.69314	Hannan-Quinn criter.	6.601478
F-statistic	195.8945	Durbin-Watson stat	2.545510
Probe(F-statistic)	0.000000		

Source: E-views.12 results of the statistical program

The Bound test ARDL was conducted to see if the variables: logarithm of CO2 emission, GDP, square of GDP, and human development index were associated with a long-term relationship, and the maximum delay length was generated automatically using the (SC) criterion. When conducting co-integration tests, if the calculated F statistic is greater than the up bound of the

tabular F statistic, the null hypothesis that there is no co-integration between the variables is rejected. On the other hand, if the calculated F statistic is less than the down bound of the tabular F statistic. The null hypothesis that there is no co-integration between the variables is accepted regardless of whether the variables are integrated by the first difference (I(1) or (I(0). However, if the calculated value of the F statistic falls between the upper and lower limits of the critical value of the statistic, we say that the results are inconclusive. It is clear from Table (3) that the value of the calculated F statistic came with a value of 11.7 greater than the value of the up bound (Bounds test) as determined by Pesaran in the case of a fixed limit of the function, and accordingly we reject the null hypothesis and accept the alternative hypothesis that the variables are integrated together and achieve a long equilibrium relationship Term at a significant level of 1%, 5% and 10% Thus, the ARDL model can be used to estimate the long and short term dynamics of the research variables.

Table (3) Limits test for the first relationship

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	11.72545	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
			Finite Sample: n=35	
Actual Sample Size	16			
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816
			Finite Sample:	

		n=30	
	10%	2.676	3.586
	5%	3.272	4.306
	1%	4.614	5.966

Source: E-views.12 results of the statistical program

Several tests were conducted on the general model, including the Heterodkedasticity test as shown in Table (4). It turns out that there is no problem of heterogeneity of the variance, as the calculated value is not significant and with a probability greater than 5%, in addition to the improbability of the chi-square. The LM test indicates that the model does not contain a serial autocorrelation, as it is clear from Table (5) that the calculated value is not significant and greater than 5%.

Table (4) Heterogeneity of variance test for the first relationship

Heteroscedaticity Test: Breusch-Pagan-Godfrey Null hypothesis: Homoscedasticity			
F-statistic	4.380377	Prob. F(5,10)	0.3226
Obs*R-squared	10.98462	Prob. Chi-Square(5)	0.0517
Scaled explained SS	4.598756	Prob. Chi-Square(5)	0.4668

Table (5) LM test for the first relationship

Breusch-Godfrey Serial Correlation LM Test: Null hypothesis: No serial correlation at up to 1 lag			
F-statistic	1.141129	Prob. F(1,9)	0.3132
Obs*R-squared	1.800398	Prob. Chi-Square(1)	0.1797

Source: E-views.12 results of the statistical program

The long-term relationship is extracted from the error correction limit - the relationship of the variables in the level - and is shown in Table (6). And the relationship between the variables in

the short term, which is represented by the error correction model and by using the ARDL (1,0,0,1) model, as shown in Table 16, and it is clear from the following two tables:

First. There is a positive and statistically significant relationship for GDP with carbon dioxide emission in the long and short term, as the long-term elasticity coefficient was about 2.19, and this means that an increase in GDP by 100% leads to an increase in carbon dioxide emission by 21.9%. The results are shown in Table (6). This is consistent with the ECK hypothesis of the environmental Kuznets curve, and according to the modification of Grossman et kneger by introducing the environment variable into the Kuznets model.

Table (6) The long-term relationship of the first relationship

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnGDP	2.189599	0.557425	5.722025	0.0002
lnGDP2	-3.133278	93.85696	-8.665610	0.0000
LnHDI	-2.976577	241.8258	-2.884960	0.0162
C	1.493293	101.4778	14.71547	0.0000

EC =lnCO2 - (-2.1896*lnGDP +3.133278*lnGDP2 + 2.976577*lnHDI - 1493.2929)

Source: E-views.12 results of the statistical program

Table (7) error correction form for the short-term relationship of the first relationship

ARDL Error Correction Regression
Dependent Variable: D(CO2)
Selected Model: ARDL(1, 0, 0, 1)
Case 2: Restricted Constant and No Trend
Date: 08/06/22 Time: 03:50
Sample: 2004 2020
Included observations: 16

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(HDI)	-75.01350	204.8060	-0.366266	0.7218
CointEq(-1)*	-0.891018	0.098350	-9.059700	0.0000
R-squared	0.745447	Mean dependent var		8.101187
Adjusted R-squared	0.727265	S.D. dependent var		9.168518
S.E. of regression	4.788169	Akaike info criterion		6.086642
Sum squared resid	320.9719	Schwarz criterion		6.183216
Log likelihood	-46.69314	Hannan-Quinn criter.		6.091587
Durbin-Watson stat	2.545510			

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1330.550	406.7015	-3.271565	0.0084
CO2(-1)*	-0.891018	0.284434	-3.132595	0.0106
GDP**	2.841989	1.038816	2.735795	0.0210
GDP2**	-4.246894	253.2756	-2.861268	0.0169
HDI(-1)	3.216253	229.3464	2.710421	0.0219

Source: E-views.12 results of the statistical program

An increase in the pace of economic growth at the beginning is accompanied by an increase in environmental pollution during the first stage of economic growth. The elasticity coefficient in the short run was 2.8, as shown in Table (7).

Second: There is a statistically significant and negative effect of the square of GDP on CO2 emission in the short and long term, as the long-term elasticity coefficient reached -3.13. Gross domestic product pushes individuals to increase investments in the field of environmental protection as a luxury good, which leads to an improvement in qualitative indicators and a decrease in pollution and environmental deterioration. (10)

Third. There is a negative and statistically significant effect of the human development index on co2 emission in the long run, as the coefficient of elasticity reached -2.9 and this is consistent with economic theory, as the better the constituent elements of the human development index, this is reflected in the decrease in co2 emission in the long run.

Fourthly. As shown in Table (7), the error correction limit coefficient is negative and statistically significant, and this indicates that carbon dioxide emission and all of the gross domestic product and human development index have a co-integration in the case of co2 emission being a dependent variable, which supports this effect in the models Short and long term movement.

To ensure the structural stability of the model, we use the structural stability test in the form of two complementary tests: the cumulative sum of successive remainders test (CUSUM) and the cumulative sum of squares test (CUSUMSQ). It reflects (7) that the coefficients estimated for the used ARDL model are structurally stable and consistent with the results in the short and long term.

4. Conclusions:

1- Then prove the hypothesis of the research that there is a reciprocal relationship between the indicators of sustainable development and the green economy and the possibility of shifting towards green alternative energies and reducing dependence on fossil fuels through the achievement of indicators of sustainable development according to a future vision by 2030.
2- A negative effect of carbon dioxide emissions and a positive human development index on the Iraqi gross domestic product.
3- The gross domestic product for the current and future periods had a positive impact on the human development index.

Recommendations

1- Preparing a comprehensive and integrated strategy for the requirements of the transition towards a green economy as a method for achieving sustainable development in Iraq.
2- Nominating leading sectors for this transformation, such as the energy sector and the agricultural sector, and requesting international institutions to support and assist in this.
3- Enhancing the material and human capabilities and the national and international economic and environmental opportunities for the transformation of the green economy.

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