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Abstract

Kyoto protocol requires a more stable and sustainable economies to reduce GHG emission so the relationship between CO_2 emission and economic growth is an important issue in the world. We proposed simple regressions model to measure the relationship between CO_2 emission and economic growth in the case of Saudi Arabia during 2008 to 2013 including the CO_2 as dependent variable while Capital , GDP per capita and energy consumption per capita is taken as independent variables. Results reveals that CO_2 emissions grow up with an increasing rate during the basic phase of economic growth, but after a certain point CO_2 emissions decrease with further growth. Empiric grounds shows a mixed relationship between economic growth and CO_2 emissions. We suggests a policy that international investors should shows a keen interest to issue the green bonds which often increase the energy-efficiency services to reduce the emissions. This study provides a valuable guidelines to policy makers and provides an ease towards decision making.

Keywords: *CO_2, Regression Analysis, Economic Growth, GDP*

Introduction

Environmental sustainability requires a more stable and sustainable economies to reduce GHG emission as global warming become visible enlargement in the world and the search of economic growth by nation of the world economies. The relationships between CO_2 emission and economic growth got more attention since a decade's because Kyoto protocol need the reduction in temperature since the level of 1990. It is also expected that in near future important global negotiation will rise to control ensure the mitigation of CO_2 emission. Under Kyoto protocol all developing and developed countries can continue their economic developments and energy consumption at a reasonable rates. Under such situation if the growth in CO_2 emission will be equal to growth in GDP it would be a most conflicted situation.

In these developed countries Kingdom of Saudi Arabia is one of the highly dependent on natural resource including crud oil and natural gases. Petroleum consumption, production, export natural gas and electricity production describe energy in Saudi Arabia. Due to top oil

producer and oil exporters, Saudi Arabian economy is considered as a world's top oil richer in energy sources. It has a petroleum based economy and almost 90%, its exports accounts from oil sector and also almost 75% government revenues received by oil energy sector 45% of GDP is produced by oil industry in Kingdom of Saudi Arabia [1] . Saudi Arabia has GDP per capita of $ 20,700 in 2015 due to oil energy resources but still Saudi government is heavily dependent on oil [2]. According to the sources from government of Saudi Arabia the manufacturing sector has more than 50% growth in number of factories since last decade [3].

The investment in manufacturing sector of Saudi Arabia has been increased by more than 90% in 2005 to 2015. The energy consumption has increased by more than 70% during 2005 to onwards which shows almost 7% growth rate in energy Mote (million tonnes of oil equivalent) consumption and 92.5% of Saudi budget revenues, 97% of export earnings, and 55% of GDP accounts from petroleum sector. Saudi Arabia has largest oil reserves having 260 billion barrels (41 km^3), about one-quarter of world oil reserves [4]. In past few decades, The relationship between CO_2 emissions and economic growth is of extraordinary involvement in the economics literature.

Th researches on this issue was published by Heal et al, [5] . Azomahou et al, [6] analyzed the relationships between CO_2 emissions and income using panel data representing 88countries and the time period 1960–1990. Their investigation do not stipulate much grounds for the existence of a causal relationship between income and carbon emissions. Soytas et al, [7] ended up that the relation between CO_2 emissions and income is linear rather than quadratic and does not influence the EKC hypothesis. Carson et al, Jaffe et al, Baldwin et al, [8-10] engaged with simple OLS in levels and found that there is no significant relationship between economic growth and CO_2 emissions. On the other hand Islam et al, [11] recovered long-run positive dependency between pollution and energy consumption using a VAR approach for EKC model. Furthermore, Soytas et al, [12] examine the long-run Granger causality relationship between economic growth, CO_2 emissions and energy consumption in Turkey. The experimental findings declare the bigness of Granger causality running from carbon emissions to energy consumption in this direction. Likewise, Akbostanci et al, [13] studied the relationship between income and environment in Turkey using time series and panel data for the periods1968–2003and 1992–2001. They show a upward relationship between CO_2emissions and income. While Hamit-Haggar et al, [14] examined a one-way relationship between energy consumption and economic growth from where the relation runs from energy consumption to economic growth [15-18].

Same like this, recently published many studies focus on energy consumption and economic growth Granger causes CO_2 emissions and at the same time causality is set up between energy consumption and CO_2 emissions and between energy consumption and economic growth [19-22]. Fodha et al, [23] and investigated the relationship between economic growth and pollutant emissions degradation based on the EKC hypothesis for Tunisia during the period 1961–2004 using time series data and co integration analysis.

Recently published studies ignored the robustness of results and selection of Saudi Arabia which is a world largest oil supplier may loss important information in the region. Recent published studies also lacks the relevant literature review regarding CO_2 emission and economic growth. Therefore this paper will bridge up the gap exist in the literature. This paper focuses on the relationship between carbon emission and economic growth including energy consumption ,capital and GDP per capita. Our contribution also includes an empirical estimation of CO_2

emission and economic growth including related variables for the case study of Kingdom of Saudi Arabia. We also contribute an enriched literature review. Our study will provide a valuable guideline for policy implication and decision making in the region.

The rest of the paper is prepared as follows: section 2 explains the methodology. Section three is devoted to presenting the data and sources, section four describing the results and discussions and section 5 discusses the conclusions and policy implications.

Methodology

We proposed an empirical study of modeling the Saudi Arabian energy content and its impacts on environments. Our study is an estimation of empirical study rather than casual relationship between energy content of manufacturing total exports and environmental performance. To measure the domestic and export energy content of Saudi Arabia manufacturing exports over the period of 2008–2013. We will evaluate the extent of KSA's manufacturing exports using energy content in all stuffs of manufacturing

Many researcher and discussions have been contravention of enlargement rate of energy used in the economy considering changes in sectoral structure, sectoral energy coefficients, and changes in overall economic activity. In regards to the environmental influences we measure it with CO2emission. The evaluation of empirical studies leads us to formulate the following empirical mannequin:

$$CO_t = f(AFSI_t, YP_t, EC_t, PD_t) \tag{1}$$

The regression model that examines the impact of energy content of manufacturing consumption on environmental quality is specified as follows;

$$LnCO_t = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 AFSI + \boldsymbol{\beta}_2 \ln YP + \boldsymbol{\beta}_3 \ln EC_t + \boldsymbol{\beta}_4 \ln PD_t \tag{2}$$

where CO is CO_2 emissions proxy for environmental degradation, AFSI is aggregate financial stability index, YP is income per capita proxy for economic growth, EC is energy consumption, PD is population density, ε is error term, ln is natural logarithm and t are years. The data on CO2 emission (measured in metric tons per capita), GDP per capita (measured inconstant 2015US$), energy consumption (measured in kilo tons oil equivalent per capita), population density (Peoples per square Km of land area) is gathered from World bank data base, IMF while the data on financial stability indicators is obtained from World Bank financial structure dataset, International Financial Statistics of IMF, State Bank of Saudi Arabia.

Data

The data used in the regression analyses is render by the World Bank database. There is lack of relevant data in the more recent years. The interdependent variable Carbon dioxide (CO2) emissions is expressed in tons CO2 emitted per capita for one period. CO2 is one of the pollutants with greatest contribution to global warming as well as national ecological degradation (Solomon, et al., 2009). It is critical to interpret what affects CO2 emissions in order to make decisions regarding the healed of the surroundings.

GDP per capita, Energy imports & exports, GDP, GDP from energy sector and price of energy intermediates current $ are measured in current $ while units of CO2 emission is metric ton per capita and units of energy consumption is kilogram of oil per capita .The gross domestic product (GDP) is a measure of the market value of all goods and services that can be produced in one period of time. The data used in this work represents the GDP/capita US dollars' value. The

variable GDP/capita is very commonly used to measure economic status as is the case for previous research in the field of environmental economics. The expected outcome deviate with contrasting theories. The study covers annual time series data over the period 1970–2013, consisting of one endogenous variable (CO_2 emissions per capita, a proxy for environmental quality) and four exogenous variables (energy consumption per capita, real GDP per capita, population density and Capital. Data sources includes [24-25].

Results and Discussion

Model summary illustrates the relationship between the dependent and independent variables. R is the association between the predicted and observed values. R2 is the square of this coefficient.

Table 1 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	95.0% Confidence Interval for B
		B	Std. Error	Beta		Significance
1	(Constant)	1.355	.386		3.513	.177
	Capital	-9.422E-13	.000	-.386	-.815	.565
	GDPPP	6.343E-6	.000	.115	.273	.830
	E Consmp	.000	.000	.977	7.701	.082
	Pop Densty	.033	.027	.322	1.232	.434

a. Dependent Variable: CO_2
b. Predictors: (Constant), Capital, GDP per capita, Energy consumption, Population density

and adjusted R2 indicates the percentage of the variation explained by the regression line out of entire variation. The value of R is 0.997 and R2 is 0.995 which shows the model variability, its mean is round about 77%. The results demonstrate that there is significant relationship of liquidity risk with the independent variables as F= 46.142v, p<0.00. This summary shows that 77% change occurs in the dependent variable due to independent variable.
Ln(CO2) = 1.355 - 3.86 Capital + 0.115 GDP capita + 0.997 Energy consumption + 0.322 Population density
 In coefficients part the beta value and their significance are given. The beta value (standardized coefficients) of the GDP per capita, Energy consumption and population density is positive which are 0.115, 0.977 and 0.322 respectively while beta values of the Capital is negative , negative which is -0.386 although the correlation of CO2 emission with capital is 0.691 but its positively insignificant relationship. The point to be notable is that growth in CO2 emission per capita is higher than that of real GDP per capita, which shows that carbon emissions intensity has been exaggerated. Therefore, more focused attention and strict measures are required to curb CO2 emissions by Saudi government.
To decrease the greenhouse gases (GHG) is a world-wide mandatory for sustainable development. The modern summit of COP 21 in 2015 further stressed this by advocacy a global movement mark to bound the global warming to less than 2 °C in comparing with pre-industrial

levels. Achieve this goal postulate a important reduction in CO2emissions. Saudi Arabia has made a plight to extenuate its yearly emissions by up to 130 Mt CO2 by 2030. Hence, it is of preponderating significance to move with a extensive study of the economicgrowth-CO2 emissions linkage. The explanation argues that CO2 emissions grow up with an increasing rate during the basic phase of economic growth, but after a certain point CO2 emissions decrease with further growth. Empiric grounds shows a mixed relationship between economic growth and CO2 emissions. For example, a number of empirical studies represent that CO2 emissions continue to grow with the increase of economic growth, with no gratuity point after which they decline, By taking into account economic composition and technology as changeless. The consequence of population growth on worldwide CO2 emissions has not received sufficient attention. Modern work propose that population growth has been one of the leading factors which cause carbon emissions in both developed and developing countries. However, to support this claim there has not been generous empirical evidence.

Conclusion and Policy Implication

Additionally, the results show that population density is statistically essentially and positively related with CO_2emissions.This mean that population density has an increasing relationship with CO_2in the short run, i.e., a 1 % increase in population density results in a 3.98 % increase inCO_2 emissions. Since the population density is the most important variable contributor to CO_2emission therefore, population stabilization may be considered an effective mechanism to deal with the rising problem ofCO_2emission. The economic development has significant positive impact on CO2 emissions. Approximately 0.39 % enlargement in CO_2 emissions could be connected with a 1 % increase in economic growth while other factors remain constant. These result authenticate the findings of Alkhathlan and Javid (2013) who accounted monotonically positive relationship between economic growth and CO_2 emissions and in the case of Saudi Arabia.

International investors should shows a keen interest to issue the "green bonds," which often increase the energy-efficiency services to reduce the emissions. Green bond investments should grew further. Countries should count rate of emissions as compared to electricity consumption rather than by production. Energy intensive enterprises should be responsible to mitigation throughout the supply chain of energy enterprises . Meticulous ecological principles should strictly applied. Larger infrastructure construction of China has been the most important driver of economic and emissions growth. Governments of China and other emerging economies should focus their commitments to decrease emissions and save energy under Paris agreement to ensure the energy efficiency policies. Realistic and affordable energy and climate change policy is impossible without an energy efficiency element.

Energy intensity enhanced by 1.8% last year and its indicate that the global economy desired fewer energy to grow. Enhancement surpass the 1.5% gain of 2014, it was a triple the average rate found in last ten years. Global energy intensity development needed to grow at least 2.6% per year to make the world on a continual sustainable pathway for a decarbonizes energy system. Policies of energy efficiency ensure to deliver the maximum amount of economic and social benefit from energy we consume. Therefore government actions and policies have a major impact on global energy demand. For example , standard global car fuel economy saved 2.3 million barrels per day of oil last year which is counted as a 2.5% of the total worldwide oil

supply. Efficiency Policy Progress Index introduced by IEA should highlights and ensure the potential gains from energy efficiency policies.

References

Alshehry, A. S., Belloumi, M. Energy consumption, carbon dioxide emissions and economic growth: The case of Saudi Arabia. Renewable and Sustainable Energy Reviews 2015, 41, 237-247.

Hussain, Z.. Saudi Arabia in a Multipolar World: Changing Dynamics. Routledge, 2016.

Rodrik, D. The past, present, and future of economic growth. Challenge,2014 57(3), 5-39.

Nejat, P., Jomehzadeh, F., Taheri, M. M., Gohari, M., & Majid, M. Z. A. A global review of energy consumption, CO_2 emissions and policy in the residential sector (with an overview of the top ten CO_2 emitting countries). Renewable and sustainable energy reviews,2015, 43, 843-862.

Heal, G., & Millner, A. Reflections: Uncertainty and decision making in climate change economics. Review of Environmental Economics and Policy,2014 8(1), 120-137.

Azomahou, T., Laisney, F., & Van, P. N. Economic development and CO_2 emissions: a nonparametric panel approach. Journal of Public Economics 2006, 90(6), 1347-1363.

Soytas, U., Sari, R., & Ewing, B. T. Energy consumption, income, and carbon emissions in the United States. Ecological Economics,2007,62(3), 482-489.

Carson, R. T., Jeon, Y., & McCubbin, D. R. The relationship between air pollution emissions and income: US data. Environment and Development Economics, 1997, 2(4), 433-450.

Jaffe, A. B., & Stavins, R. N. Dynamic incentives of environmental regulations: The effects of alternative policy instruments on technology diffusion. Journal of environmental economics and management, 1995, 29(3), S43-S63.

Baldwin, R. Does sustainability require growth. The economics of sustainable development, 1995, 51-78.

Islam, F., Shahbaz, M., Ahmed, A. U., & Alam, M. M. Financial development and energy consumption nexus in Malaysia: a multivariate time series analysis. Economic Modeling, 2013, 30, 435-441.

Soytas, U., & Sari, R. Energy consumption, economic growth, and carbon emissions: challenges faced by an EU candidate member. Ecological economics, 2009, 68(6), 1667-1675.

Akbostancı, E., Türüt-Aşık, S., & Tunç, G. İ. The relationship between income and environment in Turkey: Is there an environmental Kuznets curve?. Energy policy, 2009, 37(3), 861-867.

Hamit-Haggar, M. Greenhouse gas emissions, energy consumption and economic growth: A panel co integration analysis from Canadian industrial sector perspective. Energy Economics, 2012, 34(1), 358-364.

Saboori, B., & Sulaiman, J. Environmental degradation, economic growth and energy consumption: Evidence of the environmental Kuznets curve in Malaysia. Energy Policy, 2013, 60, 892-905.

Cowan, W. N., Chang, T., Inglesi-Lotz, R., & Gupta, R. The nexus of electricity consumption, economic growth and CO 2 emissions in the BRICS countries. Energy Policy,2014, 66, 359-368.

Kivyiro, P., & Arminen, H. Carbon dioxide emissions, energy consumption, economic growth, and foreign direct investment: Causality analysis for Sub-Saharan Africa. Energy, 2014,74, 595-606.

Menyah, K., & Wolde-Rufael, Y. Energy consumption, pollutant emissions and economic growth in South Africa. Energy Economics, 2010, 32(6), 1374-1382.

Ozturk, I. A literature survey on energy–growth nexus. Energy policy, 2010, 38(1), 340-349.

Tang, C. F., & Tan, B. W.. The impact of energy consumption, income and foreign direct investment on carbon dioxide emissions in Vietnam. Energy, 2015,79, 447-454.

Chandran, V. G. R., & Tang, C. F. The impacts of transport energy consumption, foreign direct investment and income on CO 2 emissions in ASEAN-5 economies. Renewable and Sustainable Energy Reviews, 2013, 24, 445-453.

Yıldırım, E., Sukruoglu, D., & Aslan, A. Energy consumption and economic growth in the next 11 countries: The bootstrapped autoregressive metric causality approach. Energy Economics, 2014, 44, 14-21.

Fodha, M., & Zaghdoud, O. Economic growth and pollutant emissions in Tunisia: an empirical analysis of the environmental Kuznets curve. Energy Policy, 2010,38(2), 1150-1156.