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Promoting Sustainable Growth and Development in Saudi Arabia through Environmental Investments: The Role of Incentives

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Abstract
This paper examines the role of financial and non-financial incentives in promoting environmental investment, which is critical in addressing the challenges of sustainable growth and development in the Kingdom of Saudi Arabia, whose economy is heavily dependent on fossil fuel that contributes to some of the environmental problems facing the country. The paper conducts an econometric analysis of the relationship between economic growth and environmental degradation and finds a negative and statistically significant relationship between environmental emissions and the growth rate of gross domestic product (GDP). However, the magnitude of the growth-environment coefficient shrinks when more ambitious cuts in environmental emissions are introduced, suggesting that environmental investments would help overcome environmental degradation and thereby lead to a sustainable Saudi Arabian economy. Attracting environmental investments, however, will require a strong policy incentive structure. As a result, the paper further investigates the link between policy incentives and environmental investment in the renewable energy sector of some European countries where data on a wide range of incentives exist. The estimated coefficients of all the incentive variables are positive and statistically significant at varying levels, suggesting that incentives matter in environmental investments, sending an important message to countries like Saudi Arabia that, by providing appropriate incentives, policy makers would be able to boost investments in renewable energy and other environmental goods and services and thereby help to promote sustainable growth and development.
Key words: sustainable development, Saudi Arabia, environmental investments, policy incentives, oil prices

1. Introduction

The recent slide in oil prices has exposed the vulnerability of the kingdom of Saudi Arabia to shocks in the international oil market, which has forced the country to start drawing down its foreign reserves and borrowing from local banks to support its development programs. Oil prices had plummeted from $107 per barrel in June 2014 to below $40 per barrel in December 2015, leading to a substantial decline in government revenue, with serious implications for fiscal policy. On current trends, government revenues are expected to fall by over $80 billion in 2015, equivalent to 8% of Gross Domestic Product (GDP), and the kingdom is expected to register a budget deficit of 20% of GDP in 2015 (International Monetary Fund, IMF, 2015), as opposed to 6% of GDP forecasted in the 2015 Budget. In essence, the Saudi authorities have already started feeling the adverse effect of the oil price fall as they have started dipping into the country's foreign reserves, issuing local currency bonds, and cutting spending on non-priority projects.

There are widespread speculations that the Saudi authorities are contemplating to ease the untargeted fuel subsidies that have for long encouraged cheap domestic oil consumption, especially in the power, transport and water desalination sectors of the economy. On current trend in domestic oil consumption, it is projected that by the year 2030 Saudi Arabia will be consuming more of its oil than it will be exporting (Taher and Hajjar, 2014). This will undoubtedly not only reduce foreign exchange earnings and government revenues, but it will also grossly deplete the existing oil reserves, thereby depriving future generation of valuable resources to sustain economic growth and development. Indeed, the opportunity cost of the domestic oil consumption in these three sectors alone is estimated at around 35% of government revenue by the year 2030, up from just 16.3% in 2010 (Taher and Hajjar, 2014).

In addition to resource constraining effects, over-reliance on fossil fuel could exacerbate environmental problems that could further undermine sustainability of the Saudi Arabian economy. This calls for decisive actions to diversify the economy through environmental investments. Investments in environmental business (such as environmental resources, equipment, and services) can play a big role in promoting sustainable development, which in itself is a bankable concept since such investments could generate substantial private and social returns. Environmental investments could therefore serve as a catalyst for a sustainable wealth creation

and can also induce policy changes that could create jobs, boost income and promote sustainable economic growth and development. However, a major challenge to environmental investment is its relatively high sunk costs and risks. This, coupled with inadequate financing and weak institutional and regulatory framework, can undermine the unleashing of its full potential in Saudi Arabia.

One way of overcoming these challenges is through the formulation of an appropriate incentive structure to encourage increased private sector participation in environmental investments. It is noteworthy that the Saudi Arabian government had established the King Abdullah City for Atomic and Renewable Energy (KACARE) as a first step towards building a green economy. This and other new initiatives are introduced to lay the foundation of diversifying the economy, reducing oil consumption, conserving oil for future generation and freeing more oil for exports, while at the same time fostering a much cleaner environment. However, these initiatives are at a nascent stage and it will require a strong political will as well as legal, institutional and regulatory frameworks and a host of other policy incentives to promote environmental investments in the kingdom.

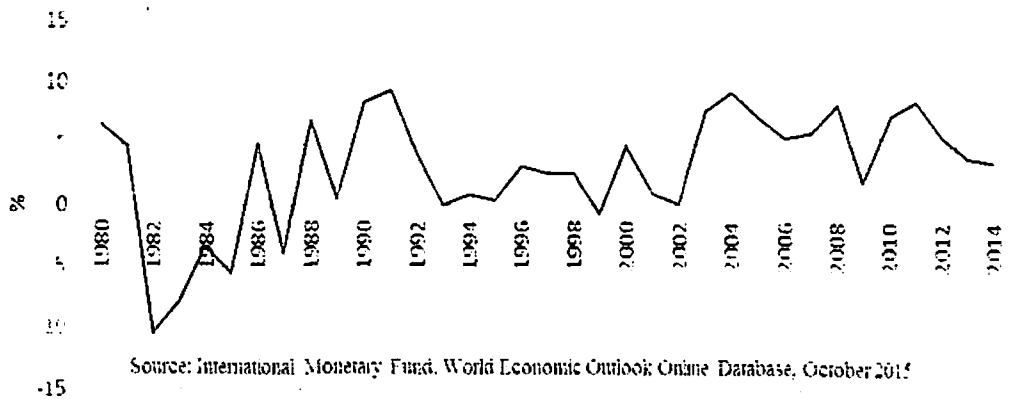
The main objective of this paper is to explore innovative ways of promoting sustainable development in the kingdom of Saudi Arabia through environmental investments. In achieving the research objectives two research issues will be examined in this paper. First, environmental investments will help to overcome environmental degradation and thereby lead to sustainability of growth and development in Saudi Arabia. This hypothesizes a positive relationship between environmental protection measures and economic growth sustainability. Second, attracting environmental investments will require a strong policy incentive structure. This hypothesis suggests that policy incentives (both financial and non-financial) act as catalysts for promoting economic diversification and sustainability.

Section 2 of the paper provides a snapshot of the Saudi Arabian economy. Section 3 discusses the literature on the link between environmental factors and economic growth sustainability. Based on the literature review, Section 4 develops, estimates and analyses a sustainable economic growth model for Saudi Arabia. Section 5 highlights the role of incentives in promoting environmental investments. Section 6 pulls together the main conclusions of the paper.

2. Overview of the Saudi Arabian Economy

Over the past decade or so, high oil revenues have supported massive government spending, which has in turn buoyed private sector activities in Saudi Arabia, leading to the rapid expansion of the economy. With the exception of the 2008 global financial crisis, however, the growth rate of real GDP since 2003 has accelerated at an annual average rate of 6% (Figure 1).

Figure 1. Growth Rate Real GDP (%)



Source: International Monetary Fund, World Economic Outlook Online Database, October 2015

The expansion of the Saudi Arabian economy was undoubtedly driven by high oil prices and output, which propelled spending by both the public and private sectors. It is noteworthy, however, that despite the overwhelmingly contribution of the oil sector to foreign earnings and government revenue, the non-oil sector has recently been the major contributor to GDP (Table 1). Nonetheless, the oil wealth has for long been instrumental in laying the foundation for solid economic fundamentals such as GDP growth rate, fiscal space, current account position, foreign reserves, price stability and physical and social infrastructure.

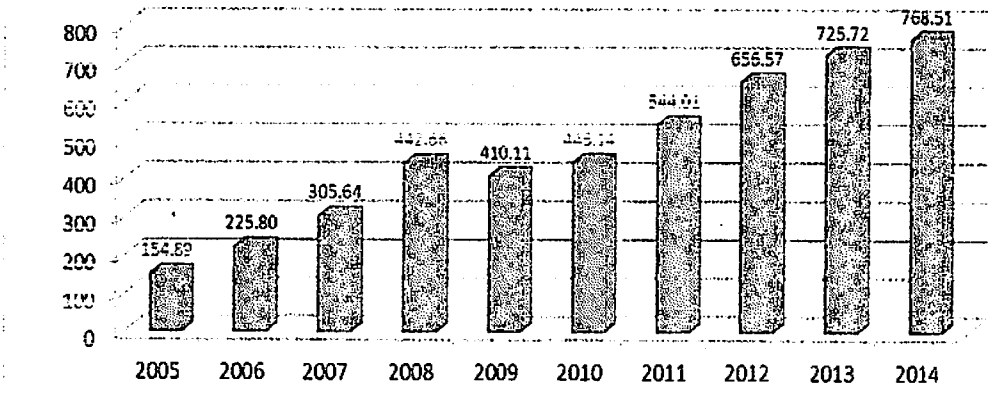
Table 1: Contribution of Oil to GDP, Exports and Total Revenue in Saudi Arabia

	Oil Exports as a % of Oil Production	Oil as a % Total GDP	Oil Exports as a % Total Exports	Oil Revenue as a % of Total Revenue
2005	77.07	50.01	75.90	89.40
2006	76.34	50.86	76.77	89.73
2007	78.97	50.40	76.46	87.46
2008	79.39	55.40	78.83	89.32
2009	76.58	40.89	73.94	85.21
2010	81.37	44.97	75.43	90.38
2011	77.52	51.19	78.14	92.54
2012	77.90	50.41	78.59	91.78
2013	78.56	47.40	85.70	89.51
2014	79.55	45.09	84.80	88.91

Source: Saudi Arabia Monetary Agency (SAMA), Annual Statistical Report (2014); IMF World Economic Outlook Online Database, October 2015.

Despite the solid economic fundamentals, the Saudi economy remains highly undiversified and faces a number of challenges in its quest to creating a sustainable economic growth and development. The current slump in the international oil prices has exposed the vulnerability of the Saudi economy. The huge foreign reserves (Figure 2) that the government had built up in the past are now under threat of being depleted to finance vital development projects.

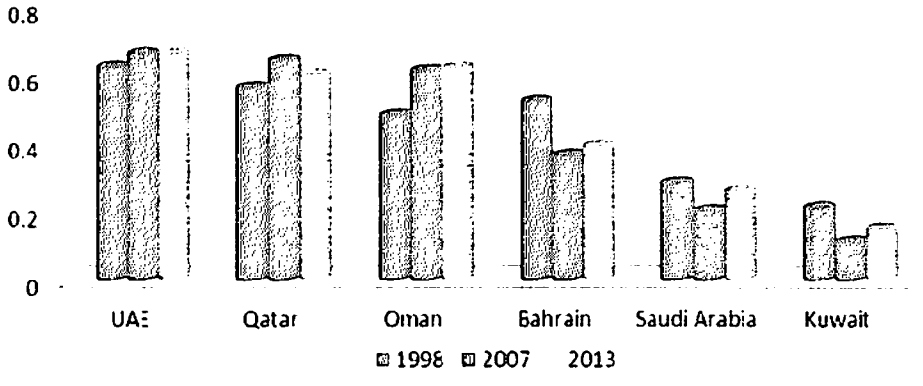
Figure 2: Saudi Arabia: Total Foreign Reserve Assets (US$ Billion)



Source: Saudi Arabia Monetary Agency (SAMA), Annual Statistical Report, 2014.

The issue of diversification is critical to sustainability of the Saudi Arabian economy and other oil-rich Gulf Cooperation Council (GCC) economies. Available estimates of exports diversification index, based on the inverse of the well-known Herfindhl-Hirscliman concentration index, using the shares of various sectors in total exports, show that the GCC countries have not made tangible progress in diversifying their economies. Even so, the UAE appears to be the most diversified economy in the region, whilst Kuwait and Saudi Arabia are the least diversified (Figure 3).

Figure 3: Diversification Indices of GCC Countries



Source: GCC central statistical agences

There is, therefore, a need for a comprehensive diversification strategy in Saudi Arabia, especially by creating conducive business environment for the private sector to invest in a wide range of non-oil sectors, especially in manufacturing, services, and trade. Challenges for diversifying the economic structure of the region are, however, real. For example, the kingdom's absorptive capacity is relatively low, which means that there is a limit to which it can absorb and efficiently utilize the huge inflows of oil money. Thus, utilizing the oil wealth would require a gradual but holistic approach to development agenda including building human and physical capital endowments of the kingdom.

The kingdom also has a young population that is increasingly becoming informed and educated. As it enters its working-age years, there is a tremendous opportunity to boost growth and raise living standards further. The government has recently introduced a number of initiatives to increase the employment of Saudis in the private sector and to support the unemployed citizens. However, according to the IMF (2014), "... increased employment of Saudis in the private sector will require a combination of reduced reliance on jobs in the public sector, measures to increase the competitiveness of Saudi workers in the private sector including through continued efforts to strengthen education and training, and expanded opportunities for women." Indeed, maintaining strong growth in the private sector is crucial for job creation, but sustainability of the growth will largely depend on the diversification of the economy through environmental investments. Through diversification, the kingdom can become a big player in the clean energy business and it can also turn its environmental wastes into profitable business opportunities.

However, as stated earlier, investment in environmental goods and services, such as clean energy, is generally characterized by relatively high sunk costs albeit with low operational and maintenance costs. These characteristics make green investments attractive in the long run but less so in the short run. In addition, investments in green projects such as renewable energy, face significant barriers such as highly subsidized conventional energy prices, lack of financial incentives, weak legal and regulatory statutes on environmental protection, inadequate institutional capacity, and trade barriers hampering deployment of green technologies. Hence, the need for an appropriate incentive structure to attract environmental investments in Saudi Arabia and other GCC countries.

3. Literature review

Concerns about the impact of environmental degradation on economic growth and development is an age long phenomenon, but the issue has attracted considerable empirical scrutiny in recent years due to the threats posed by climate change and global warming. Since the early 1990s, the United Nations' framework in the form of the Kyoto Protocol to fight global warming has not only contributed to the growth in the number of studies on economic growth-relationship, but it has also led to increased investments in environmental goods and services, such as clean energy, as well as environmental equipment and services.

At the heart of the economic growth sustainability literature lies the modelling of the relationship between economic growth and the environment. One such strand of the literature, which has gained considerable empirical popularity in recent years, is the so-called Environmental Kuznets Curve (EKC) hypothesis. The EKC

literature hypothesises an inverted U-shaped relationship between economic growth and environmental degradation, implying that environmental degradation increases with economic growth at low levels of income per capita, and it falls at high levels of per capita income. Within this category of the literature, Panayotou et al. (2000) have classified the various contributions into four broad sub-categories: optimal growth models; endogenous growth models; neoclassical growth models with environmental factors as additional inputs; and other types of economic growth-environment models (Constantini and Martini, 2006).

The optimal growth models are generally based on the utility maximisation problem of the consumer, where environmental pollution is incorporated in both the production and consumer utility functions (Brock and Taylor, 2004b; Selden and Song, 1994). Solutions to these problems are often found by using the techniques of the optimal control theory. Similarly, in the case of both the endogenous growth model and the neoclassical production function, a wide range of environmental factors are introduced into the equations. The only difference between the endogenous growth and the neoclassical growth theories is that in the former situation the production functions are often characterised by increasing returns to scale and spill-over effects, while the neoclassical models are characterised by diminishing returns to scale (Stokey, 1998; Bovenberg and Smulders, 1995). The inclusion of environmental resources as additional inputs in the production function can have potentially profound implications for sustainable growth and development due to the finiteness and exhaustibility of some environmental resources.

A number of studies have attempted to empirically investigate the theoretical relationships between the environment and economic growth based on different varieties of these models. More recent studies include Anjum et al. (2014), Chow and Li (2014), Stern (2014), Yaduma et al. (2013), Castiglione et al. (2012), Brock and Taylor (2004), Panayotou (2003), and Islam (2001). These empirical studies have found mixed evidence about the link between economic growth and the environment. While some of these studies have found strong evidence of an inverted U-shaped relationship between certain types of environmental pollutants and per capita GDP (e.g. Anjum et al. 2014; Chow & Li 2014), others such as Stern 2014, have found no discernible evidence for the so-called Environmental Kuznets Curve hypothesis that have preoccupied past empirical studies.

4. Methodology and Data Analysis

4.1 Methodology

Drawing from the foregoing review of the theoretical and empirical literature we shall investigate the environment-growth nexus for Saudi Arabia by introducing an environmental abatement variable in the standard neoclassical production function in line with Al-Torkistani et al. (2015). The generalized form of the production function can be written as follows:

$$Y = g(A.E.L.K.t) \quad (1)$$

Where:

Y = Gross Domestic Product (GDP) in real terms
L = Labor input
K = Capital stock
E = Output scaling factor due to emissions controls and environmental damage
A = Growth of technological progress
a = Elasticity of output with respect to capital
t = time trend

Equation (1) describes the aggregate production function where real GDP depends on labor (L), capital (K), technological progress (A) and an environmental scaling factor (E), which captures the net environmental pollution. In line with the standard literature, the estimated coefficients of capital, labor and technological progress are assumed to be positive, while the estimated coefficient of the net environmental pollution variable (E) is expected to be negative but its magnitude can be reduced by ambitious pollution reduction measures. A do-nothing approach toward emissions abatement will result in a substantially negative impact of environmental degradation on output, while an ambitious emissions reduction policy might mitigate most of the adverse impact of environmental damage on output. Assuming equation (1) to be linear in logarithms, taking logs and differentiating with respect to time will yield an equation describing the determinants of the growth rate of GDP, with the estimated parameters representing the elasticities of output with respect to each of the explanatory variables.

4.2 Analysis of Results

Equation (1) was estimated using the relevant data over the period 1980-2010 with the E-Views statistical software using ordinary least squares regression. Table 2 contains two sets of results corresponding to three sets of emissions-output scaling factors (E1, E2). Equation (A) in the table corresponds to the estimated parameters for the equation associated with net environmental pollution factor E1, which is based on a 5% emissions reduction scenario. In this equation, the estimated parameters of all explanatory variables are in line with the *a priori* expectations and are statistically significant at the various levels, except the coefficient of investment. The negative coefficient of the net environment degradation variable, E1, at -10.22, suggests that environmental damage reduces economic growth. This implies that, with a 5% cut in environmental pollution, *ceteris paribus*, environmental degradation would reduce Saudi Arabia's GDP by 10% vis-à-vis a do-nothing approach. The high F-statistic for this equation attests to the high overall goodness of fit of the model. The equation, however, seemingly appears to suffer from the econometric problem of serial correlation as implied by the low Durbin-Watson statistics. This is not, however, of major concern given that the data are in first differences.

The second equation (B) in Table 2 corresponds to a 10% cut in emissions (net environmental pollution variable, E2). Here again, all estimated parameters possess the correct expected signs and are statistically significant. The absolute value of the estimated coefficient on the environmental variable, at 3.13, in Equation (B) is much lower than the absolute value of the coefficient on the environmental factor, 10.22, in Equation (A). Given the relatively large emissions cut in this equation, at 10%, the magnitude of the estimated coefficient on the environmental degradation variable is smaller than the one corresponding to the emission reduction of 5%. Clearly, this suggests that the higher the emissions cut, the smaller the impact of environmental damage on GDP. The overall fitness of the model is good and, with the exception of the low Durbin-Watson statistic, which is of no concern given that the data are in first differences, the equation does not appear to suffer from any other econometric problems.

Table 2: Estimation Regression Equations: Dependent Variable: Growth Rate of Real GDP

Independent Variable	Equation A (5% cut in emissions)	Equation B (10% cut in emissions)
Constant	-33.56*** (-3.75)	-15.22 (-1.04)
E1	-9.12*** (-7.60)	
E2		-3.13* (2.32)
INV	0.11 (1.87)	0.18** (2.65)
LF	0.57*** (3.58)	0.61*** (6.12)
TFP	3.04*** (3.22)	3.78** (2.45)
Adjusted R-squared	0.97	0.97
F-statistic	125.11	127.18
Akaike info criterion	-3.77	-3.76
Schwarz criterion	-3.19	-3.41
Hannan-Quinn criterion	-3.26	-3.61
Durbin-Watson statistic	1.24	1.27
No. of observations	31	31

5. Incentives for promoting environmental investments

The foregoing results from the econometric analysis in Table 2 suggest that aggressive environmental abatement policies can enhance the sustainability of economic growth in the kingdom of Saudi Arabia. However, emission reduction policies alone may not promote a greener, competitive, and sustainable Saudi economy without a corresponding increase in environmentally-friendly consumption and production activities through investment in environmental goods and services. But, as stated earlier, environmental investments especially in the clean energy sector are characterized by high sunk costs as much as they face significant barriers from highly

subsidized energy products, weak regulatory framework, limited institutional capacity and lack of innovative financing mechanisms.

These and other constraints can be overcome by rolling out appropriate incentives to attract private sector investment in environmental businesses such as renewable energy (e.g. solar power, wind energy, biomass), energy efficiency, environmental equipment, and environmental services. Indeed, many governments around the world have resorted to providing both financial and non-financial incentives to woo private sector investment into environmental goods and services. For instance, the European Union countries are well noted for setting clean energy targets and providing incentives to attract green investments. Some of the popular incentives offered by governments in the European countries in the renewable energy sector include feed-in-tariffs, subsidy, tax breaks, soft loans and loan guarantees.

The key questions are: how do environmental businesses respond to policy incentives? What lessons could Saudi Arabia learn from the incentive schemes of the European countries? The answers to these questions can be provided by conducting a standard econometric investigation of the link between environmental investment and policy incentives in the European countries with a view to drawing important lessons Saudi Arabia.

5.1 Environmental Business and Policy Incentives

Environmental business can be classified into three broad segments: environmental resources, environmental equipment and environmental services (Environmental Business International, EBI, 2011). The environmental resources segment consists of renewable energy, energy efficiency, water utilities and resource recovery activities. Examples include solar, wind, geothermal, and hydro power systems as well as energy efficiency businesses. In the case of environmental equipment, it consists of wastewater equipment and chemicals, pollution control equipment, process and prevention technology equipment, instrumentation and information systems, and waste management equipment. The environmental services business comprises solid and hazardous waste management, remediation and industrial services, and environmental consulting and engineering.

The degree to which each of these environmental business channels responds to policy incentives may differ markedly, resulting in different financial outcomes or returns on investment. So, the choice of a particular environmental business channel or a combination of channels may largely depend on their elasticities with respect to government incentives as well as other factors that affect the demand for environmental goods and services.

As stated earlier, a host of incentives are often provided to attract environmental investments. Incentives can take several forms, including direct support instruments such as fiscal incentives and public finance mechanisms, market instruments, and legal, regulatory, and institutional capacity building mechanisms. Thus, any policy which directly or indirectly encourages growth in the market demand for environmental goods and services, such as clean energy, for example, is likely to encourage capital investment in clean energy generation.

The direct fiscal incentives comprise a wide range of monetary instruments aimed at reducing costs and improving the relative competitiveness of green investments. These include fiscal support measures, such as direct subsidies, interest subsidies, soft loans and grants, and outright public finance mechanisms. These kinds of financial incentives are very common in the renewable energy sector.

Financial incentives and guarantees are often complemented by non-financial incentives such as sound and appropriate legal and regulatory policies. In the renewable energy sphere, the legal and regulatory incentives can be classified into two broad categories: pricing laws and quantitative or quota laws. The pricing law incentive aims to guarantee renewable producers with fixed, minimum prices and to obligate electric utilities to provide grid access to renewable energy plants, while quota related regulations allow governments to set specific targets and let the market determine prices (Sawin, 2004). In the case of the renewable energy industry, these legal and regulatory policies are often implemented through specific instruments such as feed-in-tariffs, utility quota obligation, and net metering (Renewable Energy Network in the 21st Century, REN21, 2011). This is where the European countries are ahead of the rest of the world, as Table 3 illustrates.

Table 3: Renewable Energy Promotion Policies in Developed & Emerging Countries						
Country	**Feed-in Tariff**	**Capital subsidies, grants, rebates**	**Investment or Other Tax Credits**	**Sales Tax, Energy tax, Excise tax, or VAT reduction**	**Tradable Renewable Energy Certificates**	**Public Investment, loans, or financing**
Denmark	×	×	×	×	×	×
France	×	×	×	×	×	×
Germany	×	×	×	×		×
Italy	×	×	×	×	×	×
Spain	×	×	×	×	×	×
UK	×	×		×	×	×
Japan	×	×	×		×	×
US	(*)	×	×	(*)	(*)	(*)
Brazil			×			×
China	×	×	×	×		×
India	(*)	×	×	×	×	×
Morocco			×	×		×
Tunisia		×		×		×

Source: REN21 (2011)
Note: (*) means some states/provinces within these countries have state/province-level policies but there is no national-level policy.

5.2 Statistical Analysis

Table 3 lists a wide range of policy incentives used in the renewable energy sector. Some of these incentives will be incorporated in a regression equation to quantify their impacts on environmental investment using available data from 18 European countries for the period 2001-2010[1]. The following equation constitutes the specific form of the model:

$$EBIZ = C + b_1FIT + b_2SUBSIDY + b_3QUOTA + b_4LOAN + b_5TAX + b_6R\&D + b_7CONTROL + \varepsilon \quad (2)$$

Where:
EBIZ = Environmental Business in Renewable Energy
FIT = A dummy variable for feed-in-tariffs, taking the value 1 for the presence of FIT and zero (0) for the absence of a FIT policy
SUBSIDY = Subsidy, i.e. environmental aid as a percentage of total allocable aid
QUOTA = Quota to be sourced from renewable energy sources, i.e. percentage of power that is mandated to be sourced from renewable energy.
LOAN = Soft government loans and loan guarantees
TAX = Tax breaks or Tax rebates on environmental investments
R&D = Research & Development expenditure support for control and care of the environment both in absolute monetary terms (millions of dollars in constant purchasing power parity) and as a percentage of total government R&D budget
CONTROL = Control variables that might influence environmental business, including real per capita income in purchasing power parity (PPP) and growth rate of population.
$b_1, b_2, \ldots, b_7$ are the estimated elasticities for environmental business activity with respect to each of the seven independent variables, while C is a constant term and ε represents error term which is assumed to be normally and independently distributed.

[1] These EU countries are: UK, Switzerland, Sweden, Spain, Portugal, Norway, Netherlands, Italy, Ireland, Iceland, Greece, Germany, France, Finland, Denmark, Belgium, and Austria.

Equation (2) shows that renewable energy business depends on a wide range of policy incentives including feed-in-tariffs, subsidy, mandatory energy quota to be sourced from clean (green) sources, soft loan and government guarantees, and tax breaks or tax rebates on environmental investments, and R&D grant. It also depends on other non-incentive variables such as per capita income and population growth. *A priori*, the coefficient of each of the independent variables is expected to be positive, implying that an increase in the explanatory variables (policy incentives and control variables) will boost investments in the renewable energy sector, *ceteris paribus*, while a decrease in the explanatory variables will reduce environmental investments.

Four different versions of Equation (2) were estimated based on different combinations of the explanatory variables. Equation (C) is a replica of Equation (A) but with environmental subsidy added to it, while Equation (D) is a replica of Equation (B) plus subsidy. In both equations (C) and (D), however, the number of observations has dropped to 100, from 140, as 4 countries did not offer environmental subsidy throughout the estimation period 2001-2010. The estimated regression coefficients are shown in Table 4. All variables, including the dependent and the independent variables, are expressed in logarithmic terms, which means that the results of the regression equations can be directly interpreted as elasticities (i.e. the degree to which investment in the renewable energy business responds to policy incentives, income and population growth.

Table 4: Regression Equations: Dependent Variable: Environmental Investment in Renewable Energy

Explanatory Variables	Equation A	Equation B	Equation C	Equation D
Constant	0.79 (1.17)	-0.18 (-0.43)	1.22 (0.75)	-2.12*** (-2.06)
Real GDP Per Capita	0.47*** (4.51)	0.81*** (8.15)	0.49*** (3.23)	0.61*** (5.17)
Population Growth Rate	0.01 (0.46)	0.02 (1.00)	0.01 (0.76)	0.01 (0.65)
Environmental R&D Support (Value)	0.18*** (4.23)	-	0.41** (2.65)	-
Environmental R&D Support (% of Total R&D Budget)	-	0.05*** (3.11)	-	0.02* (1.97)
Environmental Tax Revenues	0.42*** (7.45)	0.32*** (6.41)	0.05*** (5.33)	0.05* (1.89)
% of Power from Renewable Energy	0.05*** (3.21)	0.06*** (2.71)	0.04*** (4.26)	0.03*** (2.69)
Dummy Variable for Feed-in-Tariffs	0.28 (0.56)	0.26 (0.77)	0.38* (1.75)	0.42* (1.82)
Environmental Aid (% of Total Allocable Aid)	-	-	0.46*** (4.12)	0.41** (2.46)
Number of Observations	140	140	100	100
F-Statistic	125.65	112.32	135.17	122.14
Adjusted R-Squared	0.87	0.92	0.90	0.96

Note: *, **, *** represent 10%, 5% and 1% significance levels, respectively. Figures in parentheses are calculated t-statistics.

As can be seen from the results, the estimated coefficients of all the incentive variables are positive and statistically significant at varying levels in all four equations, suggesting that incentives do matter in environmental investments. By providing incentives, such as feed-in-tariffs and R&D subsidies, policy makers would be able to boost investments in renewable energy and other environmental goods and services. Thus, the empirical evidence from the European countries could therefore provide an important lessons for other countries, such as Saudi Arabia, if they are to attract increased private sector investment and participation in environmental goods and services to promote sustainable growth and development.

6. Conclusion

Using econometric techniques, this paper has investigated the relationship between economic growth and environmental pollution in Saudi Arabia. It also evaluated the impact of incentives (financial and non-financial) on environmental investments in selected European countries based on data availability. The aim was to draw important lessons for Saudi Arabia and other oil dependent economies to use the incentive instruments to attract considerable investments in business channels that safeguards the environment. The main conclusion from the growth-environment analysis is that environmental damage impacts negatively on economic growth, with

devastating consequences for growth sustainability. Using two emission reduction scenarios, however, has suggested that the adverse impact of environmental pollution on economic growth could be mitigated through more ambitious emission reduction policies. Such policies can, however, take the form of 'carrots' and 'sticks' serving as incentives and penalties respectively. The incentives-based policy was the subject of further investigation in this study, which hypothesizes that policy incentives will attract private sector investment in environmental goods and services, and thereby help to promote sustainable growth and development. Results from the econometric analysis of the link between policy incentives and renewable energy investment in Europe has provided strong support to the hypothesis, suggesting that countries, such as Saudi Arabia, that aim to attract huge volumes of environmental investments must provide appropriate incentives such as R&D expenditure support, loan guarantees, tax breaks, and feed-in-tariffs (in the case of renewable energy). In addition, they should endeavor to strengthen their legal, regulatory and institutional frameworks. As Taher and Hajjar (2014) have aptly argued: "Having appropriate laws and regulatory bodies is a necessary but not sufficient condition for environmental business activity to blossom. This has to be complemented with the right kinds of human skills and expertise to oversee the legal and regulatory processes and agencies".

References

Al-Torkistani H. M., Salisu M. A., & Maimany K. A. (2015). 'Modeling a sustainable Saudi Arabian economy: the real issues'. *International Journal of Sustainable Development & World Ecology*, DOI: 10.1080/13504509.2015.1112315.

Anjum Z., Burke P.J., Gerlagh R. & Stern D.I. (2014). 'Modeling the emissions-income relationship using long-run growth rates'. *CCEP Working Papers 1403.*

Bovenberg A.L. & Smulders S. (1995). 'Environmental quality and pollution augmenting technological change in a two sector endogenous growth model'. *Journal of Public Economics*, no. 57, 369-391.

Brock W.A. & Taylor M.S. (2004). 'The Green Solow model'. *NBER Working Paper* no.10557, National Bureau of Economic Research, New York.

Castiglione C., Infante D. & Smirnova J. (2012). 'Rule of law and the environmental Kuznets curve: evidence for carbon emissions'. *International Journal of Sustainable Economy*. 4:254–269.

Chow G.C. & Li J. (2014). 'Environmental Kuznets curve: conclusive econometric evidence for CO2'. *Pacific Economic Review*, 19:1–7.

Costantini V. & Martini C. (2006). 'Modified Environmental Kuznets Curve for Sustainable Development Assessment Using Panel Data'. *Nota Di Lavoro 148.2006.*

Environmental Business International (EBI) (2011). *The Global Environmental Market, EBI Report 3000*, San Diego, U.S.A.

International Monetary Fund (IMF). (2015). IMF staff completes 2015 Article IV mission to Saudi Arabia. Press Release No.15/249. [2015 June 1], [cited 2015 September 14]. Available from: https://www.imf.org/external/np/sec/pr/2015/pr15249.htm.

International Monetary Fund (IMF). (2014). *Saudi Arabia 2014 Article IV Consultation*. Washington (DC): IMF Press.

Islam S.M.N. (2001). 'Optimal intertemporal climate change economics: a country perspective'. In Islam S.M.N. (ed.). *Optimal growth economics: an investigation of the contemporary issues and the prospect for sustainable growth*. London: Elsevier.

Panayotou T., Peterson A. & Sachs J. (2000). 'Is the Environmental Kuznets Curve Driven by Structural Change? What Extended Time Series May Imply for Developing Countries'. *CAER II Discussion Paper* no.80, Harvard Institute for International Development, Cambridge, MA.

Panayotou T. (2003). *Economic Growth and the Environment*. UNECE Online, cited 2015 May 11. Available from: http://www.unece.org/fileadmin/DAM/ead/pub/032/032_c2.pdf.

Renewable Energy Policy Network for the 21st Century (REN21) (2011). *Renewables Global Status Report: 2011 Update*. Paris: REN21 Secretariat.

Sawin J. L. (2004). 'Mainstreaming Renewable Energy in the 21st Century'. *World Watch Paper 169*, State of the World Library: Washington D.C.

Selden T.M. & Song D. (1994). 'Environmental quality and development: Is there a Kuznets curve for air pollution emissions?' *Journal of Environmental Economics and Management*, no.27, pp. 147-162.

Stern D.I. (2014). 'The environmental Kuznets curve: A primer'. *CCEP Working Paper 1404.*

Stokey N.L. (1998). 'Are There Limits to Growth?' *International Economic Review*, no.39, pp.1-31.

Taher, N. & Hajjar, B. (2014). *Energy and Environment in Saudi Arabia: Concerns and Opportunities*. Switzerland: Springer.

Yaduma N., Kortelainen M. and Wossink A. (2013). 'The environmental Kuznets curve at different levels of economic development: A counterfactual quantile regression analysis for CO2 emissions'. *Manchester University Economics Discussion Paper Series. EDP-1322.*