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The relationship amongst energy consumption (renewable and non-renewable), and GDP in Algeria

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ABSTRACT

This study aims to explore economic growth-energy consumption nexus in Algeria between 1980 and 2012. With cointegration tests, we demonstrate the existence of long-run link between real gross domestic product, real capital and the two categories of energy consumption i.e renewable energy per capita and non-renewable energy. The long-run and the short-run autoregressive distributed lag (ARDL) estimates indicate that only the non-renewable energy sort and capital can contribute to enhancing economic growth whereas renewable energy does not show any significant effect. The outcome of causality tests proves a feedback link among non-renewable energy consumption and gross domestic product, among capital and gross domestic product, and among non-renewable energy and capital, in both short-run and long-run terms. Moreover, the results reveal a unidirectional link going from renewable energy to economic growth, capital, and non-renewable energy respectively, in the long run. Furthermore, the results illustrate the presence of a unidirectional link going from non-renewable energy to renewable energy in the short term. Our outcome suggests that policy makers in Algeria should enhance the renewable energy share together with controlling the non-renewable one.

1. Introduction

The exhaustion of non-renewable category of energy, the increased energy demand, the need to achieve the sustainable development goals, and the consideration of health effects are the important reasons which motivate countries to promote the renewable energy sources. In accordance with International Renewable Energy Agency [1], 164 nations have adopted no less than one class of renewable energy target. This fact encourages researchers to integrate the renewable energy variable on the energy consumption-economic growth nexus [2].

The selection of Algeria for observational examination is activated by the ensuing fundamental reasons. Firstly, Algeria figured from the countries which have abundant fossil fuels resources. Algeria is included in the group of countries which have a massive reservoir of fossil fuel resources. In 2013, Algeria recorded 12.2% of the world oil reserves and 4.5% of the world natural gas reserves. Algeria has the seventeenth greatest oil reserves worldwide and the fourth greatest ones in Africa. It has also the tenth greatest natural gas stock worldwide and the second greatest one in Africa [3] (Table 1).

Algeria is likewise figured from the biggest fossil fuel producers worldwide. In 2013, the Algerian oil production was estimated at 1485 thousand barrels per day. Algeria is considered the eighteenth major oil producer in the world and the third important producer in Africa. While the Algerian natural gas production was measured by 81.5 billion cubic meters, it has been ranked number ten in the world and number one in Africa [3] (Table 1).

Secondly, this abundance of fossil fuels resources has created an economy which is intensely dependent on the natural resource sector. Indeed, total natural resource rents, oil rent, and natural gas rents accounted for 28.16%, 21.61% and 6.10% of GDP in 2013, respectively [4]. According to International Monetary Fund [5], Oil and gas export represented 98.1% of Algerian exports in 2013. Moreover, Algerian is one of the biggest consumers of subsidized energy. The Algerian government has adopted a policy of energy subsidies by fixing administratively the prices of electricity, fuel and set administratively under its market value [6]. In 2013, the Algerian oil consumption and gas consumption were estimated at 390 thousand barrels per day and 33.4 billion cubic meters respectively [3] (Table 1). It is considered the thirty-sixth biggest consumers of oil in the world and the third one in Africa. It also belongs to the first twenty-six biggest nations in terms of gas consumers worldwide and the second substantial one in Africa. Between 1980 and 2013, oil and natural gas consumption decreased from 191 (in thousand barrels per day) and 19.8 (in billion cubic meters) to 390 (in thousand barrels per day) and 33.4 (in Billion cubic meters), respectively (Fig. 1). In accordance with International Energy Agency [7], total energy consumption (in thousand tons of oil equivalents) soared from 12,722 to 31,894 between 1990 and 2013 (Fig. 1). In 2013, the residential sector represented the biggest share of

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Table 1
Algerian oil and gas statistics in 2013 [3].

	Total	Proportion in the world	Rank in the world	Proportion in Africa (%)	Rank in Africa
Oil proved reserves (thousand million barrels)	12.2	0.71	17	9.37	4
Oil production (thousand barrels daily)	1485	1.71	18	17.10	3
Oil consumption (thousand barrels daily)	390	0.42	36	10.39	3
Natural gas proved reserves (trillion cubic meters)	4.5	2.41	10	31.69	2
Natural gas: production (billion cubic meters)	81.5	2.39	9	39.85	1
Natural gas consumption (billion cubic meters)	33.4	0.98	28	27.76	2

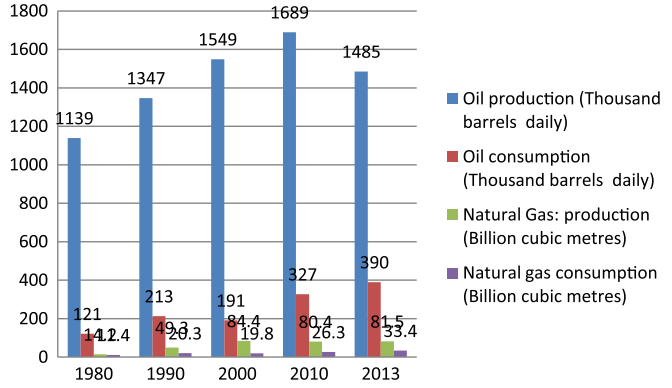

Fig. 1. Evolution of energy indicators [3].

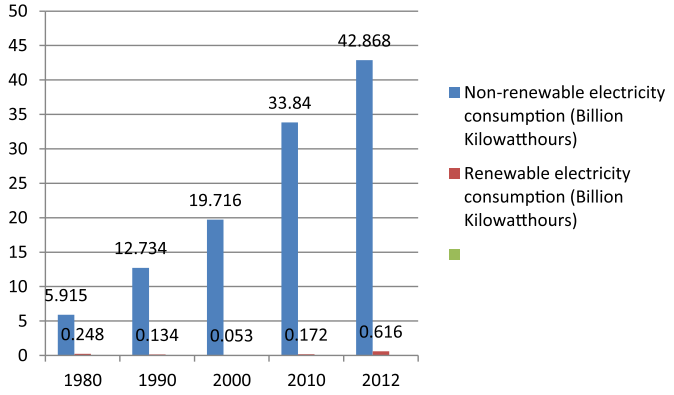

Fig. 3. Evolution of non-renewable electricity consumption and renewable electricity consumption [7].

energy consumption at 42.61% of total energy consumption, trailed by the transportation and industrial ones at 36.03% and 21.35% respectively.

Thirdly, the Algerian model of energy consumption is based on the fossil fuels which represented 99.89% in the entirety consumption of energy in 2013. The biggest share is accorded to the natural gas with 62.59%, followed by oil with 36.91% and coal with 0.39% respectively (Fig. 2). Renewable energy represents only 0.1% of Algerian energy consumption. Non-renewable electricity (in billion Kilowatt-hours) jumped from 5.915 to 42.868 between 1980 and 2012, whereas renewable electricity went up from 0.248 to 0.616 during the same period [7] (Fig. 3 and Table 2).

Fourthly, the growth of energy consumption has been associated with a decline in natural gas and oil production. Oil production increased (in thousand barrels per day) from 1138.86 in 1980 to 1989.93 in 2005. Oil production (in thousand barrels per day) declined from 1989.93 in 2005 to 1485 in 2013. The Algerian natural gas production (in billion cubic meters) rose from 14.17 in 1980 to 86 in 1999. Natural gas production (in billion cubic meters) went down from 86 in 1999 to 81.5 in 2013 [3] (Fig. 1). Fifthly, this extensive use of oil and natural gas is associated with C02 emissions repercussion [6]. As

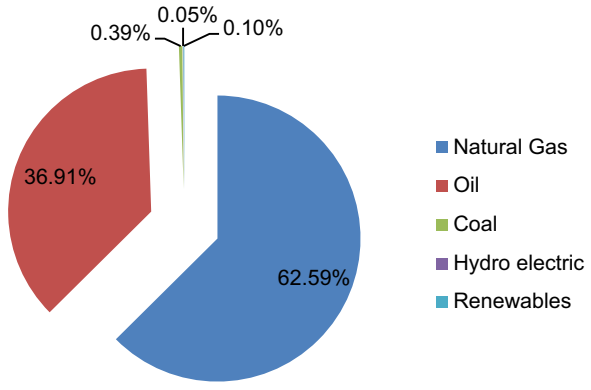

Fig. 2. Energy consumption by fuel (Million tons oil equivalent) in 2013 [7].

Table 2
Electricity net generation by fuel (billion kilowatt-hours) 2012 [7].

	Nuclear	Renewable	Fossil fuels	Hydroelectric pumped storage	Total
Generation from	0	0.616	53.369	0	53.985
Share (%)	0	1.14	98.85	0	100

indicated by the Environmental Performance Index (EPI) [8] in 2014, Algeria was ranked 92 on the list of 178 nations for their ecological result. As pointed up by U.S Energy Information Administration [7], carbon dioxide emissions (million tons CO2) moved from 41.1 in 1980 to 125.5 in 2013.

Sixthly, to satisfy the increasing needs of energy demand of its population, the decrease in oil and natural gas production, and to promote a clean environment, Algeria has increased its efforts in matters of development of other alternative energies such as renewable energy. Algeria forecasts the production of 20% of its energy from renewable energy by 2030 [1]. To reach this target, Algeria has adopted numerous options such as the development of manufacturing ability to create the solar, wind, hydroelectric, geothermal and biomass energies, along with a progressive legislative framework for the renewable energy sector, the reinforcement of structures of renewable energy, the adoption of different financial and tax benefits, and the cooperation with the European Union in relation to non-renewable and renewable energy in 2013 [9].

To our knowledge, there is no study which is interesting in the nexus among renewable energy consumption and output (which is measured by the gross domestic product) in Algeria. The study goal is to inspect the link among energy consumption and output in Algeria by assuming different components of energy i.e renewable and non-renewable between 1980 and 2012.

This document is planned as follows. Section 2 describes material and methods. Section 3 provides the main results and debates, and Section 4 integrates conclusions and policy implications.