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On the nexus of energy use - economic development: a panel approach

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Abstract

Gross Domestic Product (GDP) is inefficient for evaluating sustainable development, and the most suitable indicator for this is the Index of Sustainable Economic Welfare (ISEW). This paper focuses on distinguishing the ISEW from GDP, mainly through the study of the energy consumption - economic growth nexus. The traditional hypotheses were tested using a Panel-Corrected Standard Errors estimator for twenty-two countries for the time span from 1995 to 2013. The findings show substantial differences between GDP and ISEW. This paper contributes to the discussion about the consequences of these two approaches for the design of suitable policies for a sustainable future.

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1. Introduction

World population is increasing. It currently stands at 7.3 thousand million, and is expected to increase 1.5 thousand million by 2030. In view of this, the UN is naturally concerned with the use of the Earth's resources and well-being, and has been promoting the sustainable development of countries, defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"[1]. This problem has been discussed more seriously, and there are several indices that measure social well-being, such as the Human Development Index (HDI) and Gross National Happiness (GNH). However, only the Index of Sustainability and Economic Welfare (ISEW) created by Daly and Cobb in 1989, is established in the literature and includes the use of natural resources by each

country. In addition, it takes into account factors such as inequality in income distribution, exchange of goods/services and investment in health or education by the Government. All this makes the ISEW the best indicator for measuring sustainable development, because it considers practically all the elements necessary to achieve the goals set by the United Nations as essential for the future of our planet and the generations who will live on it. These concerns are ignored in calculating Gross Domestic Product, the economic growth proxy most used in scientific papers.

It is necessary to rethink the way we measure a country's economic development so that it becomes seen as an indication of the well-being provided by a nation and its efforts to ensure the planet's future. It is widely proven in the literature that a rise in energy consumption is related to economic growth. This used to be necessary for improving our lifestyle, but as pointed out in the 2015 UN Climate Change Conference, in the 21st century it is necessary to look at energy consumption in a sustainable way.

Following this line of thought, this paper compares the sustainable development proxy ISEW with the economic growth indicator GDP, and examines the relationship of these two variables with energy consumption. A first graphic comparison between ISEW and GDP was done, and demonstrated that the two variables diverge over the time span studied, which reinforces the initial idea that they might not be the ideal substitutes in analysing the nexus. The central question of this paper is: are the usual results of traditional energy-growth nexus (measured by GDP) valid when using a more suitable indicator for economic development, specifically the ISEW? Consequently, the paper's main objectives are: (i) to assess the impact of energy consumption on sustainable development; (ii) to appraise the different effects on ISEW from renewable and non-renewable energies; (iii) to illustrate the differences between economic growth and sustainable development. For this purpose, annual data for twenty-two countries, covering the period from 1995 to 2013, was used. To achieve the main goals, micro econometric techniques were employed.

The results show the differences between using the ISEW and GDP to analyse the energy nexus. Energy produced by renewable sources is important to development as measured by the ISEW. However, one of the major drivers of GDP growth is the consumption of non-renewable energy sources, which makes the ISEW a better indicator to measure a country's efforts to preserve the Planet.

The remainder of the paper is organised as follows. Section 2 presents a literature review on the ISEW and the energy consumption nexus. Section 3 describes the data and methodology used, and Section 4 shows the results. The interpretation of results is discussed in Section 5. Section 6 states the conclusion.

2. Literature Review

There is a lack of empirical studies analysing the nexus by focusing on development instead of economic growth, and few with comparisons of the ISEW and GDP [2]. The literature review to support this paper was divided into sections. The ISEW is in sub-section 2.1, while the relationship between energy consumption and economic growth is presented in sub-section 2.2, the determinants of economic growth in 2.3.1, and energy consumption in 2.3.2.

2.1. The Index of Sustainable Economic Welfare

As mentioned above, in comparison to others indicators, the ISEW is recent (since 1989) and arose from the need to evaluate the costs of economic activity on the well-being of societies. Increasing economic activity could imply future costs, costs that must be paid sooner or later. The payment of these costs are more likely to become accumulated over generations like debt [3]. So a share of production output must be used to offset the costs of economy activity, the so-called defensive costs. Only in this

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