

REVISITING THE GROWTH HYPOTHESIS FOR THE RENEWABLES IN THE ENERGY-GROWTH NEXUS

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Overview

Energy-growth nexus is a terminology referring to the link between energy consumption and economic growth. Since Kraft and Kraft (1980), many energy-growth nexus studies have been done. Over time, the energy-growth nexus has been developed at a more disaggregated level. For example, Ozturk (2010) discussed both the energy-growth nexus between “electricity consumption and economic growth” and “energy consumption and economic growth”. Recently, in terms of climate change and sustainable development, the studies focusing on renewable energy are also increasing. Traditional non-renewable energy consumed resources to produce electricity. On the other hand, renewable energy has a connection with the production of related industries. This can have a positive impact on economic growth and is in line with the growth hypothesis of energy-nexus. Therefore, we investigate the relationship between renewable energy consumption and economic growth considering the cost structure of renewable energy.

According to REN21 (2018), renewable energy accounted for an estimated 18.2% of global total final energy consumption. Particularly in the power sector, growth and output are continued. The renewable power generation capacity saw its largest annual increase in 2017, with an estimated 178 GW installed worldwide, raising total capacity by almost 9% over 2016. Unlike traditional electricity sources, the facility cost of renewable electricity accounts for a high percentage compared to non-renewable energy. For example, in the case of Germany, the cost of modules or inverters in the solar photovoltaics industry is more than half of the total whole capital expenditure of the business (BNEF, 2017). As previously mentioned, economic growth is driven by consuming related industries. Therefore, in order to confirm these effects, the analysis should be conducted for the countries where actually related industries are consumed. In other words, it is necessary to select a country where production related to renewable energy is made. Thomson Reuters (2017) selected renewable energy companies in the power generation sector based on various criteria. This study attempts to reflect the effect of renewable energy on other sectors by selecting countries for analysis using Thomson Reuters (2017).

Method

Engle-Granger or Johansen cointegration test applied to find a long-run relationship between variables. The Vector Error Correction Model (VECM) also used as the regression model with such cointegration tests. However, this approach requires long-term time series data. It implies that it is difficult to apply them to investigate renewable energy. Therefore, in this study, Autoregressive Distributed Lag (ARDL)-bounds testing approach by Pesaran and Shin (2001) is used. We depict GDP as GDP, renewable electricity consumption from solar PV and wind as REN and capital as K. Also, we used labor force to change each variable into per capita units.

$$\Delta \ln GDP_t = \alpha_0 + \sum_{i=1}^n \alpha_1 \Delta \ln GDP_{t-i} + \sum_{i=1}^n \alpha_2 \Delta \ln REN_{t-i} + \sum_{i=1}^n \alpha_3 \Delta \ln K_{t-i} + \lambda_1 \ln GDP_{t-1} + \lambda_2 \ln REN_{t-1} + \lambda_3 \ln K_{t-1} + u_t$$

$$\Delta \ln REN_t = \beta_0 + \sum_{i=1}^n \beta_1 \Delta \ln REN_{t-i} + \sum_{i=1}^n \beta_2 \Delta \ln GDP_{t-i} + \sum_{i=1}^n \beta_3 \Delta \ln K_{t-i} + \mu_1 \ln REN_{t-1} + \mu_2 \ln GDP_{t-1} + \mu_3 \ln K_{t-1} + e_t$$

Results

This study analyses seven countries from Thomson Reuters (2017). Table 1. shows the results of ARDL bounds testing. When economic growth is a dependent variable, there is no level relationship in Canada, Denmark and Spain. On the other hand, it has a level relationship in all countries if renewable electricity consumption is a dependent variable. This means that in the case of the GDP model, renewable energy consumption and long-run relationship are not established in the three countries mentioned above. However, in the renewable energy model, all countries have been confirmed to have a long-run relationship.

Table 1. ARDL-bounds testing results (F-statistics)

Variables	Canada	China	Denmark	Germany	India	Spain	USA
Economic growth	2.196	3.804*	2.924	5.716**	5.044**	1.298	12.136**
Renewable consumption	6.815**	4.084*	5.506**	7.097**	4.738**	6.369**	5.553**

Note: ** (*) denote statistical significance at the 1% (5%) level.

Conclusions

This study investigated the relationship between economic growth and renewable electricity consumption of 7 countries. According to the results of ARDL bound testing, we examined several countries has no cointegration in the GDP model. In Canada, hydropower accounts for a large portion of the total, so PV and wind have little impact on economic growth. Denmark and Spain are expected to see increases in PV and wind since 2018 more from past to now. Therefore, it can be seen that the countries where the development of the market itself was earlier had a relationship between renewable consumption and GDP. In the renewable energy model, economic growth has a long run relationship with the country's renewable energy consumption. Also, it indicates stronger statistical significance. In the early days, the strategic upbringing of renewable energy is not linked to economic growth. However, it can be seen that it affects economic growth after development.

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