The creation of renewable energy technology in Europe - are patents per capita converging?

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Overview

This paper combined both cross-sectional and time series tests for convergence using data on renewable energy patents from 13 industrial countries over the period 1990–2010. The objective of this paper is to provide insight in the renewable energy technology developing pattern in Europe. An answer to the research question permits immediate conclusions with regard to the success prospects of the EU's Renewable energy directive (2009/28/EC) which sets climate and energy targets for both 2020. The empirical analysis is focused on whether renewable energy patents have converged or diverged between the countries the data is based on patents granted at the European patent office the methodologies applied draws from the economic convergence literature. The question is also important to answer considering that the effect of international technology flows crucially depends on the destination country's ability to comprehend and make use of external knowledge (Mancusi, 2008). Therefore the ability to receive technological spillovers or use advancements made abroad are a function of the country's past experience in research, if there is no absorptive capacity then the spillover flow might not exist (Cohen & Levinthal, 1989).

It is also know that the renewable energy development record in Europe are mixed with substantial power capacity increases in some countries and far more modest developments in others (IEA, 2014b). Considering Cohen & Levinthal (1989) and Mancusi (2008) work on technological development, it raises two possible scenarios for the movement direction of renewable energy technology in Europe. Either there will be convergence where laggard countries learn from more advanced countries. The alternative is divergence where the less technologically developed countries are not able to implement new renewable energy in an optimal phase. The empirical part of this paper uses methodologies drawn from the economic convergence literature that have been previously applied to other fields such as environmental performance see: (Aldy, 2006; Romero-Ávila, 2008).

Methods

Firstly, conditional beta-convergence assumes possible differences among countries. What will be tested is whether the renewable energy patents per country are converging or not among the 13 EU countries. Convergence is thus conditional on similarities in country characteristics. Conditional β- convergence can be examined by adding a set of exogenous variables to the regression equation outlaid in equation (1), where differences in the steady states across countries are controlled for (Barro and Sala-i-Martin, 1992). Secondly, Sigma is considered, it consists of a dispersion measures widely used in the economic growth literature. The inter-temporal change (i.e., data normalized to the initial year) in the CV (the standard deviation divided by the average) of the cross-country renewable energy patent per capita intensity distribution. If this measure is falling over-time, that result is interpreted as evidence of convergence. Thirdly, the last convergence measure (gamma), the intra-distribution mobility was investigated. The intra-distribution mobility show whether the countries patent intensity remains the same over the years in relation to each other. Further, in line with Liddle (2010), to determine whether the shape of the distribution of renewable energy patents have changed and converged over time the kernel of the density estimates of the distribution is created.

The data set is a balanced panel of 13 of the 15 first EU member states in a time span between 1990 and 2010. Greece and Luxemburg has been omitted because of data issues. Renewable energy patents per capita are used as a measure of inventive capacity in a country. The national renewable energy patent statistics were extracted from OECD´s statistical database.

Results

In both the conditional beta convergence test and sigma convergence test the null hypothesis that inventive capabilities have diverged is supported. Overall, these empirical findings provide evidence that per capita patents

have spatially diverged.. Hence, the result does not support the hypothesis of existence of β-convergence and sigma convergence. Therefore we cannot reject the occurrence of a divergence pattern, something. Of particular interest in this paper was the question whether there is a convergence or divergence of national renewable energy innovation capabilities, i.e. whether the different rates are persistent or if they diminish or even close in the course of time. If there is a converging development of national innovation capabilities, this might also push adoption of the use of renewable energy per capita and hence achieving the 2020 and 2030 goals.

Conclusions

Considering Cohen & Levinthal (1989) and Mancusi (2008) work on technological development, who found that a low level of own research hampers the possibility to take in technological spillovers from abroad, one core issues for the European Union must therefore be both national and European policy level to promote renewable energy. Johnstone et al. (2010, 2012) showed that there are positive roles of environmental policy stringency but also general innovative capacity. Jungmittag (2004) showed that if technologies vary across countries, convergence of per capita incomes and labor productivities will only occur if there is a converging development of national innovation capabilities.

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