THE IMPACT OF PUBLIC POLICIES IN THE RENEWABLES DEPLOYMENT: A COMPARATIVE STUDY BETWEEN INSTALLED CAPACITY AND ELECTRICITY GENERATION

António Cardoso Marques, NECE, University of Beira Interior, Phone +351 275 319 600, E-mail: amarques@ubi.pt
José Alberto Fuinhas, NECE, University of Beira Interior, Phone +351 275 319 600, E-mail: fuinhas@ubi.pt
Diogo André Pereira, University of Beira Interior, Phone +351 91 097 4272, E-mail: pereira.diogo.as@gmail.com

Overview

The Public Policies Supporting Renewables (PPSR) are mainly to deal with energy market failures. Indeed, the fossil fuels technologies do not internalize in their price the costs of pollution. The shift from fossil fuels towards Renewable Energy Sources (RES) in the domestic electricity mix is a major step in preserving the environment and reducing the external dependence of electricity sources. As is also well-known, RES imply a large amount of investment in an initial phase, due to the lack of technological advance and the insufficiency of know-how. The new renewables sources are already finding ways to make themselves competitive, but they need public intervention. Despite some recent empirical studies (e.g. Aguirre & Ibikunle, 2014; Marques & Fuinhas, 2012; Polzin, Migendt, Täube, & von Flotow, 2015), the literature focused on the relationship between PPSR and RES deployment is mainly qualitative and normative (e.g. Abdmouleh, Alammari, & Gastli, 2015; Gan, Eskeland, & Kolshus, 2007), and reveals a positive impact of PPSR on RES implementation. On the other hand, empirical literature (e.g. Aguirre & Ibikunle, 2014; Marques & Fuinhas, 2012; Polzin et al., 2015) demonstrates dissimilar effects of PPSR subcategories on RES deployment. Moreover, the conclusions reached by the literature are far from consensual. Evaluating the consequences of PPSR is clearly crucial, given that governments are attempting to meet multiple objectives. On the one hand, they must keep the deployment of RES within the domestic electricity mix. On the other hand, they have to find incentives that require fewer resources from the economy as a whole. In fact, these incentives may even compromise the economic growth as quoted by some authors (Al-mulali, Fereidouni, & Lee, 2014; Cowan, Chang, Inglesi-Lotz, & Gupta, 2014; Marques & Fuinhas, 2015). In short, the balance of these two dimensions is essential in designing appropriate energy policies, and this is the main motivation for this research. Therefore, this paper aims to provide support, as well as to discuss the appropriate design of PPSR for the renewables deployment.

Methods

This research uses an annual panel data based on the 20 countries with the highest electricity production using RES and a time span from 1990 until 2014. The main objective of this study is to analyse, through a dynamic approach, the effects of PPSR, in various categories and subcategories, on installed capacity and on electricity generation by RES in an aggregated format, and in a disaggregated format for new sources of renewable energies, namely wind power and solar photovoltaic (PV). Therefore, this research makes it possible to assess the efficiency of PPSR and to provide guidelines to the design and fine-tuning of a PPSR mix capable of introducing market logic and self-sustainability of these sources of energy. On the one hand, the effects of PPSR on electricity production and on installed capacity will be evaluated in comparison, in order to analyse if, when PPSR as a positive impact on installed capacity, it also increases electricity generation. On the other hand, the effects of the PPSR on aggregated renewables, on wind power, and on solar PV will be assessed in comparison, in order to analyse the specific technological effects of PPSR.

Both panel data estimators and co-integration/long memory are pursued and discussed, specifically when dealing with the heterogeneity of the panel and the country specific effects. The comprehensive analysis of the impacts of PPSR on RES implementation requires an econometric technique that takes into consideration both short- and long-run effects. The specification tests performed are: the Breusch and Pagan LM test for random effects, to test the existence of panel effects; the Hausman test, Fixed Effects (FE) vs. Random Effects (RE), that tests the presence of individual effects against random effects; the modified Wald statistics for groupwise heteroskedasticity; the Wooldridge test for serial correlation; the tests of cross sectional dependence; and the tests to assess the panels heterogeneity of crosses, the Hausman tests by comparing the Mean Group (MG) vs. Pooled Mean Group (PMG), and the MG vs. Dynamic Fixed Effects (DFE). As noted by specification test, the Driscoll and Kraay estimator with fixed effects proved to be appropriate for handling these data features.

Results

On the whole, all models support co-integration/long memory, given that the Error Correction Mechanism is negative and highly significant. In fact, this emphasizes the relevance of using the autoregressive distributed lag approach. It is worthwhile to note that the high elasticities observed are compatible with the take-off phase that renewables' technologies experienced, precisely during the time span under analysis. This evidence is an additional proof of robustness of the results. The results show that direct investments, regulatory instruments and voluntary approaches are ineffective for promoting both electricity generation and installed capacity of RES. In contrast, fiscal/financial incentives, market-based instruments, information and educations, are effective for RES deployment.

The results prove that there are negative and positive effects of fiscal/financial incentives, but the results prove that the majority of their subcategories have positive effects. Of note in this category are the effects of FIT/premiums and tax relief to promote solar PV and wind power respectively. Indeed, FITs are in line with investors' preferences, guaranteeing a price for the electricity generated and dispatch priority order. Furthermore, this policy instrument has also stimulated consumers to be producers, through the installation of solar PV panel in their homes. Even through wind power projects imply a large initial investment, tax exemptions and reductions encourage large investments in wind power plants. These policy instruments have been drivers for the deployment of renewables, besides being more effective for this specific technology, but they are directly dependant on public budgets and this dependence can lead to an excessive burden on economies. In contrast with these types of approach, the market-driven approach, using measures such as codes and standards, are the subcategory of regulatory instruments that incorporate Renewables' Standard Portfolio policies. Actually, this approach does not guarantee a fixed price but imposes a minimum limit on electricity generation through RES. Furthermore, the policy instrument that incorporate green and white certificates are intended to make the electricity market more competitive, as the price of RES generation depends on the demand and supply of greenhouse gas licences, and imposes quota obligations for RES production. Indeed, these market-drivers can be seen as a booster of RES implementation, mainly solar PV.

Conclusions

The market-driven policies are shown to boost implementation of solar PV but not wind power, because this technology is mostly implemented through direct investments and financial support. However, policy-driven approach has a positive effect on RES implementation, mainly wind power. These policies could increase the burden on economies and negatively influence the electricity market, given that wind power generation is independent of the electricity market price. In contrast, the mix of market-driven and policy-driven approaches has a positive effect on solar PV, and encourages consumers to become producers, interacting directly with the electricity market and making the economies more dynamic. In short, a mix of market-driven and policy-driven approaches requires fewer resources from the whole economy, and can make RES and the electricity market more competitive. Indeed, the results of solar PV have demonstrated that a mix of policy- and market- driven approaches is favourable for increasing the deployment of RES.

Overall, the results seem robust and suggest that it is essential to adjust market-based policies produce the desirable effects on wind power deployment, and decrease the burden on the cost of energy for economics. At the same time, this will make wind power more competitive in the market and, consequently, decrease the cost of implementation.

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