Are the renewable energies affecting the income distribution and the risk of poverty of households?

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Overview

The transition from fossil fuels towards renewable energy sources (RES), in the domestic electricity mix, is a major step to preserve the environment, to a sustainable development, and to reduce the external dependence of electricity sources. The new RES or intermittent RES (RES-I), namely wind power and solar photovoltaic (PV), are already finding ways to make themselves competitive, but they continue to need public intervention, through subsidies because of their necessity of large investment (Kehoe, 1991; Johnstone et al., 2010; Polzin et al., 2015). Consequently, the evaluation of the consequences of RES deployment on the households income and risk of poverty or social exclusion is clearly crucial, given that governments are attempting to meet multiple objectives. On the one hand, they must keep the deployment of RES within their 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, mainly subsidies and feed-in tariffs, may even increase the electricity cost burden for households and compromise the households threatened by energy poverty, or even increase the risk of poverty and social exclusion (Andor et al., 2015; Frondel et al., 2015). Therefore, these two points raise the questions of how to relieve the RES cost burden and how to mitigate the social consequences of increasing electricity cost for households at risk of poverty. In short, the balance of these two purposes is essential to design appropriate energy policies, and this is the main motivation for this research. Accordingly, this research aims to provide support, as well as discussion about the effects of RES on both the income and risk of poverty of households. To do that, it will be used and Autoregressive distributed lag (ARDL) approach, which permits breakdown the total effects into short- and long-run effects, to answer the following questions: (i) what is the effect of the social classes income on RES deployment?; (ii) what is the consequence of RES implementation on households income distribution?; and (iii) The RES have increased the risk of poverty or social exclusion of households?

Methods

To meet the main objective and answer the questions, this research uses a panel database for 22 European countries, for the time-span from 2005 until 2015 (annual data), from Eurostat source. This research assesses both the households income distribution and the risk of poverty disaggregated, by the following household types: (i) single person; (ii) single person with dependent children; (iii) two adults; (iv) two adults younger than 65 years; (v) two adults, at least one aged 65 years or over; (vi) two adults with one dependent children; (vii) two adults with two dependent children; (viii) two adults with three or more dependent children; (ix) two or more adults without dependent children; (x) two or more adults with dependent children; (xi) three or more adults; (xii) three or more adults with dependent children; (xiii) households without dependent children; and (xiv) households with dependent children. The mean of disposable income of households types has been divided by the mean total income, to disclose the income distribution effects. Besides, this research studies both the installed capacity and the electricity generation of RES aggregated, and disaggregated by wind power, solar PV, and hydro power. For the group of countries under analysis and their household types, it is expected that the relationship between income distribution, risk of poverty, and RES deployment have dissimilar effects in short- and long-run. In fact, the partition of this effect is due to: (a) the most recent deployment of RES stimulated by social and political pressure for the development of cleaner energies; and (b) the increasing of feed-in tariffs, taxes, and levies experienced during the years under study. Thus, an ARDL methodology was applied to study this dynamic effects. Furthermore, a battery of model specification tests was carried out, which indicates that the Driscoll and Kraay estimator with fixed effects is the most suitable estimator to handle with the data features.

Results

The households types of two adults younger than 65 years; two adults where at least one aged 65 or over; two adults with two dependent children; and three or more adults have an income above the mean. Consequently, these household types are considered wealthy households, because their income is above of mean national income. In fact, their higher income allows a large saving rate and permits them to invest in RES installed capacity, directly through solar PV installations in their homes, or indirectly permitting more investments through their savings. Accordingly, these households types have been the solar PV and wind power promoters. Indeed, their income has increased both the installed capacity and the electricity generation of RES.

Table 1 summarizes the results of the RES effects, and electricity price on income distribution, it is only presented the income results because the risk of poverty results are in accordance with them, when the income increase the risk of poverty decrease, or vice-versa. In addition to the results presented, this research also studies the effects of natural gas use for heating purposes on households income and risk of poverty. The natural gas consumption has a negative effect on the income of households threatened by the risk of poverty and social exclusion. This means that poor households do not have sufficient income to ensure their subsistence, which can decrease their productivity and future income, i.e. the poor households can fall into the poverty trap. In fact, the natural gas consumption has increased the risk of poverty and social exclusion of poor households. However, the natural gas consumption has a positive effect on wealthy households, which increases their productivity and future incomes.

Table 1. RES effects on income distribution

	i	**ii**	**iii**	**iv**	**v**	**vi**	**vii**	**viii**	**ix**	**x**	**xi**	**xii**	**xiii**	**xiv**
Wind power affect		+***	-**	-**	+***	-***		+**	-**		+*	+***		+**
Solar PV affect	+***	-***	+***		+***	-*	-***		+**	-***			+***	-***
Hydro Power affect	+***	-**	-***			+**	-***		-*	+***	-***	-*	-***	+**
RES affect	-***	+***		-**			+***		-***		-***		-***	+***
Electricity price affect	+**		+*		+**	-***	-**	-**				-***		

Notes: i, ii, iii, iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv refers to the household income by types: single person; single person with dependent children; two adults; two adults younger than 65 years; two adults, at least one aged 65 years or over; two adults with one dependent children; two adults with two dependent children; two adults with three or more dependent children; two or more adults without dependent children; two or more adults with dependent children; three or more adults; three or more adults with dependent children; households without dependent children; and households with dependent children, respectively. *, **, *** denotes the level of significance 10%, 5%, 1% respectively.

The increasing share of electricity production from RES should decrease the electricity prices because its marginal cost tends to zero. However, the lower wholesale prices from the increased RES production not cause a lower retail price. In fact, this is due to the feed-in tariffs, taxes, and levies that have been used to cover the increase of average cost provoked by the deployment of RES. The European countries have subsidised large wind power installed capacities through feed-in tariffs. Besides, their investment has been made mainly by loans with the savings of wealthy households. Regarding the solar PV, the wealthy households have invested in installations of solar PV panels in their homes, through the access to feed-in tariffs benefiting from quick and high returns. Consequently, the high returns given by feed-in tariffs, taxes and levies are borne by electricity consumers in their electricity bills. Therefore, the results of this research highlight this transfer of income, through RES deployment, by low-income households to high-income households, which have provoked an asymmetric income distribution.

Conclusions

The results highlight that households with an income below the mean finance the substantial cost of RES deployment, which increases their cost burden and their risk of poverty and social exclusion. Accordingly, the RES deployment and their effective electricity generation have triggered severe distributional implications. Indeed, households at risk of poverty have to spent increasing slices of their income on electricity bills, and wealthy households have gained high returns of RES investments. Therefore, the policymakers should design energy policies that drop the surcharge for the promotion of RES. Furthermore, the governments should subsidy the electricity bills of poor households to compensate them for the increased electricity cost, which decreases their risk of poverty or social exclusion.

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