



Renewable energy sources in Italy: Sectorial intensity and effects on earnings



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ABSTRACT

The literature on renewable energy sources (RES) does not provide a shared methodology to measure the sectorial intensity of production linked to RES. Furthermore, empirical evidence on the relationship between RES sectorial intensity and workers' earnings is scant. The aim of this paper is to fill in these literature gaps providing, on the one hand, an original microdata-based methodology to measure the RES sectorial intensity, and, on the other hand, estimating, through panel data techniques, the relationship between RES sectorial intensity and earnings for a representative sample of Italian workers in the period 2002–2009. Focusing on the case of Italy in the first decade of the 21st century is very relevant given that in that period Italy promoted one of the most generous renewable support schemes worldwide. The main findings are the following: i) the RES sectorial intensity in Italy largely increased in 2008–2009; ii) on average, the RES sectorial intensity does not affect earnings levels; iii) remarkably, a clear skill-premium effect emerges when the RES sectorial intensity increases.

1. Introduction

In recent years EU policies have been driven by low-carbon strategies aimed at reducing GHG emissions. While the development of technologies related to renewable energy sources (RES) brings benefits in terms of GHG emissions reduction and, in general, environmental quality, the impact of such development on economic performance is unclear and deserves additional theoretical and empirical analysis. Indeed, EU and national policies fostering the transition to a low-carbon economy can generate non-negligible economic effects which need to be accounted for in order to guarantee an overall coherent and effective implementation of low-carbon strategies. For instance, the development of renewable energy capacity may be associated with positive economic effects, such as the promotion of green employment and high-quality jobs, the lowering of the energy deficit, the reduction of energy dependence and of the exposure to fuel-price volatility. However, against these positive effects, negative economic effects can also result, for example, the costs of renewable energy support schemes borne by final consumers or taxpayers, as well as the costs related to grid development, to congestion and to reserve capacity. On the whole, renewable energy innovations may cause changes in industrial activities and, therefore, may affect labour market outcomes. However, any analysis of the impact of RES technologies on

labour market outcomes requires prior measurement of RES sectorial intensity, i.e. the economic activities linked to the production of renewable energies.

The aim of this paper is to measure the RES sectorial intensity in Italy over the period 2002–2009 and to evaluate the impact of the development of renewable energies, in particular on workers' earnings. Indeed, a careful review of the literature has brought out two main limits of existing studies on the impact of renewable energies which we are intended to be overcome in this paper.

The first limit regards the lack of an official and shared definition of “renewable energies sector”, as well as of *green* sectors. Specifically, the economic activities linked to renewable energies have never been officially identified on the basis of a robust and common statistical approach. For this reason, estimates of the economic impact (e.g., in terms of value added, employment levels, earnings dynamics) of the development of such sectors may differ according to the boundaries assigned to them. The second limit concerns the almost exclusive focus on employment level changes characterising the existing studies on the labour market effects of the development of the renewable energies sector. Other labour market outcomes, such as earnings levels and differentials, are instead disregarded.

With regard to the issue of the measurement of RES production, among others, [44] and [6] draw attention to the general problem of

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finding agreed statistical definitions of green sectors at national, regional and international level. Some recent efforts in this direction have been made, such as the “Guidelines concerning a statistical definition of employment in the environmental sector” adopted at the 19th International Conference of Labour Statisticians [27]. However, [4] point out that “there is no rigorous, well-accepted definition of environmental job” and, five years later, [15] still underlines that “there is no universally accepted definition of what constitutes a ‘green job’”.

In order to carry out statistical analyses on green sectors and jobs many national governments have developed national initiatives to define green jobs (for a review of these initiatives, see [8, 33–35]) and several operational definitions of green jobs have been applied up to now in different countries. Most of them take an *industry approach*, i.e. they identify green jobs with employment in industries producing “green goods and services” [33]¹. In other cases, a wider approach has been adopted in order to take into account green occupations across the whole economy. This is the case of the industry-based definition developed by the United Nations Environmental Programme and the ILO [41], which includes employment in industries dependent on environmental resources and quality.

In addition to the lack of a shared definition of the renewable energies sector, there is a second serious gap in the literature regarding the focus of existing studies on the impact of renewable energies technologies on labour market outcomes. Labour market outcomes have been evaluated with different methodologies, from a macroeconomic perspective as well as from a microeconomic point of view, according to the specific goal of the analysis. However, most studies [6, 14, 24, 29–32, 39, 40, 42, 44] have focused on employment creation or destruction potential (distinguishing direct, indirect and induced employment effects)² of renewable energy policies while disregarding other labour market outcomes. Specifically, no attention has been paid to the relationship between RES development and earnings dynamics as an indicator of costs or benefits associated with renewable energy policies.³

In particular, studies based on input-output analysis [31,32], as well as those based on neoclassical general equilibrium [11,22] or Neo-Keynesian models [7], investigate the effects of green policies on some labour market outcomes, but they do not provide clear suggestions as to the effects of RES development on earnings distribution.

Up to now the only published study⁴ investigating the impact of green policies on wages is [43], in which the author makes use of linked employer-employee data for the US to estimate the long-term wage effects of job displacement due to environmental regulations. Refs. [37] and [16] argue that the lack of studies on the effect of RES policies on earnings levels and inequality is due to the unavailability of both a sound theoretical framework and specific microdata on workers in the RES sector.

In response to the lack of an official and shared definition of the RES sector and the disregard in the existing literature of the effects of RES development on labour market outcomes other than employment levels, this study focuses on both: a new methodology to measure the

¹ Following the 1999 OECD/Eurostat definition of eco-industries (i.e. industries producing environmental goods and services, such as pollution and resource management industries), the European Commission estimated that green jobs account for 2% of total employment in the EU area [19]. Using a similar approach [8] estimated that green jobs accounted for 1.5–2% of total employment in the US in 2008.

² Direct effects refer to the demand for goods and services in sectors directly impacted by renewable energy production (e.g. the construction of a wind-farm); indirect effects are represented by those effects regarding productive sectors indirectly linked to renewable energy (e.g. steel industry); induced effects include the general expansion of private expenditure on goods and services triggered by the investment in renewable sources.

³ Other studies focus, instead, on the implications of RES development on the energy market, in particular on wholesale electricity prices [12,17], on the variance of spot-market prices [46], on demand market power [5] and on the skill content of jobs [13].

⁴ Few other attempts to study wage dynamics in relation to green sectors development have been made [3,18].

RES sector using official statistical classifications of economic activities is proposed and, drawing on the results obtained, an empirical analysis of the impact of RES development on earnings levels and inequality in the period 2002–2009 in Italy is carried out.

Focusing on the case of Italy in the first decade of the 21st century is very relevant given that in that period Italy promoted one of the most generous RES support schemes worldwide. Major changes concerned the growth in wind and photovoltaic power capacity promoted by national support schemes, in particular solar power generation greatly increased [12]. Wind power capacity has been mainly supported through the Green Certificates Scheme, while solar power capacity has been directly subsidised through a feed-in premium, known as *Conto Energia*, which, according to [28] represents one of the most impressive supporting schemes in the world.

More in detail, in order to fulfil the first objective of this study, the RES production chain is taken into account, building an index of the intensity of RES production (RES index) characterising each 3-digit NACE Rev. 1.1 group. In this way, drawing on an index-based classification of 3-digit NACE Rev. 1.1 groups, a “horizontal” definition of the RES sector is obtained. Making use of the RES index and of a panel of micro-data on Italian private employees (AD-SILC), an empirical analysis of earnings dynamics and inequality in relation to the development of the RES sector is carried out, in line with the second objective of this study. Specifically, the econometric analysis undertaken allows to establish whether earnings levels and inequality move according to the RES index. In other words, such analysis highlights the effect of RES development on earnings levels and, mostly, on the earnings gap between skilled and unskilled workers in Italian industry. This serves the purpose of testing the hypothesis of a *skill-biased technical change* (SBTC) mechanism [1, 2, 9] due to the development of RES technologies. In the SBTC framework, the earnings gap, considered as the main cause of increasing earnings inequality since the 1980s, is a consequence of the development of ICT technologies which has triggered an increase in the demand for high-skilled workers not compensated by an equal increase in their supply, thus leading to higher earnings for those workers. Furthermore a reduction in the demand for low-skilled workers has reduced their earnings. While the link between earnings and green technologies, in particular RES technologies, has not been deeply investigated, some recent studies have focused on the employment effects of green innovations and some empirical evidence is consistent with the SBTC hypothesis: [36] and [38] argue that green innovation encourages the demand for high-skilled workers while discouraging the demand for low-skilled workers and [26] suggest that the increase in the demand for high-skilled workers induced by cleaner technologies may be implied by a reorganisation of industrial processes at firm level.

The paper is organized as follows. Section 2 introduces data, methodology and the empirical strategy adopted to measure the intensity of RES production and analyse the link between the earnings distribution and such intensity. Section 3 reports descriptive evidence about the development of RES and the results of the micro-econometric analysis focusing on the relationship between RES and earnings dynamics and inequality. Finally Section 4 concludes and provides some policy implications.

2. Methodology and data

This section is divided in three sub-sections. The first contains a detailed description of the methodology used to measure the sectorial intensity of RES. For this purpose the information contained the 2002–2009 Istat surveys on industrial production (*Rilevazioni annuali della produzione industriale - Prodcum*) is exploited. The second presents the longitudinal dataset AD-SILC providing the individual working histories of a representative sample of Italian workers, also collecting detailed information on firms’ characteristics that are merged with the sectorial variables obtained through the Istat surveys. Finally, the

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