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Socioeconomic impact of wind energy on peripheral regions

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ABSTRACT

The socioeconomic benefits from the development of wind power could go beyond environmental issues or the diversification of the energy mix. There is an increasing interest in quantifying the impact on regional economies of such deployment, especially in those peripheral regions with low growth rates and traditional declined sectors. However, many studies in this field are meta-analyses or they do not take into account the different dynamics between temporal and permanent activities in the sector as well as the regional singularities.

The main aim of this paper is to analyse the economic impact of wind energy, in terms of contribution to the GDP and job creation, applying as a case study the Spanish peripheral region of Galicia. This quantification is addressed from a regional and sectoral perspective. The methodology is based on the analysis of the value chains regarding the design of the investment breakdown between temporal and permanent activities, and the input–output approach in order to assess the economic impact. In addition, the regional symmetric matrices are updated by means of a variation of the RAS technique which avoids the fixed technical coefficients related to the traditional input–output models.

Empirical evidences underline the remarkable economic impact on the regional GDP and, to a lesser extent, on the employment. Although wind sector is capital intensive, employment increases in large amounts in industrial subsectors and knowledge intensive activities such as R&D. Hence, it might be an industrial alternative in peripheral regions if legislative instability is removed and promotion polices foster the regional value chain.

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1. Introduction

Environmental issues and the diversification of the energy mix have been traditional main goals in policy agendas concerning the promotion of renewable energies. However, the consolidation of technological and economic mature alternatives to conventional energy sources could trigger remarkable economic benefits, such as the diversification of the industrial structures or job creation. This phenomenon points out the necessity of quantifying the economic impact as well as to assess their potentialities and the outcomes of policies. This analysis might be even more essential in peripheral regions which are characterised by institutional

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thinness, slow economic growth and a low level of innovative performance [1,2].

Wind energy is the best exponent of this consolidation and it has reached a high degree of diffusion and technological development. Nevertheless, the economic analyses of this renewable energy undergo some disadvantages concerning the abundance of meta-analyses and metrics based on MW ratios which do not consider regional specialisations [3,4]. There is also an analitycal necessity to contemplate the differences between temporal and permanent activities in wind power [5,6].

The main goal of this paper is to analyse the economic impact, in terms of contribution to the GDP and employment, applying as a case study the Spanish peripheral region of Galicia. This region was one of the leaders in Spain regarding installed capacity, but with a low level of industrial capacity. This quantification is performed both at the regional and sectoral level, considering the productive singularities and dynamics. The methodology is based on the analysis of the wind energy value chains regarding the examination of the cost and investment breakdowns between temporal and permanent activities and the input–output approach concerning the measurement of the economic impact. Furthermore, the paper avoids the drawback in the input–output approach related to the fixed technical coefficients [5,6]. It solves this weakness by updating the Galician simmetric matrices by means of a variation of the RAS technique which is a biproportional procedure of matrix adjustment. Hence, this more accurate methodology represents a step forward in the economic analysis of wind energy because it takes into account the different dynamics in temporal and permanent activities, as well as it solves the main disadvantages of input–output models.

The paper is structured in four sections. The first section presents a brief characterisation of the Galician peripheral wind sector, focusing on the main features related to the installed capacity evolution and the institutional context. The second section describes the methodology framework regarding the Leontief Quantity Model, the cost structure and the investment breakdown between temporal and permanent activities. Likewise, it explains briefly the matrix updating technique. The next section shows the main results linked to the quantification of the output multipliers, the sectoral contritubion to the GDP and the job creation. Finally, the conclusions summarise the most significant results and empirical evidences of this research.

2. Main features of the Galician peripheral wind sector

The deployment of wind energy began around the mid-90s, when some utilities implemented large scale projects in order to take advantage of the abundant resources in Galicia. Traditionally, Galicia stands out as one of the main Spanish region in terms of installed capacity. However, its development concerning industrial capacity as well as innovation and technological performance has not been remarkable [7] in comparison with other Spanish regions, such as Navarre.

The power of grant authorisations for wind farms and the spatial planning in Spain corresponds to the Autonomous Communities (equivalent to the Spanish regions). Likewise, public tenderings are based on the multicriteria bidding procedure which takes into account some regional economic benefits (e.g. job creation or industrial capacity) related to the development of this renewable energy [8].

Fig. 1 shows the evolution of the installed capacity in the period 2000–2013. In this sense, there are two different trends, identifying the change in 2007. The first one was characterised by a continuous growth in the installed capacity, which reached 3000 MW in 2007, departing from around 600 MW in 2000. The average annual cumulative growth was 25.4% between 2000 and 2007. However, this evolution was stopped by the legal instability since 2008, because that regional tendering was appealed and the stagnation of the new one (2010). In addition, other factors such as the start of the current economic crisis and the several changes in the remuneration scheme since 2010 make worse the situation. Since then, there is a stagnation with only 300 MW installed from 2007, with an average annual cumulative growth of 1.6%. Wind energy is a capital intensive sector and, therefore, financial and planning uncertainties are crucial. Hence, the impact on the sector of the cutbacks in the remuneration model is not trivial, especially, when all the turbines installed before 2005 do not receive any kind of subsidies and the new ones undergo a significant cutback with retroactive effects. In addition, wind farm owners have to pay a regional tax, based on the number of wind turbines installed, and a national tax estimated in the 7% of the value of electricity production.

3. Analytical methodology

The empirical methodology is based on the input–output (IO hereinafter) approach and the analysis of the wind energy value chain [10]. The economic impact study should keep in mind the regional special features, as well as the distinctive characteristics of value chains [6]. The analytical methodology is described in the next subsections, focusing on the specification of the Leontief Quantity Model, which constitutes the foundation for later quantifications. It also deals with the process of gathering and organising data; and finally the explanation of the updating technique applied in order to obtain more accurate results.

3.1. Economic quantification methodology

The economic quantification stands out as one of the main instruments in order to analyse the socioeconomic importance and the potentialities of sectors, specific variables or exogenous shocks, among others. Then, there are hardly any doubts about its relevance for policy design. For this purpose, the Leontief Quantity Model (also called demand pull) is applied because it enables to quantify the result of a stimulus or change in the final demand $\Delta y = (\Delta y_i)$; triggered by the installation of new wind farms and the permanent activities developed within the daily activity.

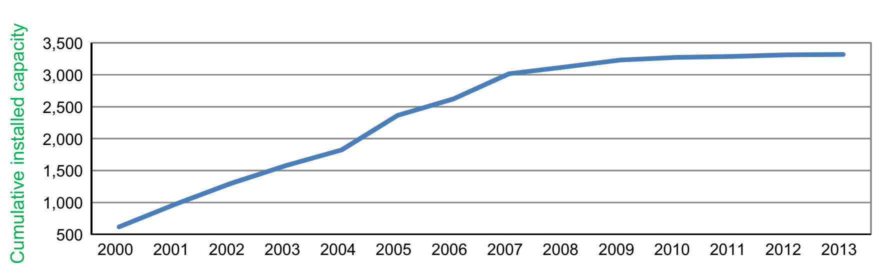

Fig. 1. Evolution of the wind energy cumulative installed capacity in Galicia (MW, 2000–2013) INEGA [9].