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Rent seizing and environmental concerns: A parametric valuation of the Italian hydropower sector

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HIGHLIGHTS

- This paper is the first attempt to estimate the hydroelectricity rent in Italy.
- We find the highest rent ever estimated for hydropower, up to 82.4 €/MWh.
- We show the impact of three different rent extraction mechanism.
- We demonstrate that a resource rent tax (RTT) is neutral to investments.
- We show how an RTT fosters the implementation of environmental mitigation measures.

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ABSTRACT

This paper is the first attempt to estimate the hydroelectricity rent in Italy, as several concessions are about to expire, and the first to analyze the implications of different redistribution mechanisms. Due to budgetary constraints, local authorities want to capture a higher part of the rent, thought to be considerable. At the same time, the renewal procedure entails the implementation of environmental mitigation measures, as set forth in the water framework directive. Hence, rent-seizing and environmental protection generate a major trade-off. We focus our analysis on the County of Sondrio, home to 18% of the overall hydropower capacity, where the first renewals will take place. We obtain the highest rent ever estimated for hydropower production, averaging from 30.3 €/MWh to 82.4 €/MWh. These high values explain why local authorities are pushing for the introduction of a 30% revenue sharing fee, as they would earn almost 90% of the rent, much more than the 50% currently seized. Albeit satisfying the rent-seizing objective, the proposed fee hinders the implementation of costly mitigation measures. In this paper, we advocate the adoption of a resource rent tax, as we show that it would reduce the trade-off between rent-seizing and environmental protection.

1. Introduction

After nearly one century, Italy is in the process of reforming the institutional background of its hydroelectricity (HE) sector. Many things changed since 1933, when the first discipline was introduced. HE is not anymore the sole nor the most important source of energy; even if its share has declined to about 15% of the total, however, it still remains strategic for the power balance and for the contribute to the production from renewable sources. New societal demands have arisen with respect to water, including environmental protection, ecological restoration, recreation and landscape. These circumstances determine the case for a substantial change in the patterns of apportioning of the economic rents generated by HE. Until now, these have been shared between HE producers, government and local communities in the absence of precise data and studies, favouring the emergence of a fuzzy public debate, in which each actor claims for a higher share of the pie and blames the others for receiving too much.

The present study offers two contributions to the debate. First, it estimates the magnitude of the HE rent. We focus on a case-study area, the County of Sondrio, hosting 18% of the total HE installed capacity. To our knowledge, this is the first attempt in this direction in the Italian context; even at an international level the existing literature is rather scarce.

Secondly, it discusses alternative mechanisms for apportioning the economic rent and the incentives that these different

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mechanisms provide to foster a transition to a more sustainable HE sector, with particular reference to environmental mitigation measures. The present one, based on a royalty calculated as a function of nominal production, is compared with two alternatives: a royalty based on actual turnover and a resource rent tax calculated as a function of the net economic rent, similar to the one adopted in Norway.

As for the first issue, our study shows that HE generates a significant rent, which averages from 30.3 €/MWh to 82.4 €/MWh, which corresponds to 0.94–1.57 billion euro per year at the national scale (0.1% of the GDP). These are the highest values ever estimated for the HE rent across several countries.

As for the second issue, we show how the current fee system is inefficient both in terms of rent seizing and in promoting a transition to a more environmentally friendly HE sector. By contrast, both the proportional system and the RRT perform well in terms of rent seizing, as the slice that would accrue to the State would be 90% and 75% respectively. However, the latter scheme is the only one that automatically deducts from its taxable base all the investments, including those in environmental mitigation measures. Consequently, we demonstrate that only an RTT scheme solves the trade-off between environmental sustainability and rent seizing.

The paper is structured as follows: in Section 2, we start with a short theoretical introduction regarding the economic concept of rent, its function in the resource allocation process, its sharing options. We then provide some background information on the HE sector in Italy and in the County of Sondrio, our case-study area. Sections 3 and 4 outline the main results, while Section 5 is devoted to policy implications and recommendations arising from the study.

2. Background and methodology

2.1. Hydroelectricity and rent generation: some stylized facts

The economic attractiveness of HE depends on three main characteristics. First, HE is cheap, in particular once investment costs have been recovered (IEA et al., 2010; Larsson et al., 2014; Hall et al., 2003). Secondly, HE is a cost-effective balancing technology, possibly the sole renewable with such a capability, as it allows meeting different load profiles (Førsund, 2012). Finally, HE is flexible, since production can be adapted to effective demand (Edwards, 2003).

HE production depends on the availability of a usable water flow. This can simply be the natural run-of-the-river, but in this case, the natural variability through seasons and years would condition production potential. However, upstream water storage facilities may regulate flows and guarantee a much more stable and reliable production (Edwards, 2003). Moreover, since water release from upstream allows activation in real time and at zero cost, HE is particularly suitable for production in peak periods. Both reasons make the production from regulated outflows much more lucrative in principle – though obviously the cost of upstream facilities should also be accounted for.

Contrary to several other renewable sources, water is an excludible good, in the sense that it is generally not possible to use the same water in the same place more than once. Sometimes it is possible to use a water flow in a sequential way, or share it for uses that are not mutually exclusive (e.g. water used for generating HE can be later used for irrigation): but these possibilities are ultimately finite. Moreover, suitable sites for building reservoirs are limited by geographical, environmental and social factors, thus the development of further facilities is extremely difficult and costly, at least for large storage plants and especially in developed countries (Ansar et al., 2014).

This circumstance represents the pre-condition for the existence of an *economic scarcity rent*, a situation that descends from the combination of exclusive rights and non-reproducible scarce resources (Amundsen and Andersen, 1992). According to the Economist's online glossary, the concept of rent in economics identifies "the difference between what a factor of production is paid and how much it would need to be paid to remain in its current use". More precisely, it corresponds to the surplus value accruing to the owner of a resource, on top of the long-run marginal costs of supplying it.

The market value of a factor of production depends on the market price of the most valuable alternative output that could be obtained using that same factor as an input; while the long-run marginal cost corresponds to operational and capital costs, the latter including depreciation of assets and the opportunity cost of financial resources that have been anticipated. In a perfectly competitive market, marginal cost and price tend to converge, since the existence of a positive gap encourages new suppliers to enter: this is precisely what cannot happen when neither reproduction nor substitution of an essential input are feasible, thence impeding entry of new suppliers. Hence, a rent can stem from differences in quality of factors of production or from scarcity. In the HE case, the total rent is normally given by the sum of three different types of rent (see Rothman, 2000, for a more thorough discussion):

- Differential rent among HE sites.
- Scarcity rent, as the restricted availability of water makes it impossible to produce electricity only with HE.
- Technological rent, as it is cheaper than other production technologies.

According to this definition, a surplus value can accrue to HE producers even in perfectly competitive markets, as there can be intrinsically different production costs that characterize each individual supplier. Fig. 1 illustrates how all three types of rent can happen simultaneously: since it is not possible to expand HE production beyond HE_{max}, the supply curve becomes vertical. In case no alternative technology exists, the price would jump to p_1, and the scarcity rent would be the area ABEF. In case it is possible to produce electricity with some other technique (more costly than HE), this latter cost will determine the market price ($p*$), leaving the scarcity rent equal to CDEF.

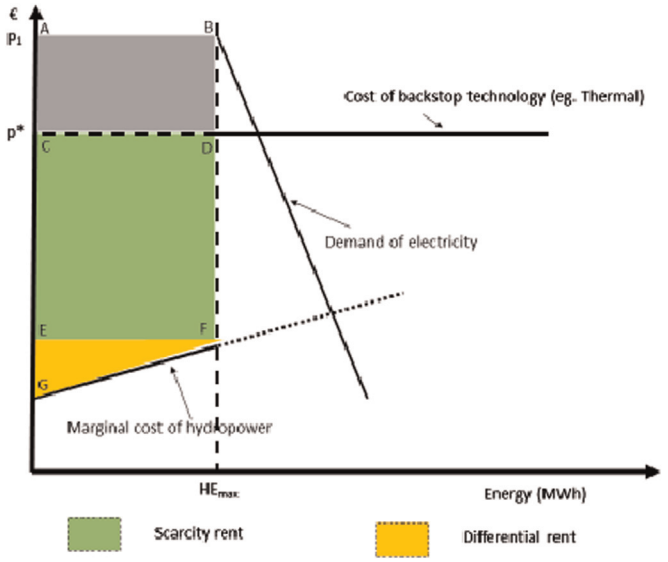

Fig. 1. Graphic representation of differential and scarcity rent.