STIMULATING INNOVATION IN GREEN TECHS: EVIDENCE BASED ON PATENTS VALUE FOR WIND POWER

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Green technologies are often presented in a Schumpeterian perspective as the new innovative wave succeeding to ICTs. Among them, technologies that aim at improving the production of renewable energy (wind power, photovoltaic, biomass, ocean power…) are at the core of public policies for greening the economy and developing a competitive advantage in that sector. Assessing the effectiveness of such policies is essential to reinforce their impact and promote a cost effective transition to a green economy.

This paper more specifically aims at providing an assessment of the additional monetary incentives to innovate in renewable energy generated by environmental friendly public policies. In this sense, it focuses on the quality of innovation rather than on its quantity and thus departs from the bourgeoning literature that emerges on the subject. Indeed, existing works address the question by building on a methodology that dates back to Brunnermeier and Cohen [2003]. These authors were the first, to our knowledge, to estimate a count data model of green patents with pollution abatement expenditures and regulatory enforcement indicators as explanatory variables. The rationale for focusing on patent counts is twofold. First, patents are considered as an unavoidable proxy for inventions and data on patents are available. Second, it is expected that an effective innovation policy is going to boost the number of inventions. Nevertheless, focusing exclusively on patent counts may be misleading. Indeed, a corollary to a higher number of patents can be a decrease of patents' quality. For instance, applying for several narrow patents to protect a same invention instead of applying for a single broad patent can constitute a rational strategy to be identified as an inventive firm and thus benefit from the grant of public R&D subsidies. Patent counts then tend to overestimate the impact of R&D subsidies. This paper is an attempt to remedy to this problem and proposes an assessment of the impact of public policies in terms of patent quality.

Focusing on patents quality is challenging for at least two reasons. First, no direct measure of patent quality is available. Second, compared to patents counts, it goes one step further on the assessment approach by providing a monetary impact of policies. A solution consists in developing an assessment strategy based on the only decision that is directly linked to the private value of patents and that is observed for each patent; namely the decision to pay for the renewal of a patent . In this respect, the proposed method builds on the seminal work of Schankerman and Pakes [1986] for estimating the value of cohorts of patents which, in turn, may be viewed as a special and simplified case of the real option approach to patents valuation (see e.g. Pakes [1986]). Attempts to implement this methodology at the level of a patent rather than at the level of a cohort or a class of patents (Bessen [2008]) fail to capture the effect of variables that change as the patent ages and that may affect its value. Variables capturing changes in environmental regulation are a typical and key example of such variables. By contrast, our paper develops an econometric model flexible enough to enable updates of the value of each patent in accordance to modifications of its technological and institutionnal environment. The model is estimated for European patents that have been applied for between 1989 and 2009 and that belong to the IPC technological class F03D corresponding to inventions intended to convert wind power into electricity. The choice

of wind power relies on the need to work on a technology field with sufficiently numerous patents renewed up the statutory life limit of twenty years. Following Johnstone Hascic and Popp [2010], a special attention is devoted to the influence of a series of key variables: i) the carbone dioxide price on the European Union Emission Trading System ii) feed-in tariffs imposed by public policies for promoting the development of "green" electricity iii) R&D support iv) tax and subsidies ii) the price of fossil fuels that affects the arbitrage of households and firms facing a choice between different sources of energy. Controlling for patents characteristics (claims, forward and backward citations…) econometric results tend to confirm the existence of differentiated impacts of the various policy instruments. Impacts of R&D support and tradable permits emerge as those with the highest magnitude.