

# Eco-innovations and firms' market value: a micro-econometric analysis of European data.

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A wide body of literature has focused on the relationship between innovation and market value in the last decades, by looking at R&D and patents (Griliches 1981; Jaffe 1986; Cockburn and Griliches 1988; Hall 1993; Megna and Klock 1993; Toivanen et al. 2002; Coad and Rao 2006; Kim et al. 2009) as well as at patent citations (Shane and Klock 1997; Hall et al. 2005). The main conclusion of these works is that all these indicators enable to identify innovative capabilities as a form of intangible capital and, above all, that each indicator gathers different elements and sheds light on different aspects of the generation of technological knowledge.

In recent years, the increasing attention has been devoted to the analysis of determinants and effects of eco-innovations, understood as new products, process or organizational and institutional arrangements leading to environmental improvement. Within the framework of the natural resource-based view approach (Hart, 1995), many studies have investigated to what extent it pays or not to “be green”, or, in other terms, whether firms are missing (getting) economic opportunities in improving (not improving) their environmental performances. Positive effects (e.g. Al Tuwaijiri et al., 2004; Dowell et al., 2000; Russo and Fouts, 1997), but also negative (e.g. Sarkis and Cordeiro, 2001) and non-significant correlations (e.g. Elsayed and Paton, 2005; Freedman and Jaggi, 1992; Telle, 2006) have been found in empirical works aimed at assessing the links between green strategies and economic implications.

These two strands of literature have remained so far rather disjointed, as to the best of authors' knowledge no systematic analyses of the relationship between eco-innovation and firms' market value can be found in the literature. This paper aims at filling this gap, by grafting the conceptual and empirical framework underlying the market value and innovation literature, onto the analysis of the economic effects of eco-innovation. In particular we aim at

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a) understanding the effects of the generation of green technologies on stock market evaluation; b) disentangling the differential effects of heterogeneous (green) technologies in this respect; c) appreciating the effects of patent citations.

The contributions of the paper are manifold. First of all it contributes the literature in the field of economics of innovation by looking at the specific stock market evaluation of firms' generating green technologies.

Secondly, and most importantly, it allows to extending the traditional framework based upon the Porter hypothesis (Porter and van der Linde, 1995), according to which strict regulatory frameworks trigger the introduction of cleaner technologies, that also allow to increasing firms' productivity. Our paper focuses on the generation rather than on the adoption of eco-innovations by positing that policymakers, by setting severe targets in terms of environmental performance, stimulate the demand for green technologies. The prospective increasing demand for a firm generating eco-innovations, leads agents operating in the stock market to improve its evaluation. In other words, environmental policy can have the indirect effect not only on the productivity of adopters, but also on the stock market performances of firms that make eco-innovations available.

The model used in this paper follows Cockburn and Griliches (1988) and the extension put forward by Hall et al. (2005), by assuming that financial markets value the firm by taking into accounts both its tangible and intangible assets and its knowledge capital, namely its command of technological and organizational knowledge that enables the introduction and subsequent exploitation of technological and organizational innovations. The market value equation is estimated through non-linear least squares (NLLS) as well as through OLS applied to the approximated equation (Hall et al., 2005; Hall and Oriani, 2006; Bloch, 2008; Griliches 1981; Jaffe, 1986; Cockburn and Griliches, 1988; Hall, 1993).

The data are drawn by the Bureau van Dijk ORBIS database, which provides information on firms' balance sheets and market value, as well as on patent applications issued. The patent identifier is then matched with the OECD HAN, the OECD RegPat and the OECD Citations database, so as to derive information on patents' technological classes and on patent citations.

We expect that a) stock markets attribute higher value to firms generating green technologies and b) higher returns are expected to be associated with more valuable green technologies, i.e. market evaluation depends on the nature of the technology considered.

This would lead to relevant policy implications: if investing in some typologies of green technologies is "self-sustained" as positively evaluated by the market, policy intervention would only be required to stimulate the uptake of technologies which are less valuable for the firm but highly valuable for the society.



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