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Analysis

The relationship between international financial reporting standards, carbon emissions, and R&D expenditures: Evidence from European manufacturing firms

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ABSTRACT

This study examines the impact of research and development (R&D) expenditures on carbon dioxide (CO2) emissions prior to and under the mandatory adoption of International Financial Reporting Standards at the firm level within the manufacturing sectors of three European countries, i.e. Germany, France and the U.K. Estimation of a threshold autoregressive model using quarterly data from 1998 to 2011 reveals that in the post-IFRS mandatory adoption year R&D expenditures show a reduction in CO2 emissions to firms, i.e. rising CO2 abatement. This is likely due to the presence of incentives provided by the new accounting disclosure regime. Our results remain robust in terms of a sector analysis, firm size, and the introduction of the European Union Emission Trading Scheme (EU-ETS) across the three countries.

1. Introduction

Carbon dioxide emission reductions can be achieved, among other means, through technological changes and investments in R&D. Jones (2002) and Vollebergh and Kemfert (2005) argue that innovations enhance labor and capital productivity, which is crucial for economic growth. Investment in R&D has an impact on technological changes, an assumption which receives support by the 'new growth theory' or 'induced technological change' literature (Vollebergh and Kemfert, 2005). Thus, technological changes and investment in R&D are common denominators for achieving both CO2 abatement and economic growth. Along these lines, Parry et al. (2003) assess whether the welfare gains from technological innovation leading to CO2 emission reductions are larger or smaller than the 'Pigouvian' welfare gains from optimal pollution control. Their empirical findings indicate that such welfare gains from innovation are smaller than those from pollution control, while Jaffe et al. (2005) claim that R&D generates positive externalities that contribute to both welfare gains and pollution control. As noted by Edenhofer et al. (2005), there is a close link between reducing emission cost efficiently and economic growth, in the sense that cost efficient abatement decreases the costs in terms of growth foregone.

Related to the role of R&D investment in the reduction of carbon emissions is the impact of environmental information disclosure by firms. Mason (2008) notes that firms have been increasing environmental information disclosure to satisfy requests from external regulatory bodies and the general public. Indeed, such information disclosure may be far ranging in light of the absence of authoritative accounting guidance (Bebbington and Larrinaga-Gonzalez, 2008). Studies in the relevant literature suggest that environmental information disclosure is important not only to enable various stakeholders to make informed decisions, but also to control business risk and develop competitive advantage (Kolk and Pinkse, 2007). Deegan and Haque (2009) argue that while carbon emissions are the core theme of climate change, information relevant to climate change should also include management approaches and other external factors related to climate change issues. Therefore, firms are under increasing public and regulatory pressure to disclose the impacts of business conduct on the environment and society (Simnett et al., 2009).

In light of the importance of R&D investment and the need for environmental information disclosure this study examines the impact of R&D expenditures (an accounting information item) on carbon dioxide (CO2) emissions prior to and under the mandatory adoption of

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International Financial Reporting Standards (IFRS) within the European Union (EU). The improvement in emission accounting disclosures is expected to have a direct impact on the way firms cope with their targeted emission reductions by improving the efficiency of their R&D expenditures to develop green products and green methods of transactions. Furthermore, the EU has demonstrated a greater willingness to cooperate with regulatory bodies and various non-governmental environmental groups in managing and disclosing carbon emission information (Kolk et al., 2008; Oberthur, 2007). Ellerman and Buchner (2008) reveal that after 2005, European firms demonstrated decreasing trends in their carbon dioxide emissions, though others claim that this decreasing trend is attributed exclusively to the global recession (Spies and Stilwell, 2009).

Our analysis is undertaken at the firm level within the manufacturing sectors of three European countries, i.e. Germany, France and the U.K., using quarterly data from 1998 to 2011. The study focuses on manufacturing firms, since this is the sector that undertakes the bulk of total business R&D. Moreover, we consider the R&D expenditures as an accounting item for which measurements under IFRS are likely to differ considerably from measurements under domestic accounting practices across the three EU countries prior to the mandatory introduction of the IFRS. To the best of our knowledge, no study has investigated the impact of accounting information associated with R&D expenditures on CO2 emissions and, in particular, prior to and after the adoption of IFRS.

Section 2 provides a brief overview of the IFRS and the eco-innovation literature. Section 3 presents the empirical methodology with results reported in Section 4. Concluding remarks are given in Section 5.

2. Overview of IFRS and the Eco-innovation Literature

All EU publicly traded firms have been required to prepare consolidated financial statements based on the International Financial Reporting Standards (IFRS), a main-stream financial reporting system. As of January 1, 2005 all EU listed firms had to adopt IAS/IFRS in order to prepare their consolidated financial statements, as an attempt to enhance the competitiveness of the European capital markets by establishing a single set of homogeneous and internationally recognized standards (Soderstrom and Sun, 2007). The adoption of IFRS initiated the computation of a common consolidated accounting system, which is expected to contribute to the elimination of certain impediments to a full harmonization as well as to greater capital market efficiency, leading to a lower cost of capital and increasing access to financing by firms. This is a major regulatory financial reporting change in the history of accounting reporting and in the convergence of national accounting systems (Agostino et al., 2008; Beneish et al., 2009; Guerreiro et al., 2008; Schipper, 2005; Whittington, 2005). The adoption of a capital-market oriented set of accounting standards would improve the transparency and comparability of financial statements over the use of past national GAAP (Hail et al., 2010). Nevertheless, a certain strand of literature highlights the high costs of transition towards IFRS (Cascini, 2008; Christensen et al., 2007), while Djatej et al. (2009) find that IFRS adoption increases public information but decreases private information.

In December 2004, the International Reporting Interpretations Committee (IFRIC) released Article 3, Emission Rights, in an attempt to address how participants should account for cap and trade emission trading schemes. According to Article 3, emission allowances, whether issued by governments or purchased in the market, are intangible assets to be accounted for in accordance with Article 38 of IFRS, Intangible Assets. Despite the withdrawal of IFRIC 3 in June 2005 there remains a number of existing standards that provide authoritative guidance on the relevant accounting that firms must use in forming their policies for carbon-related transactions. Firms must interpret the existing standards based on the pattern of their particular business model, strategy, and transactions. This includes providing relevant disclosures of policies, transactions and balances included in their financial statements. Therefore, the critical question is whether the new accounting regime of the mandatory adoption of IFRS is suitable for a carbon-constrained world.

Based on Article 38, Changes in the Market Value of Intangibles, i.e. emission allowances held and R&D, are recognized in equity. Within this framework firms should assess the technical feasibility of the intangible asset, the availability of resources (technical or financial) to complete it, the ability to reliably measure the expenses, and the ability to justify whether the asset will generate future economic benefits (Tsoligkas and Tsalavoutas, 2011). Daske and Gebhardt (2006) and Barth et al. (2008) provide evidence that the perception of disclosure quality increased around IAS adoptions. Based on this accounting reporting environment, EU firms have enhanced their data collection and reporting capabilities in disclosing their sustainability performance as well as in developing guidelines to enhance reporting. The improvement in emission accounting disclosures is expected to have a direct impact on the way firms cope with their target of emission reductions by improving the efficiency of their R&D expenses to develop green products and green methods of transactions.

This study contributes to the research on the identification of eco-innovations targeting pollutant emissions and the extension of this literature on both environmental and firm performances. Such eco-innovation activities accentuate the importance of environmental management systems (with their dual purpose of reducing environmental impacts and enabling firms to achieve enhanced organizational learning on environmental matters), leading to cleaner, cost-saving technologies while reducing the incomplete information within a firm (Khanna et al., 2009; Wagner, 2008). The IFRS regime in part represents an organizational eco-innovation in allowing firms to adopt new environmental strategies and regulatory structures to reduce industrial pollution and waste along with improving product quality by introducing environmentally superior inputs of production (Anton et al., 2004). Moreover, mandatory regulations (i.e. IFRS) drive firms to adopt eco-innovating systems, since high polluting firms could face greater risks of penalties if their pollution levels are not reduced.

Konar and Cohen (2001) show that variables related to environmental performance has a substantial impact on both pollutant emissions and the financial performance of firms. Brunnermeier and Cohen (2003) employ panel data on manufacturing firms in studying environmental innovations to find that such innovation expenses affect abatement measures. Similar results are reported by Frondel et al. (2004) in the case of European manufacturing firms. Popp (2005) argues that direct or indirect environmental regulations create 'win–win' situations in which firms enjoy high profits and produce 'clean-green' products, since such environmental regulations boost R&D expenditures and, thus, lead to economic growth. Rennings et al. (2006) discuss the effects of environmental management systems on firms' innovation activities and competitiveness across European firms to show that eco-innovation activities contribute to the integration of environmental management through information spillovers across firms and, thus, to stronger competitiveness. Arimura et al. (2007) also document the positive effect of regulation on green R&D expenditures. Horbach (2008) argues that such environmental innovations (i.e. in our case a IRFS regime) are similar to regulatory activities that promote cleaner production technologies, while Del Rio Gonzalez (2009) documents the role of regulation pressures as a primary driver in adopting cleaner technology for a number of Spanish manufacturing industries.

We focus on the question of whether differences in value relevance exist and if so, to what extent such differences are driven by the mandatory adoption of IFRS for the accounting item of R&D expenditures. Furthermore, we consider the R&D accounting item for which measurements under IFRS are likely to differ considerably