12th IAEE European Energy Conference
The Organising Committee

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Dear Sir/ Madam,

I would like to submit an extended abstract to the 12th IAEE European Energy Conference in Venice. Please consider my submission for the **special session "Diffusion of Climate-Friendly Technologies - The Role of Intellectual Property Rights, Human Capital and Environmental Policy" on September 10th,** within the context of the ClimTech project[1] within the SEEK research programme (Strengthening Efficiency and Competitiveness in the European Knowledge Economies)[2]. The session is organised by Enrica De Cian (Fondazione Eni Enrico Mattei), Elena Verdolini (Fondazione Eni Enrico Mattei) and Sebastian Voigt (Centre for European Economic Research).

The special session will focus on the most recent contributions studying the diffusion of energy and climate technologies in developed and developing countries. Core of the project is the role of energy and environmental policy, Intellectual Property Rights, and human capital as drivers of technological development. Particular attention is also devoted to the resulting impact on energy performance and anthropogenic emissions. Diego Comin (Harvard Business School) and Francesco Vona (SciencesPo) are invited speakers to the session.

Thank you very much.

Kind regards,

Sebastian Voigt

[1] http://seek.zew.eu/seek/projekte-2011/die-diffusion-klimafreundlicher-technologien-die-rolle-von-intellektuellen-eigentumsrechten-humankapital-und-umweltpolitik.html
[2] http://seek.zew.eu/

IPRS, INNOVATION AND CLIMATE POLICY: REGIONAL AND SECTORAL IMPLICATIONS ON ENERGY TECHNOLOGIES DIFFUSION

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Overview

The adoption and deployment of low-carbon and environmentally-friendly technologies has been at the center stage of recent climate negotiations. Technology diffusion from developed to developing countries can facilitate access to affordable and appropriate emission-reducing technologies. A number of recent contributions analyze innovation in energy and climate-friendly technologies and their diffusion across borders (Popp et al. 2010, Carraro et al. 2010). In a few cases, the analysis is extended to include developing countries (Verdolini and Galeotti 2011, Bosetti and Verdolini 2012, among others). However, no study links the innovation and diffusion of energy and environmental technology to a systematic analysis of economic and environmental performance across countries.

What is currently lacking is a comparative study looking at how efficient and environmentally friendly technologies impact the performance of different sectors in different countries. This is the result of a difficulty in finding appropriate data that can be easily compared. The broad available literature examining productivity trends and energy-augmenting technological change is mostly confined to country level data. Common approaches are cost function or factor demand frameworks (Jorgenson and Fraumeni, 1981, Sue Wing and Eckaus, 2007), which allow singling out the contributions of technological change, prices, and structural changes. A few sectoral studies exist (Sanstad et al. 2008, Kratena 2007), but are limited to selected countries.

Another strand of literature explores the drivers of energy intensity using a simplified approach that lacks a structural framework (Hübler and Keller 2009). The few contributions looking at the drivers of energy intensity and factor productivity using a structural approach are either limited to selected OECD countries (Carraro and De Cian 2012) or exploit very detailed micro-level data, but for just one country (Fisher-Vanden et al. 2004).

This paper uses a decomposition approach to analyse how technology and environmental policy relate to the environmental performance of different industries. The first contribution is the development of industry-level indicators of energy and environmental performance for 40 countries, including BRIC (Brazil, Russia, India and China). To test our hypothesis, we develop new indexes of environmental policy and intellectual property rights which, unlike previous available data, details the policy framework of a large number of countries, distinguishing between industry, power sector, and, more broadly, energy policies. In this lies the second contribution of this paper.

Our regression analysis investigates the impact of innovation and diffusion drivers (such as knowledge and human capital stocks, Intellectual Property Rights regimes and environmental policy) on the performance of various energy-intensive sectors of the economy, controlling for other relevant variables including prices, capital turnover and capital intensity. Particular attention is devoted to the BRIC countries, which represent the major future emitters and whose markets are attractive also for foreign innovators.

Methods

Our main goal is to analyze the joint effect of (energy and environmental) policy and Intellectual Property Regimes on the environmental performance of energy-intensive industries. Performance indicators are developed using the WIOD database (WIOD 2012), a consistent and very comprehensive KLEM dataset enhanced with satellite environmental data. The dataset allows computing and comparing the development of energy- and carbon-intensity indicators. A major strength of this database is the inclusion of emerging and developing countries, so that an important component of our analysis is the focus on BRIC countries.

An important step in our analysis is the development of indicators representing the stringency of environmental and climate policy as well as the strength of IPR regimes. Regarding environmental and energy policy, we build a series of policy stringency indicators based on the IEA Policies and Measures Databases (IEA 2008), which include policies aimed at renewable sources as well as policies aimed at the production of energy through fossil fuels. We use such indicators to test the role of environmental policy on both economic and environmental performance. Regarding IPR indicators, we complement already available data with novel data on reforms of IPR systems, which allow compiling improved indicators of quality and stringency.

We also account for the role of absorptive capacity in each sector and country through the development of knowledge variables through the use of patent data.

Results

The data shows that there is a positive relationship between the strength of the IPR regime and the number of environmental and energy policy interventions, as well as the absorptive capacity of each country/sector. As a result, any econometric study which does not account for these inter-dependencies will result in biased estimates. The combined effect of environmental and technology policy needs to be assessed to fully understand the drivers of environmental performance. Underlying variables that could cause variation in both policy indicators, such as the institutional framework of a country, need to be controlled for.

We show that policy stringency has a positive impact on both carbon intensity of energy and on energy intensity of output in energy intensive sectors. Nevertheless, diverse regional patterns emerge. In many developed countries both indicators decrease as a consequence of a higher number of policy interventions. On the other hand, in the BRIC regions outcomes are ambiguous, with increases in both indicators in some cases, and significant declines in other. This partly stems from different levels of policy intervention. While China, for instance, underwent many climate and environmental policy actions in recent years, Russia showed considerably less interventions in the same period so that the policy stringency might have been high enough to induce a substantially better environmental performance.

Preliminary empirical results show that the higher the stringency of policy (both environmental and technology), the lower is the carbon intensity of energy and of output in a given sector. The relationship between energy intensity and policy is on the other hand less straightforward.

Conclusions

This paper provides the first preliminary analysis of sectoral economic and environmental performance for 40 countries between the years 1995-2009. In our contribution, we control for confounding factors and show that knowledge stocks, IPR protection and stringent environmental policy are associated with lower energy and carbon intensity in the economy. While this is a general conclusion, developing countries show very different trends from developed countries. These country-sector specificities need to be accounted for when drafting successful and efficient energy and environmental policies.

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WIOD (World Input-Output Database: Construction and Applications), 2012. WIOD: FP7-funded project, http://www.wiod.org/.