The Effect of "Green" Energy Policies on Innovation and International Competition

NBER Innovation Policy Research Grant Proposal

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In recent decades, national governments have adopted a range of policies to promote the development of "green" energy technologies. In addition to protecting the natural environment, these policies often aim to create domestic economic benefits, such as energy independence, increased domestic employment, and international competitiveness in an evolving industry. The logic behind many such policies, as articulated by Porter and van der Linde (1995: 98), is that more stringent home-country environmental regulations foster firm-level innovations that may serve as a source of global advantage. Yet, policies intended to encourage innovation at home may also stimulate foreign competition that directly thwarts this intended effect.

The well-publicized recent bankruptcy of several federally-subsidized American solar energy firms provides a suggestive example. The Obama Administration and members of the United States Congress attributed the fledgling companies' failure to competition from Chinese solar panel manufacturers (Sweet and Tracy, 2011). Data from the Earth Policy Institute are broadly consistent with this claim: Chinese solar panel production grew by nearly 11,000 MW while U.S. production grew by only 1,000 MW during the period 2000 – 2010, despite the fact that installed solar generation capacity in the U.S. increased 65% more than capacity in China did during this time—largely as the result of U.S. federal and state policies requiring American electric utilities to dramatically increase their use of power generated using solar technologies.[1]

We seek to augment such anecdotal observations by systematically examining the extent to which different types of green energy technology policies spur domestic innovation or, alternatively, attract foreign competition. Our empirical approach will be to analyze the national identities of the firms applying for different classes of green energy technology patents in multiple countries following national governments' adoption of different types of green energy policies, such as "demand-pull" versus "supply-push."

Prior research on the link between environmental policy and innovation is limited. In a review article, Jaffe et al. (2002) concluded that such environmental initiatives do induce innovation. Recent research has delved more deeply in the empirical relationship between policies and innovation outcomes. Johnstone, Hascic, and Popp (2010) found that alternative policy mechanisms had a differential impact on innovation rates in lower-cost (wind and biomass) versus higher-cost (solar and oceanic wave) technologies. Aghion et al. (2011), in a recent working paper, found that tax-inclusive fuel prices and R&D subsidies fostered increased innovation in "clean" automotive technologies versus "dirty" ones in a sample of 80 countries. No prior study of which we are aware, however, has considered the national origin of the firms directly responsible for desired innovation outcomes such as these. Without such knowledge, it is infeasible to draw sound conclusions about the impact of green energy technology policies on domestic economic development and

[1] Installed solar generation in the U.S. increased by 856 MW and that in China by 520 MW.

competitiveness, a topic of substantial interest to policymakers as well as private investors seeking to promote the development of a domestic green energy industry.

We will draw the data for our study from two primary sources. The first of these is the EPO Worldwide Patent Statistical Database (PatStat), which categorizes patents generated by inventors in over 80 countries using the international patent class (IPC) scheme. Following other recent studies,[2] we will exploit the extensive OECD categorization of patent classes to identify IPC classes for renewable energy generation technologies, including wind, solar, biomass, oceanic waves, geothermal, and hydroelectric (Johnstone et al. 2010). These data also include the country of the inventor, the priority country of patent application, and the recipient countries of patent duplication, which will allow us to track the country origin and international transfer of patented inventions for renewable energy production.[3]

We will combine the patent data with information from the International Energy Agency (IEA) Global Renewable Energy Policies and Measures database (IEA 2007), which records energy policy initiatives in up to 40 countries during the period 1970 – 2010. This database include detailed information that we will use to classify polices. R&D subsidies and tax breaks, for example, represent supply-push policies, while requirements or incentives to procure specific amounts of "clean" energy represent demand-pull initiatives. We will use the combined cross-national panel dataset to examine the extent to which the adoption of different policy types was followed by (1) increases in patent applications by domestic firms, and (2) increases in domestic patent applications by foreign firms for technologies first developed (and patented) elsewhere.

Developing a more nuanced understanding of the domestic and global impact of innovation-promoting policies is critical for those promoting the development of green technology sectors. While global technology transfer may be desirable from an economic efficiency perspective, and externally-sourced technologies may best achieve certain policy goals (such as generating renewable energy at the lowest cost), policies that promote these objectives may be inconsistent with the goal of creating a domestic renewable energy sector and "green" jobs.

A research grant from the NBER Innovation Policy Working Group would substantially assist us on this project. We would use the research grant to purchase the PatStat database (at a cost of $700 – $800, depending on the exchange rate); hire one or more research assistants to assist with coding the IEA policy data (anticipated cost of $3,000); and support multiple domestic and international field visits and interviews by the principal investigators.

References

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[2] These data cover up to 80 countries for varying periods of time. We anticipate that the data we need will be available for 30 – 40 countries.

[3] Hascic and Johnstone (2009) and Johnstone (2010) used this technique to trace the diffusion of environmentally friendly technologies among OECD countries.

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