The impact of renewable energy incentives vs. R&D in driving innovation

Jeffrey G. York, Michael J. Lenox & Mary Margaret Frank

University of Colorado, Leeds School of Business; University of Virginia, Darden School of Business

Introduction

We examine the conditions under which public policy mechanisms influence the direction of innovation activity. In particular, we will examine the role that tax credits for the adoption of "green technologies" such as renewable energy play in increasing innovations which create environmental benefits.

In the U.S., many states are adopting such tax incentives not only to increase adoption of renewable energy by electric utilities in the state, but to spur innovation in the state. We build a panel of state tax incentive programs in the United States over the past seventeen years. We augment this data with micro-level data on "green" innovation; specifically count data on patents in a variety of renewable energy technologies. We leverage variance in state tax programs both across states and over time to estimate count models based on the number of patents in a renewable energy technology sector (***Solar***, ***Wind***, ***Geothermal*** and ***Tidal*** energy). In doing so, we examine the role that state-driven tax incentives play in producing innovation across regions, for each technology.

Data

For our dependent variables we measure innovation as the number of patents in a variety of renewable energy technology fields including solar energy (*Solar Patents*), wind energy (*Wind Patents*), geothermal energy (*Geothermal Patents*) and tidal energy (*Tidal Patents*).

We coded laws and policies into 4 groups: 1) tax incentives which focus on tax credits for the adoption of renewable energy, 2) direct investment by the state, 3) demand incentives such as state agreements to purchase renewable energy and 4) policy incentives such as the implementation of Renewable Portfolio Standards. We code each of these for each technology group.

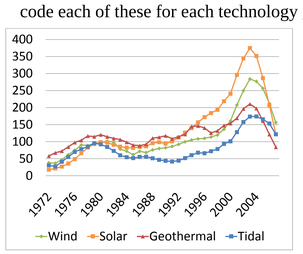

Figure 1. US Patent Applications by Technology (3-year Moving Average)

Renewable Energy Patent Density and Locations

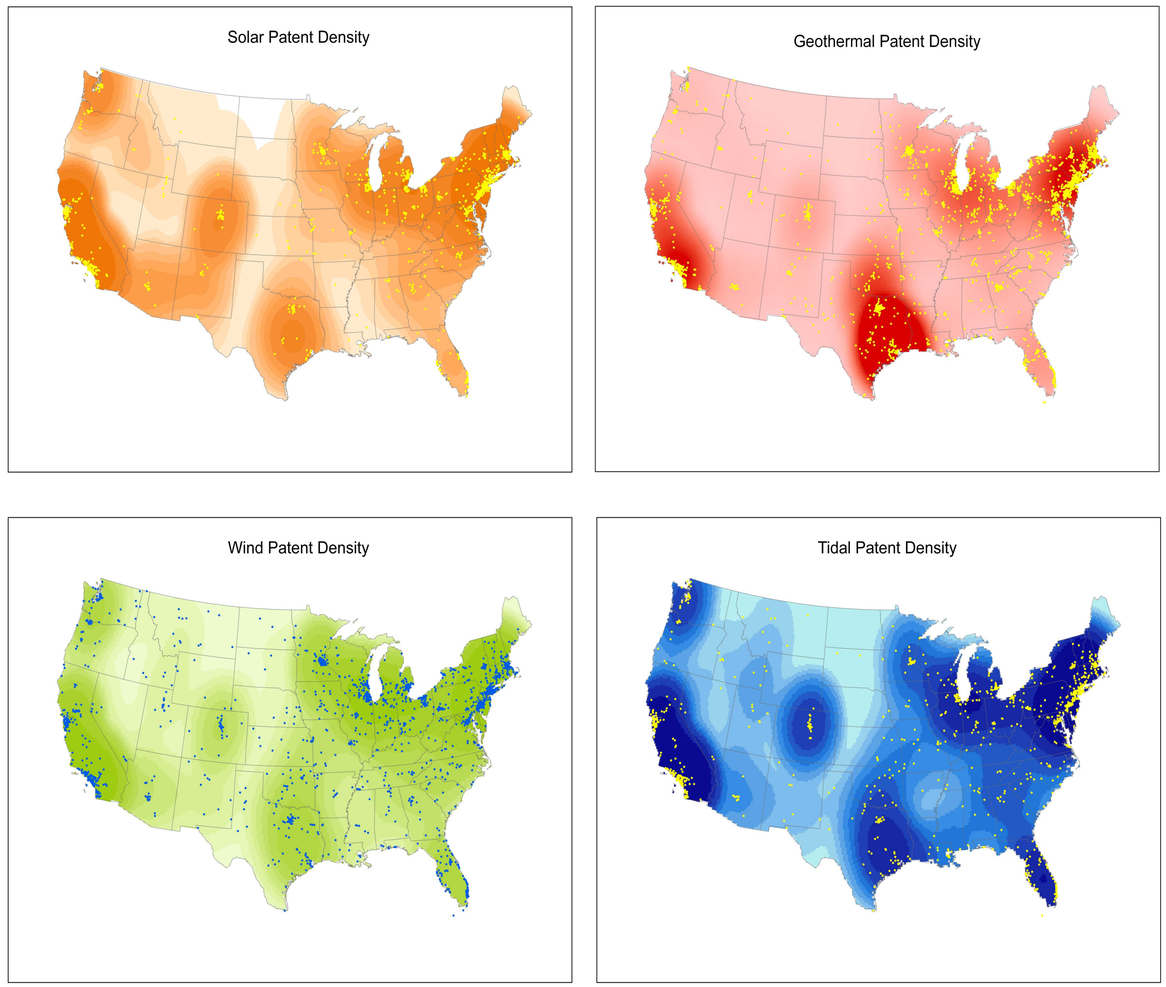

Figure 2. These maps illustrate both the regional density and specific locations of patent filings for renewable energy technology using solar, wind, geothermal or tidal energy. In this research, we will investigate: 1) how do state policies effect the rate of innovation in renewable energy and 2) does R&D investment have an effect differentiated from state level policy?

Preliminary Results

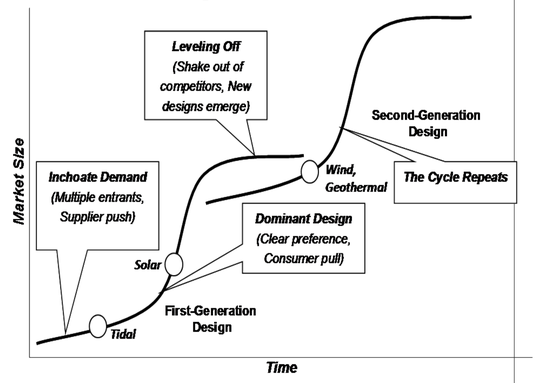

Figure 2. Our model hypothesizes that technological sectors will be differentially impacted by how close the technology is to dominant design. Based on the placement of the technology on the S-curve, we outline a series of hypotheses.

Table 1: Hypotheses and Results

Hypothesis 1: The higher the level of tax incentives in a state for the adoption of solar energy, the higher the rate of solar technology innovation in that state. (Supported, p<.005)

Hypothesis 2: The higher the level of direct investment incentives in a state for the adoption of wind energy, the higher the rate of wind technology innovation in that state. (Not Supported)

Hypothesis 3: The higher the level of demand incentives in a state for the adoption of wind energy, the higher the rate of wind technology innovation in that state. (Not Supported)

Hypothesis 4: The higher the level of direct investment incentives in a state for the adoption of geothermal energy, the higher the rate of geothermal technology innovation in that state. (Not Supported)

Hypothesis 5: The higher the level of demand incentives in a state for the adoption of geothermal energy, the higher the rate of geothermal technology innovation in that state. (Supported, p<0.01)

Hypothesis 6: The higher the level of investment policies in a state for the study and generation of renewable energy, the higher the rate of tidal energy technology innovation in that state. (Not Supported)

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For further information

Please contact Jeffrey York at *yorkj@darden.virginia.edu.*