Executive Summary: Spatial dependence in state renewable policy: Effects of renewable portfolio standards on renewable generation within NERC regions

Eric Bowen, PhD, Research Assistant Professor, Bureau of Business and Economic Research, College of Business and Economics, West Virginia University

Donald J. Lacombe, PhD, Research Associate Professor, Regional Research Institute, West Virginia University

Motivation

The electric power generation sector has undergone a significant transformation in recent years as renewable sources of electricity have become a larger share of the fuel mix. More than 9 percent of total power generation came from renewables in 2015, up from and a little more than 3 percent 10 years ago. This dramatic rise in renewable generation has been driven in large part by a variety of federal subsidies for renewables, such as the federal production tax credit, as well as state level policies such as net-metering and renewable portfolio standards (RPS).

RPS laws have been widely adopted across the United States, and a number of studies have attempted to ascertain whether they have been effective at increasing renewable energy in the states that adopt the policies. Most of the recent literature has found little significant impact from RPS policies on either renewable capacity or generation in RPS states. However, because electricity can travel over a wide geographical area across multiple state boundaries, spatial interaction among these state policies is crucial to understanding renewable energy markets. Spatial dependence exists when the values observed in one spatial location are dependent on the values in neighboring locations (LeSage and Pace 2009). As far as we are aware, none of the existing literature has examined in a rigorous econometric context the spatial interactions of RPS policies on surrounding states.

Methodology

The influence of spatial dependence in RPS policies on the electric grid has not been previously studied in the existing literature relating to these policies. In the case of the electric grid, reliability is overseen by the North American Electric Reliability Corporation (NERC), which has defined eight regions in the lower 48 US states where electricity is shared extensively. Balancing authorities within each NERC region are interconnected so that power can be generated and sold across a wide geographical area in order to both dispatch the lowest-cost generation and to maintain reliability in the grid. Because of the interconnected structure of the electric grid, we believe there is considerable evidence for spatial dependence in the electric grid that should be considered when evaluating RPS policies.

To assess the spatial dependence of RPS policies we take advantage of recent scholarship in the spatial econometrics literature to account for space and time unobserved effects in a panel regression context. We specify a number of spatial econometric models, and ultimately decide that the spatial Durbin model (SDM) is most appropriate for this study. This model allows us to take into account potential spatial dependence among the independent variables by including a weighted average of each independent variable from contiguous states. This specification allows the examination of the impact of RPS laws within a region on member states, which is the key question we are trying to address.

Conclusions

Our results, taken as a whole, indicate that previous studies of RPS laws that do not account for spatial dependence among states are missing important information to judge the effectiveness of these policies. We find evidence that while stronger RPS laws do not necessarily increase the share of renewable energy within a state, they do have a positive impact on the NERC region generally. In other words, our results suggest that a strong RPS law in a given state causes renewable generation to be sourced from neighboring states that may have weaker RPS laws. These results lead us to believe that spatial dependence is a primary reason why previous literature has shown little effect on own-state renewable generation from RPS laws.

Policy Implications

Our results have a number of implications for policy makers. First, while RPS policies may not necessarily promote renewable generation within a given state, these policies do appear to be effective in stimulating renewable generation on a system-wide basis. This is an important finding because it indicates that electricity markets, which are not bound by state political borders, are incorporating renewables into the fuel mix by finding the least-cost locations for renewable capacity to serve load in states with stronger RPS laws.

However, in many states, policy makers have promoted RPS laws not only for their environmental benefits, but also as a potential engine of economic development. Our results suggest that RPS laws may be more successful at the former than the latter. If an RPS policy in a given state promotes renewable capacity additions outside of that state, it may not generate significant economic gains for local residents. We believe that examining this spatial distribution of renewable policies' economic benefits is an important area for further study.