Assessing the Impact of Wind Turbine Permissions on Preserved Farmland in the Midwest

Introduction

In response to mounting development pressures on agricultural land, states face the dual challenge of preserving farmland while meeting the rising demand for renewable energy. Particularly in the Midwest, there is a clear convergence of sites engineeringly feasible for renewable power generation and existing farmland, as the flat open spaces vital for wind and solar power have traditionally been utilized for agriculture. This underscores an inseparable relationship between renewable energy and farmland. This study exploits a natural experiment in Midwest to examine how permitting wind turbine deployments on preserved farmland, particularly the 2008 revision of Michigan's farmland preservation policy, influences wind turbine installations.

Michigan's farmland preservation policy, commonly known as Public Act (PA) 116, safeguards one-third of the state's farmland by granting the government development rights upon enrollment, ensuring that it remains dedicated agricultural use. Enrolled landowners receive Michigan income tax credits, and the enrolled land is exempt from special assessment. If the contract is terminated prematurely, landowners must repay tax credits received in the last seven years. In 2008, PA116 was revised to permit wind turbine construction on enrolled land, with the condition of continued farming on the rest.

This paper contributes to the literature on the impact of policies on the installation of renewable energy, addressing a gap in research related to the connection between agricultural land use and wind power generation. While the association between agricultural land and wind power is evident, previous studies have largely focused on general wind turbine deployment without considering the agricultural context (Yin and Powers, *Energy Policy*, 2010; Hitaj, *JEEM*, 2013; Deschenes et al, *Resour. Energy. Econ*, 2023). This study aims to fill this gap by investigating how allowing wind turbines on preserved agricultural land affects the capacity and deployment of wind turbines in Michigan. The research seeks to provide insights into the consequences of such regulatory decisions for the development of renewable energy.

Methods and Data

Using a difference-in-differences and synthetic control approach, I analyze three Midwest states—Michigan, Minnesota, and Wisconsin—from 1992 to 2022. Wisconsin and Minnesota serve as suitable counterfactuals for Michigan, given their comparable farmland preservation policies as well as geographical proximity, and similar agricultural practices. All three states maintain comparable farmland preservation policies, necessitating a contractual commitment for tax benefits. Until 2008, these states prohibited wind turbines on land enrolled in farmland preservation policy. However, in 2008, Michigan amended PA116, allowing wind turbines on enrolled lands, while restrictions persisted in Wisconsin and Minnesota. The event study analysis provides evidence that the conditional parallel trend holds in the samples.

This study analyzes county-level data with a focus on wind turbines situated on farmland. The dependent variable, annual newly constructed wind turbine capacity, is derived from the United States Wind Turbine Database (USWTDB) and the Cropland Data Layer (CDL). As the dependent variable is a positive integer with many zeroes, I employ Poisson regression with county and year fixed effects. I also include the lagged effect of policy to account for the time required to obtain permits and construct a turbine.

Independent variables include two categories: landowner characteristics and wind power market conditions. Landowner characteristics, sourced from the Agricultural Census, include the percentage of farmers residing on the farmed land, age, population density, and land value. Wind power market variables comprise transmission lines, inception dates of county-level zoning ordinances, and projected demand required from Renewable Portfolio Standard.

Existing literature demonstrates a positive effect of access to transmission lines on wind turbine capacity (Hitaj, JEEM, 2013), but often overlooks temporal variations in access. This research introduces a novel variable to account for temporal variations in access to transmission lines, addressing a gap in the literature. Transmission line variable encompasses the number of transmission line construction approved within a county, with information sourced from the Public Service Commissions of Minnesota and Wisconsin, and MISO's Transmission Extension Plan for Michigan.

Results

The findings suggest some evidence that the policy shift allowing wind turbines on preserved farmland led to an increase in wind turbine capacity, though the effect is not statistically significant. Assuming a five-year gap between the decision to build and the operation of wind turbines, the policy shift resulted in an approximately 130% increase in total wind turbine capacity, which can be translated to 36 MW rise in wind power. A partially pooled synthetic control analysis indicates a 23MW increase, although the impact is not statistically significant.

Transmission line construction and wind capacity exhibit a positive correlation, as does the ordinance. In contrast, the percentage of the population over 65 is negatively correlated with wind turbine capacity, challenging the notion that wind turbines are seen as a favorable investment for retirees. The percentage of farmers residing on their farmland is negatively associated with wind capacity, suggesting reluctance among farmers to host wind turbines where they live.

Further analysis examines the relationship between wind turbine capacity and farmland preservation enrollment across Michigan, Minnesota, and Wisconsin. The results show a negative correlation between wind capacity and enrollment in farmland preservation programs, suggesting that counties with more wind turbines are less likely to participate in these programs. However, the degree of this correlation varies by state. In Michigan, where wind turbines are permitted on preserved farmland, the negative correlation is smaller than in Minnesota and Wisconsin, indicating that the decision to host wind turbines on farmland has a weaker effect on farmland preservation enrollment in Michigan.

Overall, the results suggest that while the policy shift did not significantly increase wind turbine capacity, it has contributed to maintaining landowner participation in farmland preservation programs.

Conclusions

This study makes a contribution to understanding the intersection of farmland preservation and renewable energy policy by examining how allowing wind turbines on preserved farmland affects wind capacity and land use decisions. By leveraging a natural experiment in Michigan, the research addresses a key gap in the literature, which often overlooks the agricultural context when analyzing wind power development. The findings suggest that while the policy shift did not lead to a statistically significant increase in wind turbine capacity, it played a role in sustaining landowner participation in preservation

programs, particularly in Michigan, where turbines are permitted on preserved land.

The policy implications are twofold. First, allowing wind turbines on preserved farmland can support renewable energy goals without drastically undermining farmland protection efforts, as seen in Michigan where the negative impact on preservation enrollment was less pronounced than in other states. Given that wind turbines are more compatible with row crop farming than solar panels, this finding suggests a promising avenue for states with farmland preservation policies to boost renewable energy capacity.

Second, policymakers should prioritize not only infrastructure improvements, such as expanding transmission lines, but also the role of well-planned local zoning ordinances. The positive correlation between local ordinances and wind capacity suggests that carefully designed regulations can facilitate wind energy development. By ensuring zoning policies are clear, supportive of renewable energy, and well-aligned with infrastructure planning, states can better promote wind turbine installations in agricultural areas. This coordinated approach allows for the effective integration of wind energy while preserving farmland, fostering both economic and environmental sustainability in rural regions.