Positive and Negative Local Externalities of Wind Turbines

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Overview

Wind turbines play a vital role in the energy transition by reducing greenhouse gas emissions and contributing to energy security. However, their deployment often generates significant local externalities, including noise and visual pollution, which can lead to local opposition, delays, and even cancellations of projects. Such opposition, commonly associated with the "Not-In-My-Backyard" (NIMBY) syndrome, poses a substantial barrier to achieving climate goals. A frequent response to this opposition is relocating projects to remote areas with fewer residents, which can increase overall costs due to higher operation and maintenance expenses, reduced electricity production efficiency, or additional grid infrastructure needs. This paper investigates both the negative and positive externalities associated with wind turbine siting in Germany. Using a unique and granular dataset, we quantify the impacts on property prices, local tourism, housing supply, and municipal tax revenues. Our findings underscore the importance of integrating local externalities into cost-benefit analyses (CBA) and designing transfer policies to mitigate opposition while minimizing overall deployment costs.

Methods

The analysis employs the hedonic pricing method to quantify the effects of wind turbines on property values. This method decomposes property prices into implicit prices for their various characteristics, isolating the impact of wind turbine proximity. To address endogeneity concerns stemming from the non-random siting of wind turbines, we implement an instrumental variables (IV) approach. The instrument leverages exogenous variations in wind energy subsidies across time and regions in Germany, which affect the profitability and timing of wind turbine installations. Data for the analysis are drawn from the RWI-GEO-RED database, covering 8,039 German postal codes from 2011 to 2018. The dataset includes detailed information on property prices, wind turbine characteristics, and socio-economic variables such as population density and average purchasing power. This approach ensures robust causal estimates of the impacts of wind turbines on local economies.

Results

The results reveal that wind turbine installations decrease house purchase prices by an average of 1.9% in affected municipalities, with the adverse effect being most pronounced for the first turbines installed in a given area. Additionally, wind turbines reduce local tourism activity and lead to a decline in building permits for apartments and houses, exacerbating housing shortages. On the positive side, wind turbines contribute significantly to local tax revenues, with each installation increasing a municipality's local tax capacity by 1.8% through higher commercial tax income. These findings highlight the heterogeneous costs and benefits of wind turbine deployment, emphasizing the need to carefully weigh local externalities against broader environmental and economic gains.

Conclusions

The deployment of wind turbines presents a trade-off between global environmental benefits and local costs. Our analysis demonstrates that accounting for local externalities, particularly property value impacts, is essential for effective cost-benefit analysis. The findings suggest several policy recommendations to mitigate local opposition and optimize wind energy deployment:

1. Include local externalities in cost-benefit analyses: Explicitly account for property value changes, tourism impacts, and housing supply effects when evaluating wind energy projects.
2. Implement transfer policies: Use the increased tax revenues generated by wind turbines to compensate affected residents, potentially reducing opposition and ensuring a fairer distribution of costs and benefits, but if and only if it is beneficial.
3. Prioritize expansion of existing wind farms: Favor the addition of turbines to existing wind farms over the construction of new projects in undeveloped areas to minimize local opposition and capitalize on existing infrastructure.
4. Strategically allocate projects: Target areas with lower levels of opposition to reduce costs associated with delays and compensation measures.

Our findings align with broader evidence, such as the work by Jarvis (2023), which estimates the cost of misallocating wind farm investments in the UK at £8 to £23 billion. Incorporating willingness-to-accept measures and compensatory mechanisms could substantially lower these costs while facilitating the energy transition. Future research should further explore similar IV strategies in other contexts to improve the generalizability of these findings and refine policy design for renewable energy deployment.

References

Jarvis, S., 2021. The economic costs of NIMBYism: evidence from renewable energy projects Publisher: London School of Economics and Political Science.