Property Tax Incentives and Wind Energy Development:
Effectiveness and Fiscal Impacts in the Great Plains

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Summary

• We examine property tax incentives (PTIs) for renewable energy.

• We linked geospatial data with local conditions and state policies to empirically assess the effectiveness of PTIs for wind energy development in eight states in the Great Plains from 2007 to 2016.

• We found that added capacities are positively associated with PTIs.
Background

• The property tax is a tax on the market value of privately owned property, such as land, motor vehicles, machinery, business inventory, etc.
  • Power generators are also taxed by their assessed value

• Property tax is an important source of revenue for local governments.
  • The tax base is relatively immobile

• Some advocates argue that property tax payments from wind projects provide much-needed revenue to rural communities for building infrastructure (NREL).

• Others see tax policy as a potential policy tool to facilitate energy transition.
Objectives

• Estimate the effects of PTIs on wind energy development since 2007
  • Hitaj (2013) JEEM is the only existing empirical study that takes PTIs into account
  • PTIs are found to have negative or no effects from 1975 to 2007
• Explore the potential impact of PTIs on local revenues
  • No published studies so far
Data

- We assembled a longitudinal dataset at the county level using data from the following sources:
  - The United States Wind Turbine Database (USWTDB)
    - Location, time of installation and nameplate capacity of utility-scale wind turbines in the United States
    - Added capacities aggregated to the county level
  - GIS data from NREL
    - Identified areas with 50m wind speed rating of "Good" or higher
  - Database of State Incentives for Renewables & Efficiency (DSIRE)
    - Identified state PTIs and RPS
  - Analytical sample covers 590 counties in CO, IA, KS, MN, ND, NE, SD, and WY.
    - Relatively homogeneous sample of rural counties with decent wind resources
Empirical Model

- We estimate variations of the following regression model:

\[ Y_{cst} = \beta_0 + \delta_1(PTI_{st} \cdot WindArea_c) + \delta_2(RPS_{st} \cdot WindArea_c) + X'_{cst}\beta + \alpha_{cs} + \gamma_t + \epsilon_{cst} \]  

1. \( Y_{cst} \) is the added capacity in the county
2. \( PTI_{st} \) represents the availability of property tax incentives
3. \( RPS_{st} \) represents the state has a renewable portfolio standard in place
4. \( WindArea_c \) represents the high wind area in county \( c \) in squared miles
   - Interacted with the policy variables to explore heterogenous effects
5. \( X'_{cst} \) is a vector of covariates controlling for local conditions
6. \( \alpha_{cs} \) represents the fixed-effects controlling for time-invariant unobservables
7. \( \gamma_t \) represents the year dummies controlling for common shocks (e.g. federal PTC)

- We also estimate this model on a restricted sample to above median \( WindArea \) for robustness.
## Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pooled</th>
<th>FE</th>
<th>Pooled Restr.</th>
<th>FE Restr.</th>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
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<tr>
<td>WindArea</td>
<td>0.131***</td>
<td>0.250*</td>
<td>0.144</td>
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<tr>
<td></td>
<td>(0.047)</td>
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<tr>
<td>PTI</td>
<td>0.558**</td>
<td>0.560</td>
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<tr>
<td></td>
<td>0.224</td>
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<tr>
<td>PTI=0 # WindArea</td>
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<tr>
<td>PTI=1 # WindArea</td>
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<td>0.235***</td>
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<tr>
<td></td>
<td>(0.049)</td>
<td>(0.022)</td>
<td>(0.146)</td>
<td>(0.082)</td>
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<tr>
<td>RPS</td>
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<td>(0.188)</td>
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<td>RPS=0 # WindArea</td>
<td>-0.047**</td>
<td>-0.059**</td>
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<tr>
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<td>(0.02)</td>
<td>(0.028)</td>
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<td>-0.222</td>
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<tr>
<td></td>
<td>(0.031)</td>
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<table>
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<tr>
<th>State FE/trends</th>
<th>State and Year FE</th>
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</table>

Note: Continuous variables are log-transformed. Standard errors in parenthesis and clustered at the counties.
Marginal Effects (Full Sample)
Marginal Effects (Full Sample)
Marginal Effects (Restricted Sample)
Marginal Effects (Restricted Sample)
Next Steps

• Preliminary results show some evidence of positive effects but are limited by imprecise measurement and potential endogeneity concerns

• Local tax rates and revenues
  • Collecting precise data from state and municipal governments

• Concerns of potentially endogenous policy
  • Use composition of state legislature to instrument state policies
Thank you!

Please send comments to zchen64@syr.edu