The Disamenity Impact of Solar Farms: A Hedonic Analysis

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Solar Farms

• Photovoltaic (PV) panels convert sunlight into direct current

Solar farm

• Solar panels are 1-2m off the ground arranged in rows to facilitate access and avoid shading
Environmental Impacts

• Waste, use of rare earths and toxic materials

• Electromagnetic radiation and noise

• Glint and glare

• Potential for negative interactions between various taxa and panels

• Visual impacts generally ignored in surveys of the impacts (Tsoutsosa, 2005)
Literature review

- There are no hedonic analyses of the impact of solar farms

- Von Mollendorff and Welsch (2017) examine differences in subjective wellbeing for individuals located near to solar facilities in Germany

- There are numerous studies of whether the installation of PV solar panels on residential houses is capitalised into house prices

- Numerous studies of the impact of windfarms on nearby property values
Solar power in the UK

- The number of PV solar farms in the UK has grown considerably.

- Planners told to avoid sites with high quality agricultural land and land with high environmental or cultural value.

- **Community reactions:** The main objections involve the visual impact but difficult to find comments made about the impact on house prices (which are anyway irrelevant for planning purposes).
This Paper

• First hedonic analysis of the impact of solar farms on nearby property prices

• DID methodology to investigate the impact of solar farms on property values in England and Wales

• Dataset: information on >600 solar farms and >5000 properties

• Results suggest that there is a significant impact on property prices and that solar farms are not environmentally benign
Data

• Data on PV solar farms is taken from the Renewable Energy Planning Database (REPD) for August 2017

• Data includes dates when solar farms were proposed / permitted / built / operational as well as capacity

• Property transactions data taken from the England and Wales Land Registry (EWLR) database from January 1995 to September 2017

• Using geographical coordinates it is possible to identify the 6-digit postcode where solar farms are located
Regression analysis

- DID Regression with Postcode Fixed Effects
  (including controls for the type of property)

- DID Regression with Postcode Fixed Effects by capacity
  (including controls for the type of property)

- DID Regression with Property Level Fixed Effects
## DID with postcode-FE

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached</td>
<td>0.522***</td>
<td>0.542***</td>
<td>0.536***</td>
<td>0.518***</td>
</tr>
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<td>(0.034)</td>
<td>(0.040)</td>
<td>(0.039)</td>
<td>(0.037)</td>
</tr>
<tr>
<td>Semi-detached</td>
<td>0.121***</td>
<td>0.131***</td>
<td>0.135***</td>
<td>0.131***</td>
</tr>
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<td>(0.030)</td>
<td>(0.035)</td>
<td>(0.029)</td>
<td>(0.029)</td>
</tr>
<tr>
<td>Flat</td>
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<td>-0.029</td>
<td>-0.090</td>
<td>-0.124</td>
</tr>
<tr>
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<td>(0.080)</td>
<td>(0.086)</td>
<td>(0.108)</td>
<td>(0.085)</td>
</tr>
<tr>
<td>Freehold</td>
<td>0.203**</td>
<td>0.214**</td>
<td>0.068</td>
<td>0.068</td>
</tr>
<tr>
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<td>(0.097)</td>
<td>(0.106)</td>
<td>(0.107)</td>
<td>(0.105)</td>
</tr>
<tr>
<td>New</td>
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<td>-0.012</td>
<td>-0.042</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.062)</td>
<td>(0.052)</td>
<td>(0.065)</td>
</tr>
<tr>
<td>Proposed</td>
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<td>-0.065***</td>
<td>-0.068**</td>
<td>-0.060**</td>
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<tr>
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<td>(0.018)</td>
<td>(0.022)</td>
<td>(0.029)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Permitted</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Built</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Trend</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
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<td>Postcode-FE</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>No. Obs.</td>
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<td>2866</td>
<td>3630</td>
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</tbody>
</table>

- Basic model considers relative prices before-and-after solar farm is PROPOSED / PERMITTED / BUILT / OPERATIONAL
- Any of these is associated with a statistically significant reduction in relative prices
- Simultaneously including all of these dummy variables suggests that the key moment is when a development is PERMITTED
### DID with postcode-FE by capacity

<table>
<thead>
<tr>
<th>Variable</th>
<th>≤ 5MW Model 5</th>
<th>&gt; 5MW Model 6</th>
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</thead>
<tbody>
<tr>
<td>Detached</td>
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<tr>
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<td>(0.054)</td>
<td>(0.041)</td>
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<tr>
<td>Semi-detached</td>
<td>0.130***</td>
<td>0.138***</td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.037)</td>
</tr>
<tr>
<td>Flat</td>
<td>0.120*</td>
<td>-0.187*</td>
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<tr>
<td></td>
<td>(0.071)</td>
<td>(0.102)</td>
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<tr>
<td>Freehold</td>
<td>0.360***</td>
<td>-0.092</td>
</tr>
<tr>
<td></td>
<td>(0.082)</td>
<td>(0.154)</td>
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<tr>
<td>New</td>
<td>0.018</td>
<td>-0.082</td>
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<tr>
<td></td>
<td>(0.077)</td>
<td>(0.065)</td>
</tr>
<tr>
<td>Permitted</td>
<td>-0.059**</td>
<td>-0.076***</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.029)</td>
</tr>
<tr>
<td>Trend</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Postcode-FE</td>
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<td>YES</td>
</tr>
<tr>
<td>No. Obs.</td>
<td>3,161</td>
<td>1,463</td>
</tr>
</tbody>
</table>

- Developments with a higher capacity impose a larger disamenity impact but not significantly so
- Households are unlikely to care about the generating capacity of the solar farm so much as the area of the development (5MW ≈ 24 Ha)
- Over the last 10 years the efficiency of panels has increased from 12 to 17 percent
The model controls for all structural and locational attributes of individual properties (other than whether it is a new build). Identification relies on before-and-after sales of the same property.

Because there are relatively few repeat-sales straddling the dates of interest the statistical significance of these variables is reduced.

The PERMITTED dummy continues to be statistically significant (not statistically different to the postcode-FE model).
Conclusions

• Solar farms impose disamenity impacts on properties located in the same 6-digit postcode of between 4-6 percent depending on the model.

• It would be interesting to compare these results with studies from other countries as well as those from other valuation methodologies (when available).

• Do impacts extend beyond the 6-digit postcode and do they differ depending on existing land cover e.g. brownfield versus greenfield sites?

• How do disamenity impacts vary with scale of the development?
Thank you!

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