Are tenants willing to pay for energy efficiency?
Evidence from a small-scale spatial analysis in Germany

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Background
Background

Final energy demand German building stock

Dena 2019, p 34

Refurbishment rate

- 1.7% p.a. (2015)
- 1.9% p.a. (2015)
- 1.4% p.a. (2015)
- 2.0% p.a. (2015)
- 2.6% p.a.
- 2.8%
Are tenants willing to pay a premium for energy efficiency?
Review of 20+ international studies on green premiums:
• Most studies identify price premiums for energy efficiency in the residential sector & larger premiums in the sales market than in the rental market
• → Common view: energy efficiency is clearly rewarded in the market

• But not all studies identify price premiums
  • Other criteria (e.g. location, neighbourhood) play a greater role
  • Large variability in estimates, even within a single geographical context
  • Many conventional hedonic modelling approaches do not account for spatial dependence

• Spatial analyses show more differentiated picture
  • Taltavull et al., 2017 – Bucharest:
    • Conventional hedonic analysis: predicted 3.5% premium
    • Spatial analysis: premium varied across neighbourhoods (e.g. North: 6.5%; West: 2.2%; no significant premiums identified elsewhere)

Research Gap:
• → Small-scale spatial approaches and analyses are needed
• → Present study: first city-level spatial analysis in Germany
Data and methodology
1. Hedonic apartment characteristics (Immoscout 24 database)
   - Germany’s largest real estate platform
   - Georeferenced data from 2012-2019
   - Large set of hedonic variables, including:
     - energy efficiency performance (Energy performance certificate)
     - rental price
     - apartment characteristics, e.g. fitted kitchen, balcony, guest toilet
   - Approx. 12,300 entries

2. Neighbourhood characteristics (City of Wuppertal; ALKIS property register)
   - Sociodemographic + socio-economic statistics on building block level, e.g. unemployment rate, population density
   - Data on the settlement structure, e.g. share of traffic area, recreational area
   - Quality of residential area (simple, average, good, exclusive)
Spatial Autocorrelation and Spatial Regression

„All things are related, but nearby things are more related than distant things“
Tobler´s first law of geography

Would you pay the same rent for an identical apartment if it is situated…
Methodology
Spatial Error Regression

\[ \ln(\text{price}_i) = \alpha + \beta \text{EE}_i + \gamma \text{H}_i + \delta \text{N}_i + \mu \text{T}_i + \textbf{u}_i \]

- **Rental (€)** price per sqm
- **Constant**
- **Energy performance of the apartment based on EPC measured in kWh/sqm*a**
- **Housing/apartment characteristics (e.g. floor, fitted kitchen, building age, living space, etc.)**
- **Neighbourhood characteristics (e.g. population density, unemployment rate, etc.)**
- **Time Dummy**

\[ u_i = \lambda w^i u_j + \varepsilon_i \]
Results
Results

Median rent level development 2012-2019 in Wuppertal and in different residential locations
Median rent level depending on the EPC rating
Results
Overall Regression

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>SEM</th>
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<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Standard Error</td>
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<tr>
<td>(Intercept)</td>
<td>1.98468384***</td>
<td>0.097687</td>
</tr>
<tr>
<td>Energy Performance</td>
<td>-0.00007408***</td>
<td>0.000022</td>
</tr>
</tbody>
</table>

N                  | 12232                     | 12232                     |
F / Likelihood Ratio (LR) | 283.00 ***                | 3263.20 ***               |
Adjusted / Pseudo R² | 0.452                     | 0.611268                  |
AIC                | -19535                    | -22796.12                 |

Note: * p < 0.05; ** p < 0.01; *** p < 0.001; Heteroscedasticity-consistent standard errors are shown for the OLS regression

- the willingness to pay increases by 0.017% for each improvement in energy efficiency of 1 kWh/sqm*a

Key results:
- WTP among tenants exists
- WTP higher for more visible apartment features
- No evidence of easier re-letting

But:
- Energy efficiency investments barely economically viable for landlords
Results
Overall Regression

Renovation from EPC

G → C

Rent increase (Median)
0.14 Euro/qm

Renovation costs
80 Euro/qm

Payback time:
48 years
# Results

## Regression by residential area quality

<table>
<thead>
<tr>
<th></th>
<th>Simple</th>
<th>Average</th>
<th>Good</th>
<th>Exclusive</th>
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</thead>
<tbody>
<tr>
<td><strong>Energy Performance</strong></td>
<td>0.00014 *</td>
<td>-0.00019 ***</td>
<td>-0.00029 ***</td>
<td>-0.00026</td>
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<tr>
<td></td>
<td>(0.00006)</td>
<td>(0.00003)</td>
<td>(0.00008)</td>
<td>(0.00025)</td>
</tr>
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<td>Apartment characteristics</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Neighbourhood characteristics</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Time</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Lambda</td>
<td>0.58003 ***</td>
<td>0.67856 ***</td>
<td>0.56532 ***</td>
<td>0.33045 ***</td>
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<tr>
<td></td>
<td>(0.02869)</td>
<td>(0.01068)</td>
<td>(0.02267)</td>
<td>(0.08422)</td>
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<tr>
<td>N</td>
<td>1545</td>
<td>9260</td>
<td>1260</td>
<td>155</td>
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<tr>
<td>(Pseudo) R2</td>
<td>0.61411</td>
<td>0.57407</td>
<td>0.68705</td>
<td>0.67343</td>
</tr>
<tr>
<td>AIC</td>
<td>-2954.57772</td>
<td>-18031.03925</td>
<td>-2243.33783</td>
<td>-255.43674</td>
</tr>
</tbody>
</table>

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Discussion & Policy Implications
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→ Other financing concepts needed (e.g. refurbishment obligation)
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5. Increasing rental prices due to dynamic market developments → suggests rent increases to refinance energy efficiency investments are possible…

6. … but need to be considered within the context of urban development policy to avoid energy-related gentrification and social segregation
Thank you for your attention

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