The Effect of Electricity Transmission Infrastructure on Subjective Well-being

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Motivation

- Electricity transmission infrastructure is likely to impose negative effects on households.
- In this paper, we analyze this claim through a new and promising technique, **the life satisfaction approach**:
  - The life satisfaction approach is an additional technique that complements traditional methods used to assess the external effects of power towers, like hedonic regressions and stated preference questionnaires.
- The idea is to shed additional light on the well-being consequences of proximity to power towers.

Policy Relevance

- Every cost benefit analysis of infrastructure projects requires accurate cost assessments.
- Siting difficult, public opposition, and general cost valuation of transmission lines call for a robust valuation of the external costs imposed on households in proximity to power towers.

Research Objective

- Quantify the effects that proximity to transmission infrastructure has on personal well-being.

Literature and Contribution

- Related literature:
  - Hedonic pricing: (Franois, 2002), (Sims and Dent, 2005), (Hamilton and Schwann, 1995).
  - Stated preferences: literature review in (Jackson and Pitts, 2010).
  - Life satisfaction: Krekel and Zerrahn (2017), (Van Praag and Baarsma, 2005), (Welsch, 2002).
- This paper contributes to current literature as it is the first using the life satisfaction approach to value the external costs of power towers.

Empirical Research Design: Treatment Effect Estimation

- Treatment effect estimation to quantify the effect that proximity of power towers to households has on self-reported well-being.
- Treatment group: Individuals with power towers in a pre-specified treatment radius, e.g. 100 m. or 1500 m. from the household.
- Control group: Individuals with no power tower in proximity to their household and comparable to the treatment in terms of other relevant covariates.
- Treatment effect: Statistical difference between treatment and control groups in terms of well-being due to proximity effects.
- Here: Pooled ordinary least squared regression as a preliminary step in the analysis.

The Life Satisfaction Approach

- $SWB_{it} = f(tower_{it} + \mathbf{MIC}_{it} + \mathbf{MAC}_{it})$
- Advantages:
  - Avoids framing and several other biases typical of stated preference methods.
  - Does not rely on assumptions such as perfect equilibrium in market goods and choice rationality of agents, necessary for revealed preference assessments.
  - Does not require cognitive abstraction of the mechanisms affecting the individual.

Data

- German Socioeconomic Panel Study:
  - German panel data study comprising a large set of economic and socio-demographic variables on a representative sample of German households.
  - Access to geo-coded households.
- New self-constructed data set on power towers:
  - Data extracted from open source "OpenStreetMap".
  - Thoroughly data review through satellite images.
- The final set has 35,498 households of which 2,067 have at least one high voltage ($\geq$ 220 kV) power tower in an 800 meters radius.

Power Towers in Germany

220 kV & 380 kV

110 kV

Preliminary Regression Results

Dependent variable: **satisfaction with life**					
Treatment radius in meters	100	300	400	500	750
Treatment	-0.4523^{***}	-0.1952^{***}	-0.1713^{***}	-0.1511^{***}	-0.1871^{***}
	(0.1784)	(0.0467)	(0.0402)	(0.0297)	(0.0253)
Income	0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Unemployment	-1.0179^{***}	-1.0118^{***}	-1.0191^{***}	-1.0186^{***}	-1.0203^{***}
	(0.0387)	(0.0386)	(0.0385)	(0.0384)	(0.0379)
Bad health	-0.2546^{***}	-0.2485^{***}	-0.2468^{***}	-0.2467^{***}	-0.2462^{***}
	(0.0138)	(0.0140)	(0.0140)	(0.0141)	(0.0142)
N	165,908	165,908	165,908	165,908	165,908
Size of the treatment group	60	499	733	1028	2119
Size of the control group	33,621	33,493	33,456	33,418	33,250
R^2	0.0792	0.0790	0.0792	0.0791	0.0797

Heteroskedasticity-robust standard errors in parentheses, clustered at the individual level. *, **, *** indicate significance at 10%, 5%, and 1% levels, respectively.

Estimation Equation:

$$SWB_{it} = \alpha + \beta tower_{it} + \mathbf{MIC}'_{it}\gamma_1 + \mathbf{MAC}'_{it}\gamma_2 + \sum_t \delta_t year_t + \epsilon_{it}$$

Conclusion

- Strong, statistically, and economically significant negative relation between treatment status and subjective well-being.
- The relationship appears to decrease with treatment intensity (distance to the power tower).

Further Steps

- Ultimate goal of the analysis: identify **causal** effect of power towers on well-being.
- Problems to address: self-selection and adaptability:
  - Exploit temporal variation on construction dates of high voltage power towers.
  - Exploit other forms of exogenous temporal variation.
  - Identify the effect of construction and assess temporal adaptability.
- Further, determine the willingness to pay from the substitutability relation between income and externality exposure.

Thank you.

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