REGIONALIZED INPUT-OUTPUT MODELING TO ASSESS THE IMPACTS OF ENERGY TRANSITION INVESTMENTS ON THE LOCAL ECONOMY: THE CASE OF SCHLESWIG-HOLSTEIN, GERMANY

Lucas Croé, Institute for Future Energy Consumer Needs and Behavior (FCN) / E.ON Energy Research Center
RWTH Aachen University, Mathieustrasse 10, 52074 Aachen, Germany, +49 241 80 49831, lucas.croe@eonerc.rwth-aachen.de
Reinhard Madlener, Institute for Future Energy Consumer Needs and Behavior (FCN) / E.ON Energy Research Center
RWTH Aachen University, Mathieustrasse 10, 52074 Aachen, Germany, +49 241 80 49820, RMadlener@eonerc.rwth-aachen.de

Overview

The regional impact of investments in the energy transition and new energy infrastructure plays an important role for the local acceptance of these investments. In the tradition of Keynesian multipliers, input-output (I/O)models are an established procedure to estimate the systemic impacts of asset investments onto various industries and have been applied widely to many national economies, lately also to Ac and DC power grid infrastructure (Schreiner and Madlener, 2019 & 2021). A lack of data on the regional level, however, has led to the underutilization of these models in regional economic analysis. In recent years, new methods of regionalizing I/O analysis using national input-output data as well as regional economic survey data have been established and used in several fields, most notably trade, tourism, and ecological economics. Schleswig-Holstein is a particularly interesting example to estimate the regional impact, as it is one of the leading German federal states with regard to investments into energy supply infrastructure (in particular grid infrastructure and renewable energy assets), due to its Northern coastal location with makes it particularly well-suited for windpower generation.

In this paper, we use data from the German Federal Office for Statistics (destatis), the Statistical Office for Hamburg and Schleswig-Holstein, and the German Research Data Centres to build a regionalized I/O table for the federal state of Schleswig-Holstein to estimate the impact of current pilot investments into energy infrastructure on the local and regional economy, as well as the impact of a wider roll-out of similar energy infrastructure on a larger (non-pilot) scale. Whilst our analysis is limited to the impact of energy assets, it could easily be generalized to other infrastructure investments, too.

Methods

We develop a regional input-output model for the regional economy of Schleswig Holstein using the Augmented Flegg Location Quotient (AFLQ) method. The AFLQ method has been found empirically to produce the most robust results amongst the wider class of location quotient methods (c.f. Flegg et al., 2016; Klijs et al. 2016). Particular attention is paid to the choice of the augmentation parameter δ and some sensitivity analysis is performed. We use data from a recent pilot-project for energy asset investments to assess the impacts of this project on the local economy of Schleswig-Holstein and calculate multiplier effects. Since the size of this pilot project is rather small, we also estimate the hypothetical impact of such investments if they were rolled out on a larger scale.

In order to estimate very regional impacts on the county level, we consider the state-wide economy to be representative of the economy in that county, but decrease self-sufficiency parameters in the model to estimate the economic impact directly visible to citizens in the areas affected by the new energy assets. Since the data for an exact estimation of those parameters are unavailable on the local level, we provide a baseline estimate based on other studies from the literature.

Results

The study is currently ongoing and regional I/O tables are being calculated. We will be able to present preliminary results and conclusions at the conference.

Conclusions

Regional economic impacts play an important role in the acceptance of renewable energy assets, and can also help to contribute to a fair sharing of the costs and benefits of the energy transition. So far, the economic impact of renewable energy assets in a region such as a part of the German federal state of Schleswig-Holstein were mostly estimated using a bottom-up approach. Our study provides a top-down macro-focused assessment of those regional economic impacts. Our study thus can help inform on the robustness of other forms of economic impact assessment as well as inform policy decisions on public investments into grid infrastructure and other energy assets.

References

1. Becker, Lisa S, et al. “Die wirtschaftliche Bedeutung der Windenergie an Land in Schleswig-Holstein“, *DIW Econ* (2020), https://diw-econ.de/wp-content/uploads/1318_DIW-Econ-2020-Wirtschaftliche-Bedeutung-der-Windenergie-an-Land-in-Schleswig-Holstein_3.0.pdf

2. Flegg, Anthony T., Leonardo J. Mastronardi, and Carlos A. Romero. "Evaluating the FLQ and AFLQ formulae for estimating regional input coefficients: empirical evidence for the province of Córdoba, Argentina." *Economic Systems Research* 28.1 (2016): 21-37.

3. Flegg, Anthony T., C. D. Webber, and M. V. Elliott. "On the appropriate use of location quotients in generating regional input–output tables." *Regional Studies* 29.6 (1995): 547-561.

4. Klijs, Jeroen, et al. "Regionalising input-output tables: comparison of four location quotient methods." *Impact assessment in tourism economics*. Springer, Cham, 2016. 43-65.

5. Kronenberg, Tobias, and Marc Ingo Wolter. "Harmonization of regional and national input-output models: the case of Germany." *Atlantic* 19 (2017): 23.

6. Kowalewski J (2015) Regionalization of national input–output tables: empirical evidence on the use of the FLQ formula. *Regional Studies* 49(2):240–250

7. Kutz, Christiane. „Regionalökonomische Effekte der Nutzung von Windenergie in Schleswig-Holstein“. *Windcomm Schleswig-Holstein*, 2012.

8. Nasrollahi, Zahra, and Mehran Zarei. "Introduction and evaluation of industry-specific FLQ method to regionalization of national input-output tables: A Case study of Yazd province in 2011." *Journal Of Economics and Regional Development* 24.13 (2017): 112-140.#

9. Schreiner L., Madlener R. (2021). A Pathway to Green Growth? Macroeconomic Impacts of Power Grid Infrastructure Investments in Germany, *Energy Policy* (in press)

10. Schreiner L., Madlener R. (2019). Investing in Power Grid Infrastructure as a Flexibility Option: A DSGE Assessment for Germany, FCN Working Paper No. 11/2019, Institute for Future Energy Consumer Needs and Behavior, RWTH Aachen University, August (revised April 2020).

11. Többen, Johannes, and Tobias Heinrich Kronenberg. "Construction of multi-regional input–output tables using the CHARM method." *Economic systems research* 27.4 (2015): 487-507.

12. Zhao, Xiaoyun, and Sung-Goan Choi. "On the regionalization of input–output tables with an industry-specific location quotient." *The Annals of Regional Science* 54.3 (2015): 901-926.