

PRIMUS/17/HUM/16: Economics of Energy and Environmental Policy

Institute of Economic Studies & Charles University Environment Center

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About



Project devoted to evidence-based energy policy modelling which links together the economics behind energy issues (Institute of Economic Studies) and environmental expertise (Charles University Environment Centre).

Main goals:

1. **Modelling consumer's behavior** (how do people react to policy changes)
2. **Impact modelling** (how does the environment react to changes)

Ongoing cooperation:



John Ioannidis (Stanford University, CA)
David Zilberman (University of California at Berkeley, CA)
Chishio Furukawa (MIT, MA)
John Ingram (Oxford)
Tom Stanley (Deakin University, Australia)
Chris Doucouliagos (Deakin University, Australia)
David Stern (Australian National University, Australia)

Impact

Two of the world's most important legislative bodies have used our research in policy-making discussions:

- US Congress
- European Parliament



Other selected institutions using our research:



Cited in:

- American Economic Review
- Science



Interviews for:

- Hospodářské Noviny
- New York Times
- Der Standard



Outputs

During 2018-2022, our research team...

... published together

63 articles in impacted journals



... supervised and mentored together

32 doctoral students

about half of which actively participated at conferences or had a research visit abroad. Moreover, a 6 supervised bachelor and master theses received excellence award for being extraordinarily good.

... organized

5 international conferences

with about 60 participants in cooperation with the **University of Economics in Prague**



... established and lectured in total

4 courses in English relevant to this grant project at 3 different CUNI institutes:

- Institute of Economic Studies (Faculty of Social Sciences)
 - Center for Economic Research and Graduate Education (CERGE)
 - Department of Sociology (Faculty of Arts)
- Moreover, we received **IES best-course award** for seminar to diploma theses providing individual advice on economics, statistics, and academic writing; also in energy-related topics.

... actively participated at key professional events

- **American Economic Association Meeting** the world's most prestigious economic conference
- **MAER-Net colloquium (keynote speech)** the only conference on meta-analysis research in economics and finance

... coordinated two huge EU grants

GEMCLIME + GEOCEP project



- We manage 2 EU Staff Exchange Programs covering travel costs for our doctoral students outgoing to Harvard, Princeton, Berkeley, Cornell, MIT, Columbia, and other partners
- Budget of EUR 2.5M for 2016-22, 2022-26

... and were awarded

GACR EXPRO project



- Same team as in Primus
- Budget of CZK 50M for 2019-2023
- Project is a direct consequence of joining IES & CUEC forces via PRIMUS

GACR STAR project

- Lead by PI for 2023-2027, project develops methods based on Primus outputs

Research Examples

Replication crisis in economics:

Not all the estimates get published; systematic misrepresentation of certain estimates creates biases in the literature. And some studies do not yield the same results when replicated. Why?

Possibly because of

- context dependence (with different data you get different results) and
- publication bias (journals like to publish good stories).

Our own research shows that

many economic facts are greatly exaggerated.

Research using demand equations is one of the most biased areas in empirical economics:

- Law of demand is a **strong theory** that with increasing price of a good its demanded quantity decreases. It is reflected in negative coefficient of the price elasticity of demand.
- Positive price elasticities rarely get reported but they should occur due to the laws of chance.
- Income elasticities, another output of demand equation, are affected as well.

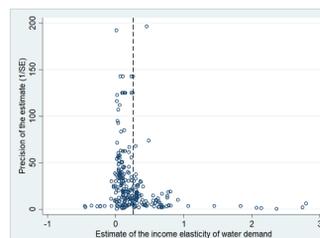
Example 1 (environmental policy)

Endogeneity and Publication Biases in Water Demand Studies

(Corresponding author: Zuzana Havránková)

How does the demand for water evolve as developing countries get richer? Income elasticity of water demand shows a sensitivity of demand for water to changes in income. Economic theory says the demand for water increases with an increasing income.

Visual funnel test suggests a bias towards positive estimates of income elasticity:



Formal funnel asymmetry tests (meta-regression) show publication bias in estimates that control for price endogeneity of the demand function:

If the ratio of the point estimate to its standard error has a t-distribution, then the two quantities should be independent:

$$\text{estimate}_i = \underbrace{\beta}_{\text{true effect}} + \underbrace{\beta_0 SE_i}_{\text{publication bias}} + \mu_i$$

| | Unweighted | | Study | | Precision | |
|-------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | OLS | FE | OLS | FE | OLS | FE |
| SE (publication bias) | 0.290 (0.307) | 0.286 (0.288) | 0.753 (0.576) | 0.523 (0.450) | 1.010** (0.405) | 0.326 (0.340) |
| Constant (effect beyond bias) | 0.223*** (0.0347) | 0.224*** (0.0445) | 0.188*** (0.0569) | 0.218*** (0.0581) | 0.112*** (0.0121) | 0.148*** (0.0153) |
| Observations | 142 | 142 | 142 | 142 | 142 | 142 |

| | Unweighted | | Study | | Precision | |
|-------------------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|---------------------|
| | OLS | FE | OLS | FE | OLS | FE |
| SE (publication bias) | 1.053*** (0.252) | 1.054*** (0.437) | 0.919*** (0.0942) | 0.834*** (0.166) | 1.650*** (0.490) | 3.689*** (1.159) |
| Constant (effect beyond bias) | 0.153*** (0.0327) | 0.153*** (0.0421) | 0.140*** (0.0246) | 0.151*** (0.0217) | 0.0959*** (0.0153) | 0.0631 (0.0396) |
| Observations | 165 | 165 | 165 | 165 | 165 | 165 |

Consistent estimation techniques eliminate endogeneity bias at the micro level but lead to the publication selection problem that affects the entire literature.

Controlling for biases and other sources of heterogeneity in the literature we show the average estimate is **exaggerated twofold**.

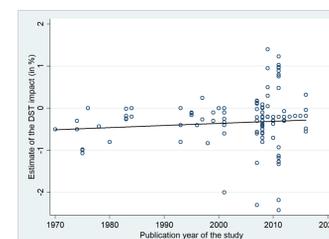
Project available at meta-analysis.cz/water.

Example 2 (energy policy)

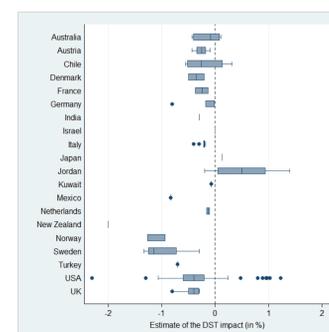
Daylight Saving Time Saves no Energy

(Corresponding author: Zuzana Havránková)

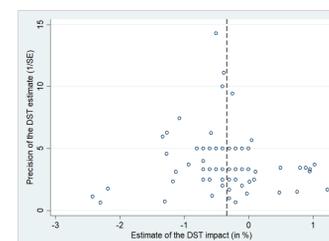
The main argument for establishing the daylight saving time policy was energy savings. How large are these savings? No clear message in 50 years of research:



Vast data-, method-, publication-, and country-specific heterogeneity among studies:



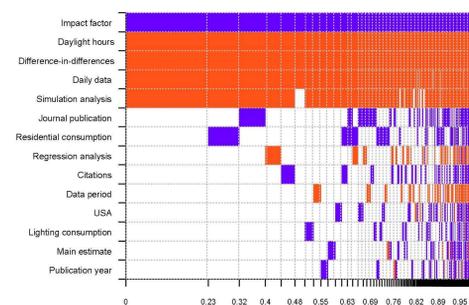
Funnel plot suggests no publication bias among estimates:



Funnel asymmetry tests confirm there is no publication bias:

| | OLS | FE | BE | Country | ME | IV |
|------------------------|----------------------|-----------------------|------------------------|-----------------------|------------------------|--------------------|
| SE (publication bias) | -0.410 (0.265) | -1.217 (0.790) | -0.410 (0.757) | -0.496 (0.805) | -0.449 (0.688) | 0.226 (1.088) |
| Constant (true effect) | -0.293* (0.00778) | -0.222*** (0.0700) | -0.294*** (0.00812) | -0.276*** (0.0459) | -0.291*** (0.00731) | -0.445* (0.243) |
| Observations | 101 | 101 | 101 | 101 | 101 | 90 |

But the true effect systematically depends on specification. We show it using Bayesian Model Averaging which accounts for model uncertainty:



To evaluate the true effect, we create a synthetic study based on best-practice study design and the Bayesian Model Averaging analysis.

The **final estimate is close to zero** and robust to different best-practice variations and BMA priors.

Project available at meta-analysis.cz/dst.

To allow for replication, we maintain a web of datasets and codes at www.meta-analysis.cz