
Open Source Economics

A platform for transdisciplinary research and education

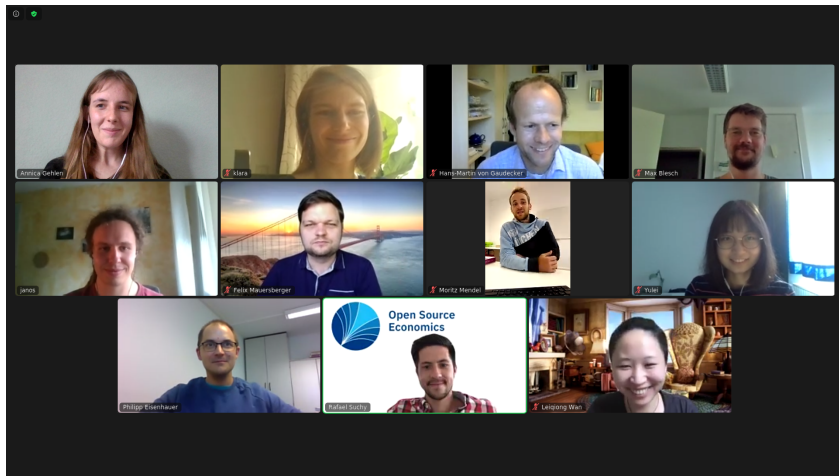
The OSE team

September 23, 2020



Open Source
Economics

Sampling the core team



*We provide a platform for economists, mathematicians, and computational scientists to facilitate the **transdisciplinary collaboration** in the development, analysis, and application of **computational economic models**.*

*Together, we **expand the set** of possible economic questions that we can address and **improve the quality** of our answers.*

Motivation

- Facilitate academic rigor
- Study mechanisms
- Predict public policies

Motivation

- Facilitate academic rigor
- Study mechanisms
- Predict public policies

Transdisciplinary in nature

- Economic model
- Mathematical framework
- Computational implementation



THE greatest improvement in the productive powers of labor, and the greater part of the skill, dexterity, and judgment with which it is anywhere directed, or applied, seem to have been the effects of the **division of labor**.

- Adam Smith, The Wealth of Nations



Institute for
Numerical Simulation



What we are doing

Economic models

- **respy** Finite-horizon discrete Markov decision problem
- ruspy Labor economics
- pydsge

What we are doing

Economic models

- respy
- **ruspy** Infinite-horizon discrete Markov decision problem
Industrial organization
- pydsge

What we are doing

Economic models

- respy
- ruspy
- **pydsge** Dynamic stochastic general equilibrium model
Monetary economics

What we are doing

Analysis pipeline

- **estimagic** Numerical optimization
 Estimating structural econometric models
- econsa
- robupy

What we are doing

Analysis pipeline

- estimagic
- **econsa** Sensitivity analysis
Assessing uncertainty of model implications
- robupy

What we are doing

Analysis pipeline

- estimagic
- econsa
- **robupy** Robust optimization
Incorporating model ambiguity

What we are doing

Analysis pipeline

- estimagic
- econsa
- robupy

⇒ Intellectual arbitrage from work in applied mathematics

What we are doing

Analysis pipeline

- estimagic
- econsa
- robupy

⇒ Intellectual arbitrage from work in applied mathematics

⇒ Adapted to the needs of economists

Development

Workflow

- GitHub organization
- Code reviews
- Testing harness
- Continuous integration

Development

Workflow

- GitHub organization
- Code reviews
- Testing harness
- Continuous integration

Support

- Documentation
- Chatroom
- Hackathon
- Conferences

OSE Research

Understanding individual decisions

- Human capital investment
- Consumption–savings decision

Understanding individual decisions

- Human capital investment
- Consumption–savings decision

Predicting effects of policies

- Welfare programs
- Tax schedules

Understanding individual decisions

- Human capital investment
- Consumption–savings decision

Predicting effects of policies

- Welfare programs
- Tax schedules

Mathematical framework and implementation

- Finite-horizon discrete Markov decision problem
- Backward induction algorithm

Understanding individual decisions

- Human capital investment
- Consumption–savings decision

Predicting effects of policies

- Welfare programs
- Tax schedules

Mathematical framework and implementation

- Finite-horizon discrete Markov decision problem
- Backward induction algorithm

⇒ Transdisciplinary research on their **economics**, data, and computation

Understanding individual decisions

- Human capital investment
- Consumption–savings decision

Predicting effects of policies

- Welfare programs
- Tax schedules

Mathematical framework and implementation

- Finite-horizon discrete Markov decision problem
- Backward induction algorithm

⇒ Transdisciplinary research on their economics, **data**, and computation

Understanding individual decisions

- Human capital investment
- Consumption–savings decision

Predicting effects of policies

- Welfare programs
- Tax schedules

Mathematical framework and implementation

- Finite-horizon discrete Markov decision problem
- Backward induction algorithm

⇒ Transdisciplinary research on their economics, data, and **computation**

Economics and data

- **Biased expectations** Incorporate subjective expectations
Collaboration with DIW for SOEP-IS data collection
- Robust decisions Facilitating development of **soepy** and **respy**
- Option value

Economics and data

- Biased expectations

- **Robust decisions**

Account for ubiquitous uncertainties

Robust decision in light of model misspecification

- Option value

Building on **respy** and **robupy**

Economics and data

- Biased expectations
- Robust decisions

- **Option value**

Schooling reform for identification and validation

Collaboration with Statistics Norway

Extension of **respy** to capture schooling system

Computation

- **Uncertainty quantification** Capture parametric uncertainty
Assess competing policy implications
- Global optimization Need to adapt **econsa** to challenges in economic models
- HPC implementation

Computation

- Uncertainty quantification
- **Global optimization**
 - Explore estimation uncertainty
 - Acknowledge multiplicity of local minima
 - Show use-case for **estimagic** features
- HPC implementation

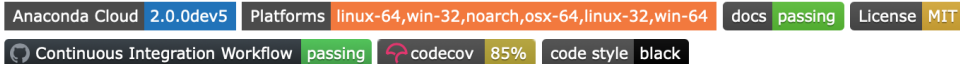
Computation

- Uncertainty quantification
- Global optimization
- **HPC implementation**

Enable increased realism and auditing of economic models
Exploit large-scale parallelism on supercomputers
Refactor **respy** to meet needs



A research code for the flexible specification, simulation, and estimation of Eckstein–Keane–Wolpin models.



Core devs Tobias Raabe, Janos Gabler

Docs respy.readthedocs.io

Ecosystem

- Permissive license
- Online documentation
- Benchmark data sets
- Retreat

Ecosystem

- Permissive license
- Online documentation
- Benchmark data sets
- Retreat

Infrastructure

- Research software engineer
- Pre-doc position
- Lectures
- Courses

OSE Education

Components

Economics

- Motivation
- Interpretation
- Application

Programming

- Simulation
- Exploration
- Visualization

Components

Economics

- Motivation
- Interpretation
- Application

⇒ Level of difficulty easily adjusted

Programming

- Simulation
- Exploration
- Visualization

Components

Economics

- Motivation
- Interpretation
- Application

⇒ Level of difficulty easily adjusted

⇒ Skills transferable across domains

Programming

- Simulation
- Exploration
- Visualization

Scientific computing for economists

- Basic numerical methods
- Dynamic model of human capital application
- Software engineering
- Guest lectures
- Contributors

Docs ose-scientific-computing.readthedocs.io

Data science for economists

- Methods of causal analysis
- Applications in labor economics
- Python data science ecosystem
- Simulation experiments
- Reproducible workflow

Docs ose-data-science.readthedocs.io



- Complete environments
- Identical configurations
- Browser-based
- Cloud-hosted
- Scalable workflows

Conclusion

Join us!



<http://bit.ly/ose-github>



<http://bit.ly/ose-zulip>



https://twitter.com/open_econ



<https://open-econ.org>

Let's make it a success!



**Open Source
Economics
Bonn**

Appendix

Contributors

- Professors
- Postdoctoral researchers
- Ph.D. students
- Master students
- Bachelor students

