

# OpenSourceEconomics

– A platform for transdisciplinary collaboration –

We are a group of economists at the University of Bonn using computational models in our research. We leverage insights from mathematics and computational science to support our model development, increase the transparency of implementations, and ease code extensibility. In doing so, we expand the set of possible economic questions that we can address and improve the quality of our answers.

The participating institutes at the Hausdorff Center for Mathematics offer unique expertise in all three components that make up our typical research project: economic model, mathematical formulation, and computational implementation. Given our question of interest, we draw on existing theoretical and empirical research in economics to set up a model that captures its key aspects. The economic model is then translated into a mathematical formulation to study its general features. Finally, to estimate the model on observed data, we require a computational implementation.

We organize our existing collaborations around an ensemble of versatile research codes that allow for the analysis of different classes of economic models. These codes are systematically developed, thoroughly tested, well documented, and actively used in our group. Their architecture allows focussing on selected mathematical and computational challenges within a deliberately simplified model while offering the immediate ability to scale up to a full-fledged research project.

The `respy` (respy, 2018) package is our most advanced research code. It is capable of solving, simulating, and estimating a whole class of economic models commonly used in labor economics. The analysis of such models allows to study the driving forces behind observed inequalities in a variety of economic outcomes. They are used to assess the relative importance of competing economic mechanisms and to predict the effects of public policies. Their mathematical formulation corresponds to a finite-horizon Markov decision process whose computational implementation poses several numerical challenges.

These include integration, function approximation, global optimization, and uncertainty quantification. We are currently working with Prof. Garcke and Prof. Griebel from the Institute for Numerical Simulation to implement the state-of-the-art approaches in our codebase.

Such transdisciplinary collaborations allow us to gain insights and build competencies that we then combine with our unique access to data sets to produce new economic insights. As part of our ongoing research, we are, for example, collecting data with the German Institute for Economic Research and have access to large administrative records at Statistics Norway.

We are organizing several events in support of our research activities. We maintain an active chatroom, host monthly meetups, and contribute several symposia to the Platform for Advanced Scientific Computing conference each year. We also established our annual retreat this summer. We build the event around two research codes that our group is actively developing. This greatly facilitated a productive exchange of ideas with the participants from the University of Zurich as well as the Australian National University.

We would highly appreciate the opportunity to participate in and contribute to the ongoing activities of the Hausdorff Center for Mathematics. The support will allow us to embed our group within the broader research community at the University of Bonn, increase the professionalism and sustainability of our efforts, and permit to further develop our research codes into community resources for the whole economics profession.

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## References

respy. (2018). *respy: An open-source package for the simulation and estimation of a canonical model of human capital investment*. Retrieved from <http://doi.org/10.5281/zenodo.595547>