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UNIVERSITÄT BONN

DEPARTMENT
OF
ECONOMICS

UNIVERSITY OF BONN · IAME · D-53012 Bonn

TRA 1: Modelling
Steering Committee

Prof. Dr. Philipp Eisenhauer
Professor of Applied Microeconomics

Institute for
Applied Microeconomics
(IAME)

Postal address:
53012 Bonn
Germany

Visitor address:
Lennéstraße 43
53113 Bonn

Phone +49 228 73-9219
Assistant: Simone Jost
Phone +49 228 73-9238

peisenha@uni-bonn.de
https://peisenha.github.io

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respy - code as research

Dear Colleagues:

Thank you very much for considering our funding request and the chance to clarify our description.

Research The research group around Prof. Scheidegger has unique expertise in the solution of economic discrete-time recursive models using high-performance computing infrastructure. They have developed two solvers that appear promising in the context of `respy`. One implements sparse grids that are parallelized using a hybrid CPU and GPU approach, while the other relies on deep neural networks that are implemented via TensorFlow and parallelized using Horovod (https://github.com/horovod/horovod). For additional details on each of the two approaches, please see the following publications:

- S. Scheidegger, D. Mikushin, F. Kubler and O. Schenk, "Rethinking large-scale economic modeling for efficiency: Optimizations for GPU and Xeon Phi clusters," 2018 IEEE International Parallel and Distributed Processing Symposium (IPDPS), Vancouver, BC, 2018, pp. 610-619, doi: 10.1109/IPDPS.2018.00070.

- M. Azinovic, L. Gaegauf, S. Scheidegger, "Deep equilibrium nets," available at SSRN: https://ssrn.com/abstract=3393482.

Our goal is to develop and implement a customized version tailored to the class of economic models covered by `respy`.

Funding We seek funding for professional software development support as we hope to establish `respy` as a community code in economics. This requires a customized and high-quality implementation going well beyond the usual prototyping as part of the scientific process. Mr. Mikushin is Prof. Scheidegger's Ph.D. student and offers such services. He is funded with a 50% position by the Swiss National Science Foundation and supplements his income by providing professional teaching and consulting services for high-performance computing. For example, he taught at the

University of Munich and the University of Kaiserslautern. He will charge the fee using his company *Applied Parallel Computing* (https://parallel-computing.pro).

Kind regards,

Prof. Dr. Philipp Eisenhauer