

# Agent-based models to inform economic policies on migration (ABM2Policy)

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The 2008 global financial crisis kindled interest in agent-based models (ABMs) as possible tools for economic analysis. ABMs can generate complex and volatile simulated economies, and some have suggested that they can do a better job of representing financial markets and other economic complexities than standard dynamic stochastic general equilibrium (DSGE) models; yet, there remains skepticism that ABMs can provide a realistic representation of the economy and the effects of public policy.

Building on earlier IIASA and CEMI work to develop large-scale ABMs of the Austrian and Russian economies, respectively, the ambitions of the ABM2Policy project are twofold: i) advance the ABM methodology in order to realistically analyze migration as an external economic shock, and ii) explore the usefulness of an ABM combined with a gamified user-interface to support the Austrian migration policy-making discussions. In meeting these ambitions, the project addresses two challenges of large-scale ABMs: i) their rigorous calibration and validation and ii) their usefulness in stakeholder-engaged policy design.

In the first year of the project, the Austrian research team has made significant progress in adapting IIASA's ABM so that it can analyze the macroeconomic impacts of migrant inflow. The ABM takes account of the interactions of millions of agents representing all residents and all businesses in Austria. Importantly, the model has now been calibrated and validated, and shown to compete with vector-autoregressive (VAR) and DSGE models in out-of-sample forecasting of macroeconomic variables. Model parameters have been set to include government expenditures on social transfers and revenues from social security contributions, as well as individual and business taxes, including special social transfers for refugees (Mindestsicherung neu). The next step is to test the economic consequences of alternative policy interventions for use in the planned policy exercise.

A main purpose of the policy exercise is to demonstrate the usefulness of the ABM for informing stakeholder policy deliberations in the complex migration policy setting. As envisaged, the participants will play roles of different stakeholders to reach a negotiated settlement on selected policy issues aided by the gamified ABM. The background work for the policy exercise is well underway. In the first year of the project, a literature review of model-based stakeholder participatory processes with a specific focus on Companion Modeling has been undertaken (23 papers reviewed in detail and 15 papers scanned). The review categorized the studies based on their policy questions, spatial and temporal scales, organization of the stakeholder processes and employment of a role-playing game as envisaged in this project. The review will inform the design of our policy exercise.

As additional background for the role-playing policy exercise, a scoping study of the main actors and political party positions on migration has been carried out in Austria. This study reveals strong divisions in policy positions across the rapidly changing political landscape, including but not exclusive to the economic impacts of migration. This suggests expanding the scope of the role-playing exercise beyond the economic considerations that are analyzed by the ABM. The study also posed a number of research questions primarily related to the economic consequences of migrants that could be addressed by the model and subsequently incorporated in the policy exercise. It also emphasized some challenges. For instance, the short-term time horizon of the ABM can overestimate the economic costs (and underestimate the benefits) of migrants into Austria.

Moreover, the national scale of the model precludes a more nuanced and policy relevant focus on local contexts.

Interaction with the Russian team was reinforced by publishing a joint paper on an aggregated agent-based model of migration flows (Makarov et al., 2019) and a visit (Sept. 2019) of Prof. Andranik Akopov from the Central Economics and Mathematics Institute (CEMI), Russian Academy of Sciences (RAS) , where he presented agent-based models developed at CEMI and discussed possible research synergies. In addition, IIASA team member, Dr. Elena Rovenskaya visited Russia (Oct. 2019) and discussed future collaboration with the Russian partners (Prof. Andranik Akopov and Prof. Albert Bakhtizin). A second joint paper is in preparation. Due to the COVID-19, the visit of the Russian team to IIASA originally planned for Apr. 2020 has been postponed to a later time, but on-line communication will continue.

### References

Makarov V, Bakhtizin A, Beklaryan G, Akopov A, Rovenskaya E, & Strelkovskii N (2019). Aggregated Agent-Based Simulation Model of Migration Flows of the European Union Countries. *Ekonomika i matematicheskie metody* 55 (1): 3-15. DOI:10.31857/S042473880004044-7. [In Russian]