Identification and validation of agent-based macroeconomic models

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The empirical implementation of structural macroeconomic models suffers from the challenge of having to estimate relatively rich models with many parameters on the base of relatively few data points (of the order of less than 10^3). Typically, the complex structures of such models also do not allow to derive closed-form likelihood functions so that either numerical approximations to the likelihood or moment-based estimators have to be used for parameter inference. As a way to cope with this problem, the DSGE literature has resorted to Bayesian estimation *with strong priors*, often derived from microeconomic analogies to the structural macroeconomic parameters. Given the scarcity of data points this approach can tilt parameter estimates strongly towards the chosen priors which have been more or less chosen in a heuristic fashion. As a result, the data itself might only have a minor influence on the outcome of such an estimation exercise.

The question of identifiability of parameters becomes even more pronounced in agent-based macroeconomic models, in which the closure of the model via rational expectations is given up, and replaced by various explicit adaptive expectation formation mechanisms that usually come with additional parameters to be estimated. Here we explore this issue using a prototypical behavioral macro model with some ABM flavor, the model with heuristic-switching between predictors of growth and inflation by De Grauwe and Ji (2020). We estimate this model via Approximated Bayesian Computation (ABC), a method geared towards complex models without closed-form solution of the likelihood, and impose relatively *weak priors*. As it turns out, we encounter formidable difficulties in estimating the parameters of this model. With data of the length of typical macroeconomic time series, estimates of the 13 parameters almost never converged to their 'true' values in Monte Carlo simulations. Even when increasing the number of observations by one to two order of magnitudes, or reducing the estimated parameters to small subsets of the original ones, no significant improvement was observed. This also applies if the 'behavioral' parameters are assumed to be known and only 'structural' parameters are estimated. We believe that such unsatisfactory results should be characteristic for most modern macro models, be it of the DSGE or ABM variety that do not impose excessively *strong priors* in their estimation.

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