An empirically calibrated large-scale agent-based model for an entire national economy

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With the digital transformation of all aspects of human society the quality and quantity of economic data is expanding rapidly. Public sector data, such as tax records and social security data as well as private collections of consumer spending and business information like credit and financial data are available on an astonishing level of detail on individuals and companies. At the same time computing power has grown in line with Moores law for decades, allowing large-scale computer simulations that helped advancing various research fields. These developments allow for a new approach to economic modeling. We present the first empirically calibrated large-scale agent-based model (ABM) for a national economy. Our ABM includes all economic activities (producing and distributive transactions) as classified by the European system of accounts (ESA) and all economic entities, i.e. all juridical and natural persons, as represented by agents (at a scale of 1:10). The economy is structured into four sectors households, firms, banks and government entities where each of them is populated by a number of heterogeneous agents that all interact with each other on different markets. The structure of our model is standard in the ABM literature and all equations follow well-established relationships from economic theory. The results of our model simultaneously fit observed macroeconomic time series, stylized facts, and observed distributions between agents on the micro-level. Our proposed procedure of embedding ABMs in observed empirical data allows ABMs to be used not only for theoretical arguments, but also to make forecasts and predictions. Potential applications of this ABM include economic forecasting of various sectors, quantify systemic risk in various economic networks, predicting responses of the economy to endogenous shocks, e.g. from the financial system, and exogenous shocks like transformative technological innovations or unintended consequences of political interventions such as subsidies and tax policies.