Public Policy from the Bottom Up
Using Agent-Based Modeling:
The Eurace@Unibi Model

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The Eurace@Unibi model is a multi-region macroeconomic simulation model that has been developed with the goal to provide a platform with strong micro-foundations for economic policy analysis in a variety of policy domains. The model builds on work carried out during the European project EURACE ("An agent-based software platform for European economic policy design with heterogeneous interacting agents"), which was funded from 2006 to 2009 as part of the European Union's 6th Framework Programme. Since then, it has been substantially extended and further developed.[20]

Using an agent-based, bottom-up approach, the model captures the heterogeneity of economic actors by simulating an economy populated by many households, firms, banks and institutions, such as fiscal authorities and a central bank. The agents differ with respect to their key characteristics (e.g., skills or wealth for households; size or productivity for firms; balance sheets for banks) and potentially also with respect to their decision rules. Furthermore, the institutional framework of the interaction between these agents on markets or in direct, bilateral transactions is described in considerable detail. A statistical office (Eurostat) collects data from all individual agents in the economy and generates aggregate indicators. The agents in the economy have access to these indicators and can use them, for example, as input for their decision rules.

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20 A full documentation and additional information about the model is provided at www.wiwi.uni-bielefeld.de/lehrbereiche/vwl/etace/Eurace_Unibi.

An important goal in developing the Eurace@Unibi model has been to establish a solid empirical foundation for the decision-making routines of all agents. Firms, households and banks are endowed with decision rules that are based on heuristics used by actual, real-world decision-makers, according to the relevant literature. For example, the decision rule for firms' pricing is based on a heuristic described in the managerial literature on strategic pricing. Each firm carries out "simulated purchase surveys" among a random sample of households in order to estimate how the demand for its product would react to price changes. It then combines this estimate with a prediction of changes in total costs associated with different adjustments in output in order to calculate expected profits over a fixed planning horizon for a set of potential price changes. Then, the price is chosen so as to maximize discounted profits over the planning horizon. A similar approach to incorporating decision heuristics that are used by actual decision-makers has been followed in all parts of the model. This general methodology is called the "Management Science Approach."

The Eurace@Unibi model endogenously (that is, without external aggregate shocks) generates economic fluctuations that match the empirical stylized facts with respect to business cycle characteristics as well as serial correlation and amplitude ratios between output and other key variables, such as consumption and investment. This stands in strong contrast to standard macroeconomic models, such as Dynamic Stochastic General Equilibrium (DSGE) models, where different types of aggregate shocks are typically introduced to generate cycles and to match business cycle features.

In addition, a large set of empirical stylized facts on different markets and at different levels of aggregation (e.g., firm size distributions, Beveridge curve) have been reproduced by the model (for a discussion of this issue, see Dawid et al. 2015). Dawid, Harting and Neugart (2013) demonstrate that a standard calibration of the model also produces patterns of income-inequality comparisons across economies that match those observed in different parts of the European Union. The fact that a large set of different kinds of stylized facts can be reproduced by the model strongly suggests that the approach to build-

ing an economic model with strong empirical micro-foundations was successful in capturing key mechanisms that drive the dynamics of real-world economies. This lends strong credibility to the insights obtained from policy experiments.

A wide variety of policy issues related to labor-market design, banking regulation, economic growth and income inequality has been studied using the Eurace@Unibi model (for a survey, see Dawid et al. 2015). For example, in Dawid, Harting and Neugart (2013; 2014), the model is used to examine how different measures of cohesion policies in the European Union should be designed so as to successfully foster the convergence of per capita output between technologically lagging and leading regions. In van der Hoog and Dawid (2015), several macroprudential credit market- and banking regulations are studied for their effects on the financial fragility of the real sector and the stability of the financial system. The agent-based approach allows us to obtain detailed insights into the effects of different policy measures on both the micro and macro levels. This yields a sound understanding of the mechanisms driving these policy effects, which is crucial for the proper design of policies and highlights the potential of the agent-based approach for policy studies.

References

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