A High Resolution Agent-based Model of the Hungarian Housing Market

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This paper presents a complex, modular, 1:1 scale model of the Hungarian residential housing market. All the 4 million households and their relevant characteristics are represented based on empirical micro-level data coming from the Central Credit Information System, the Pension Payment database and transaction data of property sales collected by the National Tax and Customs Administration and the largest real estate agencies. The model features transactions in the housing and rental markets, a construction sector, buy-to-let investors, housing loans, house price dynamics and a procyclical banking sector regulated by a macroprudential authority. We have also implemented demographic trends, including childbearing, marriage and inheritance.

The major innovations of the paper with respect to other agent-based housing market models published recently are the following:

- When choosing a flat, households consider the consumer surplus according to standard utility maximization theory. In order to take into account the heterogeneity of agents' preferences, each household in the model has been assigned a reservation price function which was calibrated uniquely using a stochastic optimization procedure. The higher is the consumer surplus, the greater is the probability that a household makes a bid for a flat.
- Besides credit constraints, also the impatience of buyers can amplify credit cycles: if households have to wait longer to buy a suitable flat, they become more tolerant regarding the price and the characteristics of flats.
- Flats have multiple characteristics, including size and quality while each flat belongs to a neighbourhood. We divided the country into 124 homogenous neighbourhoods based on hedonic price regressions.
- We also consider the changes in the housing stock: The quality of flats decreases from period to period. Households may renovate their flats, and the construction sector may build new high-quality flats. Construction takes several periods, which is a source of friction in the housing market.
- Buy-to-let investors may purchase flats with either long-term or short-term rental agreements, the latter representing the effect of Airbnb.
- While housing market models typically include mortgage loans only, we included two further loan contract types: personal loans which can be used for renovation purposes and bridge loans for households wanting to buy a new flat and sell the old one simultaneously.

Initiating the model simulation from 2018, it managed to reproduce the number of transactions and the observed house price dynamics in most of the regions of Hungary for 2018-2019, while the volume of new housing loans and their distribution regarding income deciles and loan-to-value ratios were also in compliance with the empirical data.

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The model is suitable for analysing various types of macroprudential, fiscal and monetary policies as well as for the assessment of exogenous shock scenarios. We can investigate how different LTV and DSTI combinations affect the profitability and the shock absorbing capacity of the banking sector and house price dynamics, as well as the indebtedness and housing conditions of different household segments. It has already been used to assess the effect of a monetary tightening on housing affordability, the consequences of a material cost shock in the construction sector, and the effect of easing LTV requirements for first-time-buyers.