



THE IMPACT OF BORROWER-BASED MACROPRUDENTIAL POLICIES ON FINANCIAL STABILITY, INEQUALITY, AND HOUSING STOCK WITH A HIGH-RESOLUTION, DATA-DRIVEN MODEL



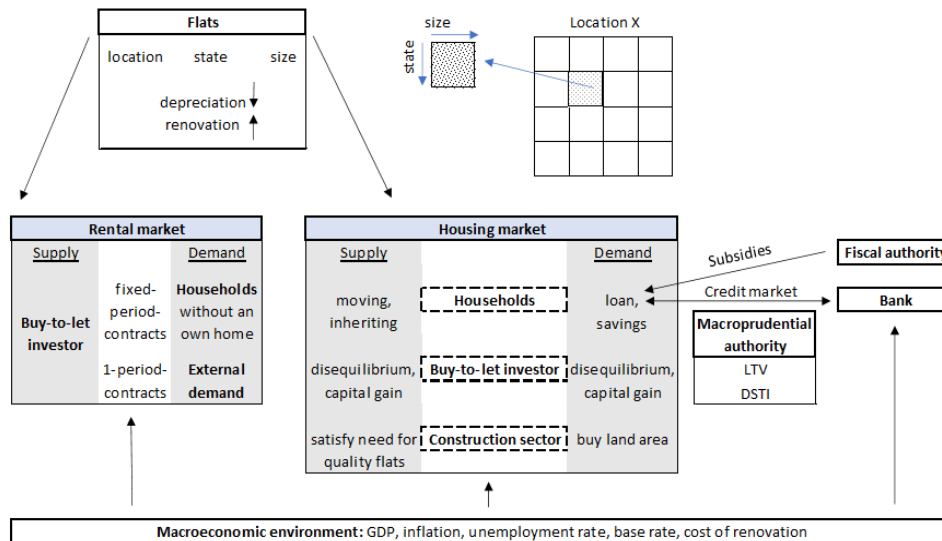
Policy challenges

- Preventing the emergence of excessive financial risks in the economy
- In the context of the housing market:
 - Inhibiting the build up of vulnerable loan portfolios
 - Restraining the volatility of the prices on the housing market
- **BUT:** Finding an optimal trade-off between stability and the costs of the regulation

Contributions

- 1) Multiple objectives beyond the „stability-economic growth trade-off“:
 - Social, welfare and inequality consequences
 - Housing stock quality, housing standards, energy efficiency
- 2) Heterogeneity of the housing market → Disaggregated policy impact assessment along:
 - Geographic (neighborhoods, counties, regions),
 - Social (income, FTB vs HO vs. BTL)
 - Economic (LTV, DSTI)dimensions.

MODEL CHARACTERISTICS



Mérő, B., Borsos, A., Hosszú, Z., Oláh, Z., & Vágó, N. (2023). A high-resolution, data-driven agent-based model of the housing market. *Journal of Economic Dynamics and Control*, 155, 104738.

- Stochastic (vs. deterministic)
- Non-linear (vs. linear)
- Dynamic (vs. static)
- Discrete time (vs. continuous)
- Iterative (vs. fixed-point)
- Asynchronous updating (vs. synchronous)
- Data-driven (vs. „toy” model):

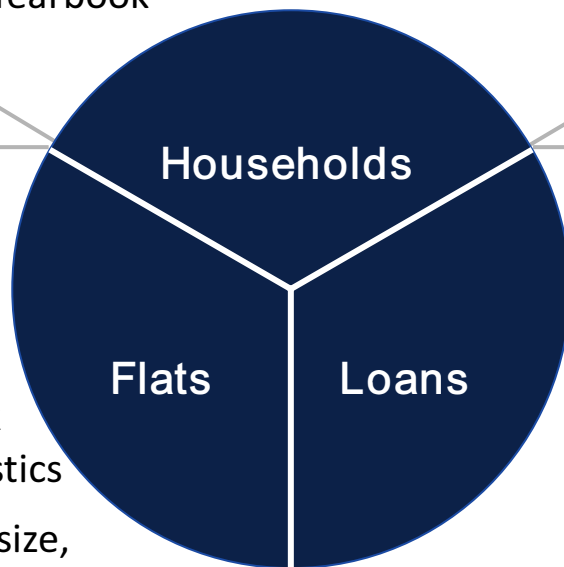
$$\{x_{i,t}\} \sim P(\{x_{i,\tau < t}\}, \theta)$$

where the parameters (θ) and the state variables (x) are initiated from empirical micro data.

1:1 SCALE MAPPING



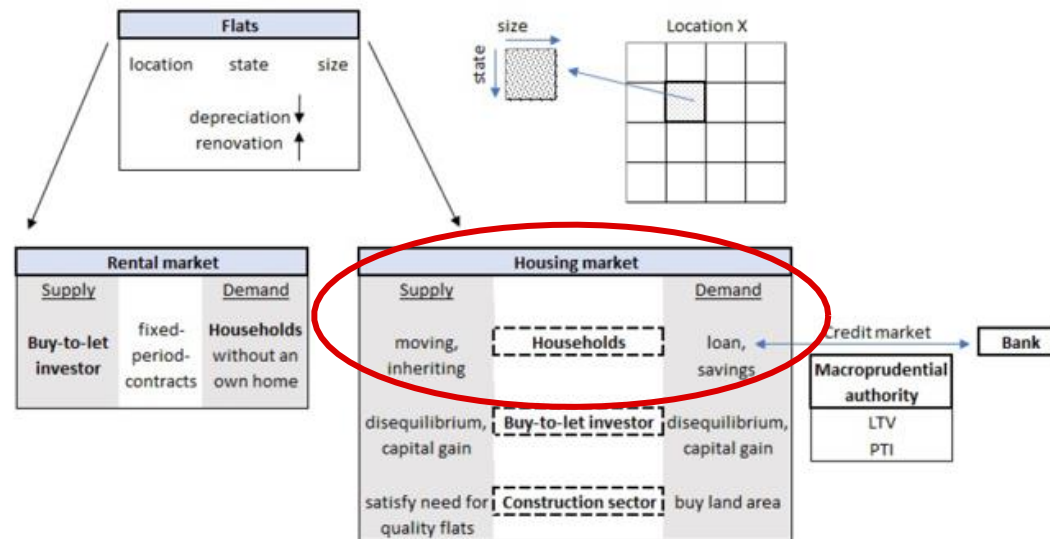
- **All of the 4 million Hungarian households**
- Occupational classification, income, social welfare benefits, education, age, sex, place of living, etc.
- Central Administration of National Pension Insurance
- Demographic Yearbook



- **cc. 200K flats (realtors)**
+ all transactions (NTA)
+ aggregated statistics of
HCSO micro census → 4M flats
- Reconstructing the housing stock
such that it mimics the agg. statistics
- 3 characteristics: neighborhood, size,
quality attributes.

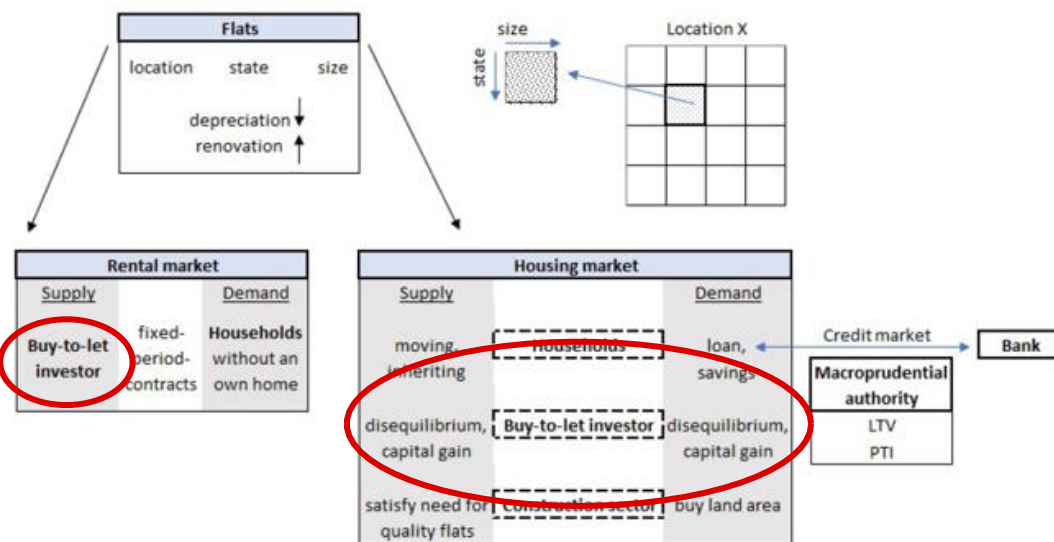
- **All 700K housing loan contracts**
- Central Credit Registry
- Start date, contracting value,
maturity, principal outstanding,
payment, interest rate, non-
performing status, non-
performing start date

THE MODEL IN A NUTSHELL 1/5 – HOUSEHOLDS



- Standard consumption theory
 - Based on consumer surplus (CS)
- Each household has been assigned a uniquely calibrated **reservation price function** with which they can assess the CS of each flat.
- The higher a flat's **consumer surplus** is for a HH, the higher the **probability** will be for the HH to bid on the flat.
- Moving probability is also influenced by the **neighborhood preferences**, the **demographic status** and the **financial situation** of the HHs.

THE MODEL IN A NUTSHELL 2/5 – INVESTORS

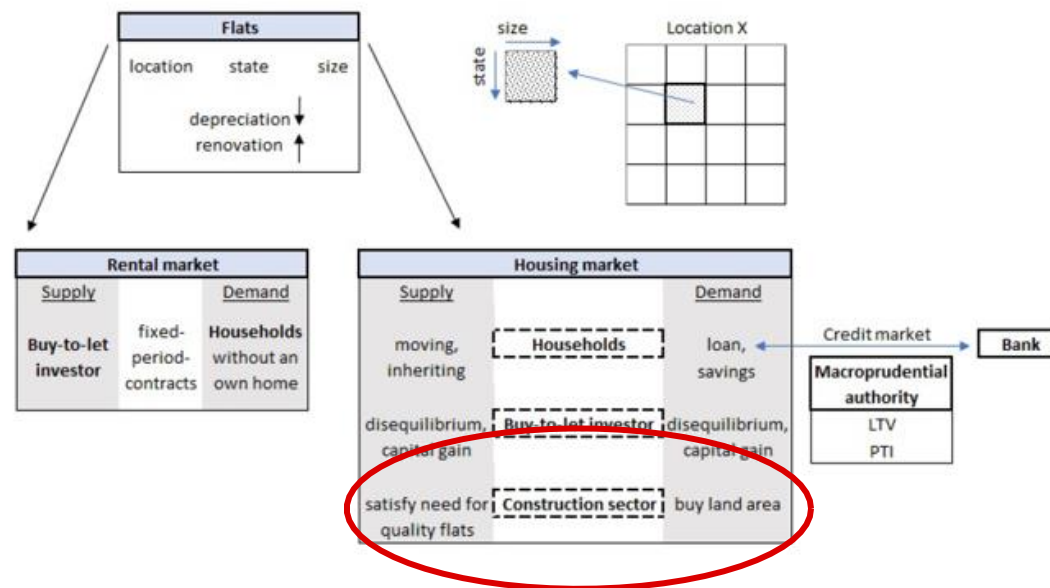


- Representative professional investor + HHs
- Demand is influenced by the obtainable **capital gain**, so their decisions are determined by
 - price changes and
 - vacancy rates.
- The supply and demand sides can be temporarily detached → **disequilibrium**
- The **endogenous change** in the **prices** and in the **rental markups** ensures the long term convergence to equilibrium

THE MODEL IN A NUTSHELL 3/5 – CONSTRUCTION



- The construction sector
 - is represented by a representative firm,
 - which estimates demand for newly built flats heterogeneously for neighborhoods and flat categories.
- Construction process:
 - The construction sector **builds high quality** flats.
 - It needs **land site** to build, so it buys the flats with the lowest unit price for sale in the neighborhood where it wants to build.
 - Construction takes **18 months**, but the construction firm can sell the flats even before they are finished.
 - Construction costs are proportional to the regional average salary (and higher than the renovation cost).



THE MODEL IN A NUTSHELL 4/5 – RENTAL MARKET



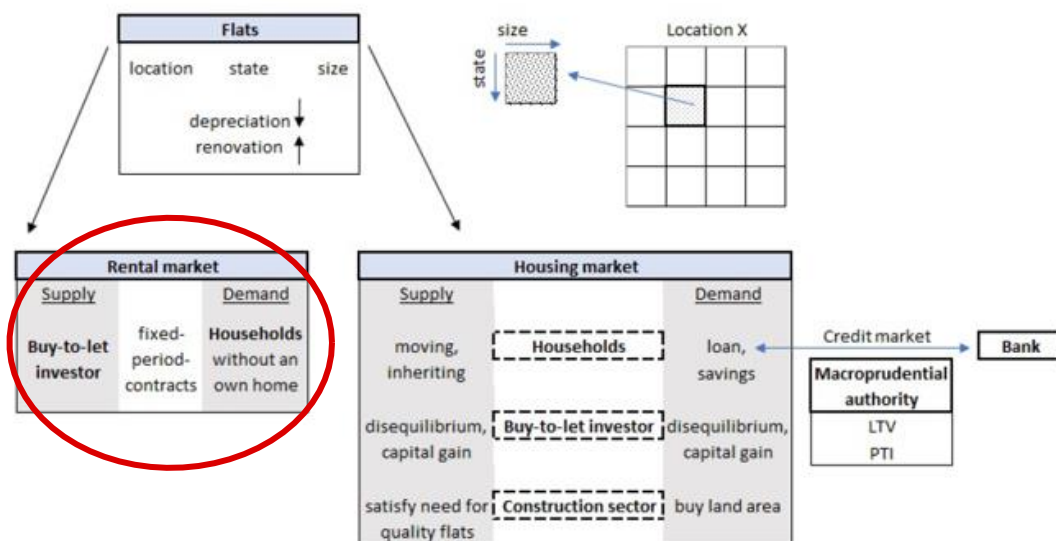
We distinguish between short-term (maximum one month) and long-term renting.

- Short-term

- represents online market place platforms (e.g. Airbnb), which mostly serve the demand coming from tourism.
- → time-dependent, exogenously given external demand for every for neighborhoods and flat categories based on empirical data

- Long term

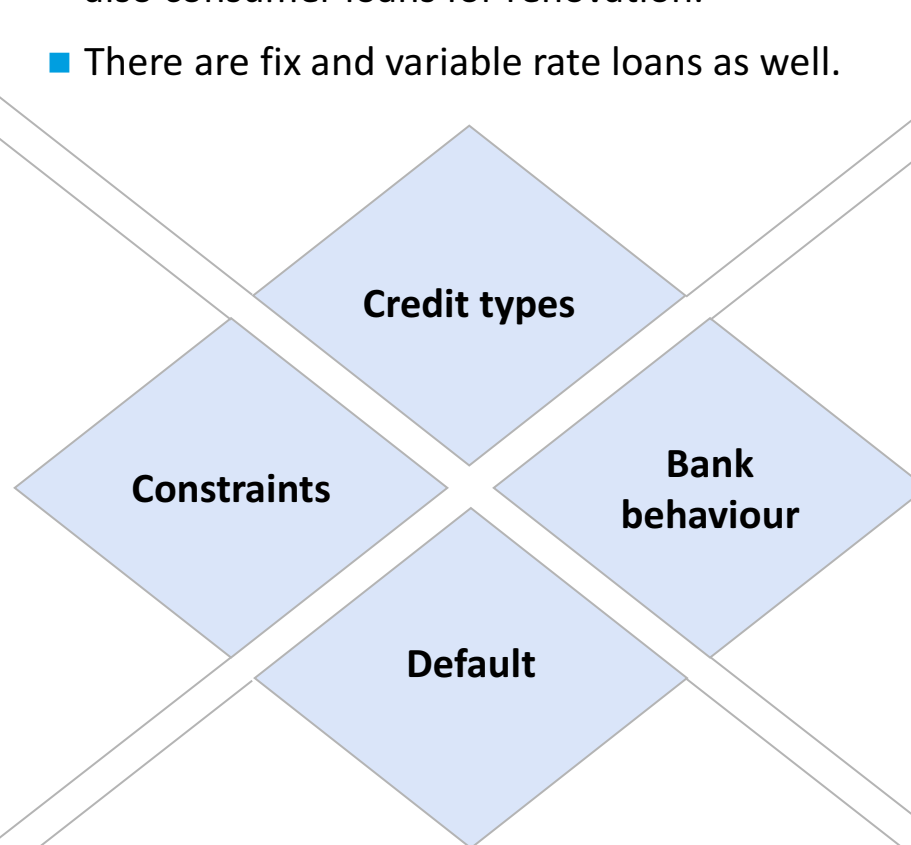
- If a household does not have an own home, it can go to the rental market.



THE MODEL IN A NUTSHELL 5/5 – CREDIT MARKET



- There are housing mortgage loans, bridge loans and also consumer loans for renovation.
- There are fix and variable rate loans as well.



- The bank increases and reduces the credit supply procyclically.
- The bank determines the credit margins with a regression model estimated on actual empirical data.

- In case of non-performance, households first try to reduce their consumption → the bank restructures the loan → finally the collateral will be liquidated.

- A household is eligible for a loan if:
 - (1) it meets the LTV and DSTI rules;
 - (2) its expected income covers the credit payments and a minimal consumption level;
 - (3) and it did not have a defaulting loan in the past five years.
- There can be only one mortgage on one flat



MACROPRUDENTIAL POLICY APPLICATION

Macroeconomic environment

Official macro. numbers until 2022Q1, central bank forecasts until 2024Q4:

- **2018-19:** high growth rate, low unemployment, inflation and interest rate
- **2020:** COVID slowdown
- **2021:** recovery in GDP, but growing unemployment, inflation and interest rate
- **2022-24:** Very high inflation and interest rate environment

Versatile conditions:

- **richer results**
- **higher validity**

Policy scenarios

3-3 versions of LTV and DSTI:

- Either unchanged, or +/- 10 percentage point change (3x3)

+1 „No limit” scenario:

- No regulatory rules, only credit history and consumption constraints

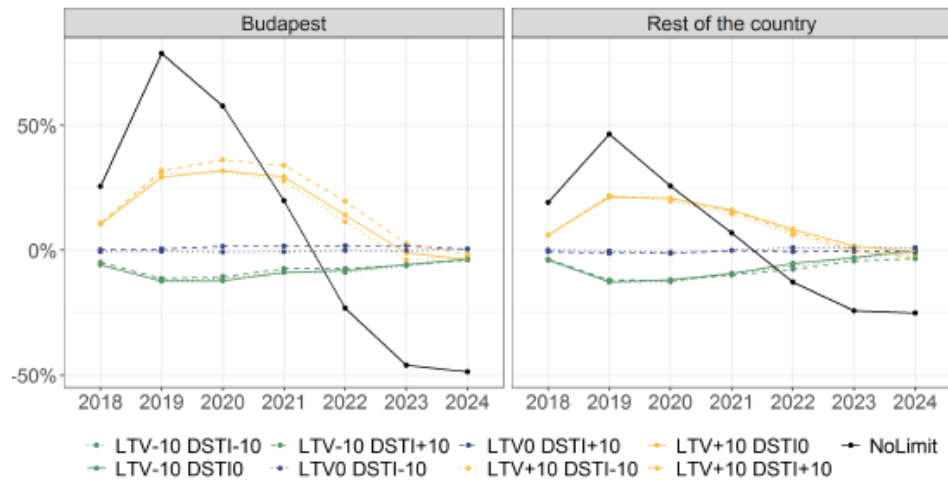
The results are always relative to the current official regulatory framework in Hungary:

- **LTV: 80%**
- **DSTI: 50%**

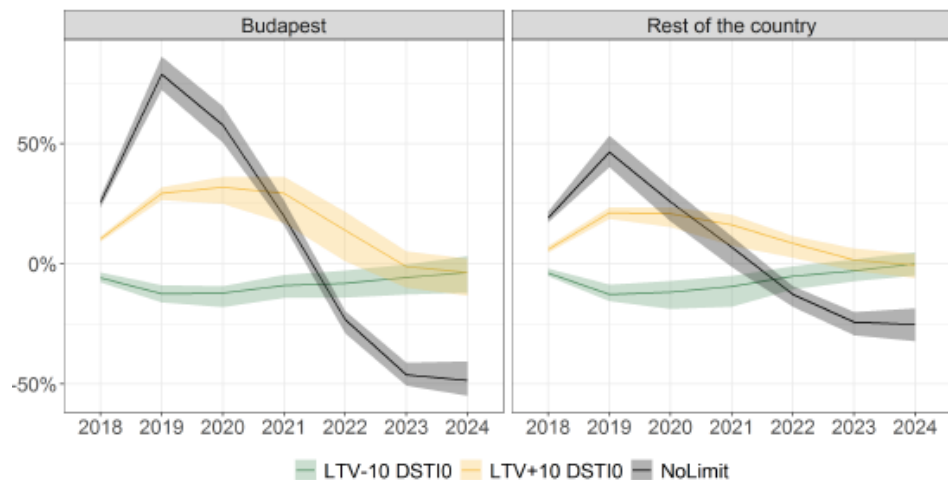
Disaggregated results

Output variables	Disaggregation dimensions			
	Capital/ Country-side	Income deciles	Age	LTV, DSTI
House price index	x			
Number of transactions	x			
Newly built transactions	x			
Credit Availability Index	x	x	x	
Housing Affordability Index	x	x	x	
Gross credit flow	x	x		x
Purchases for investment				x
Default rate				

PRICE INDEX DECOMPOSITION BASED ON REGIONS



(a)

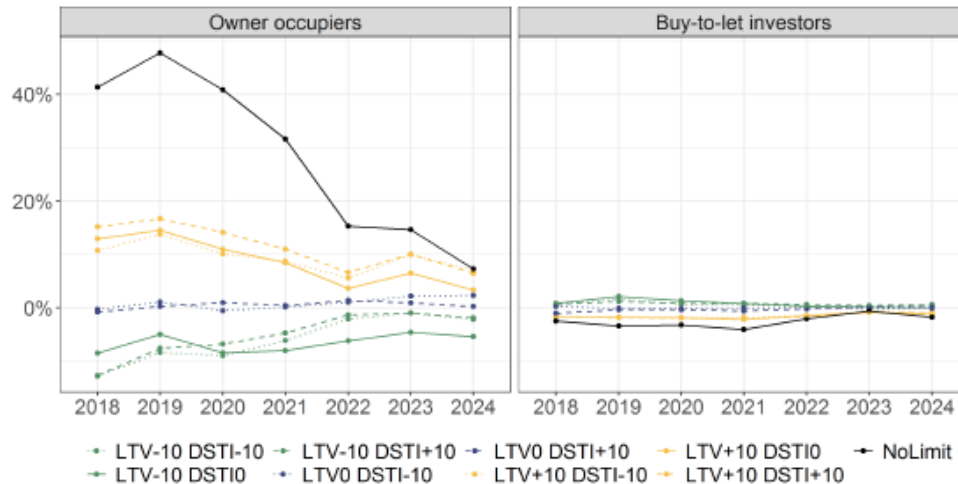


(b)

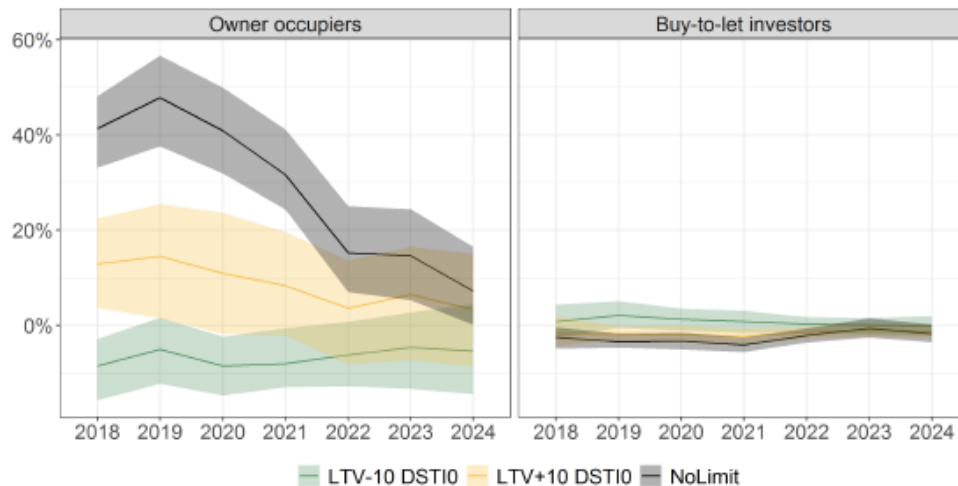
Figure 1: Changes in the house price index relative to the 12 | baseline scenario decomposed based on regions of the country

- **Looser (or no) LTV →** house price boom (especially in Budapest)
 - „no limit” → bubble bursts endogenously
 - Loose LTV → bubble bursts only in the crises
- **Stricter LTV →**
 - Does not decrease considerably the volatility of the house prices
 - Effect is similar in the whole country
- **DSTI**
 - only relevant when the LTV is looser

DECOMPOSITION OF TRANSACTION NUMBERS BASED ON THE PURPOSE OF PURCHASE



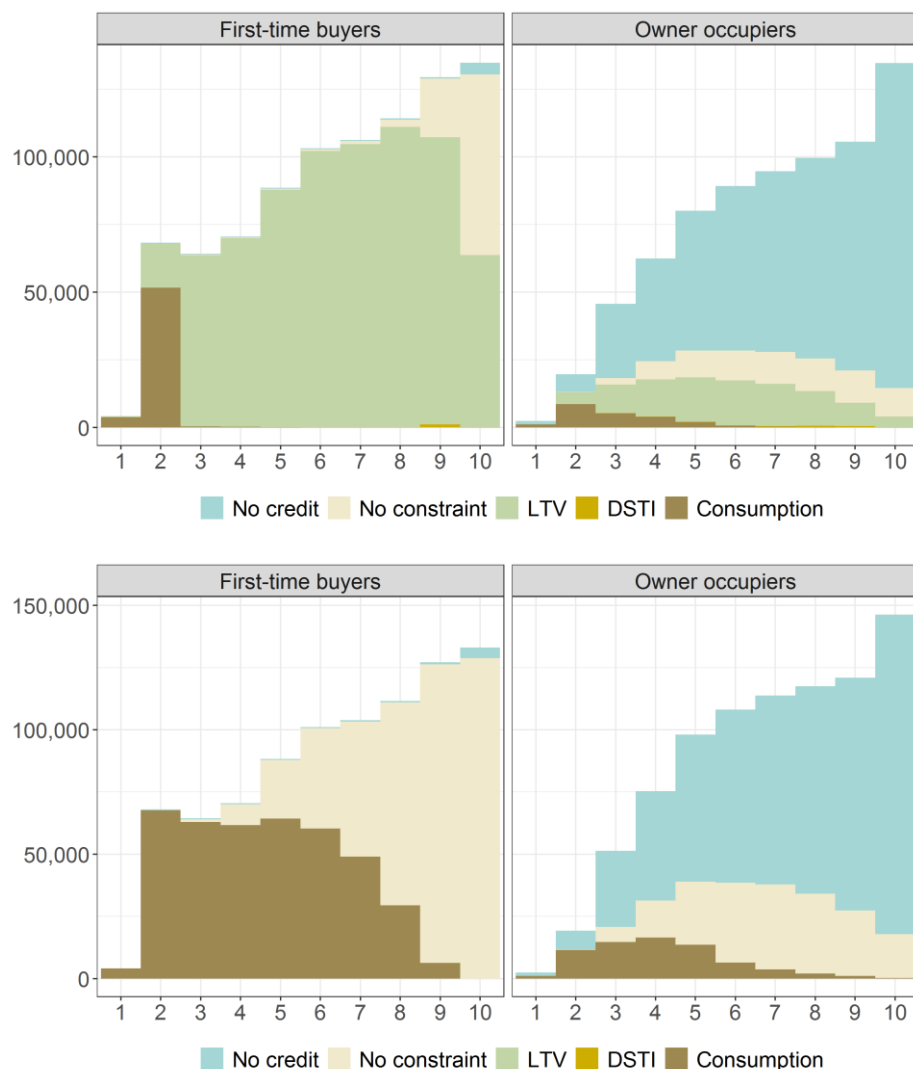
(a)



(b)

- Macroprudential tightening (easing) leads to lower (higher) transaction numbers
 - This is driven by owner occupiers
 - And only minimally by buy-to-let investors as they are far less credit constrained
- The direction of change is the opposite for BTL transactions:
 - Professional investors tend to be more countercyclical (they focus more on fundamentals)
 - More first-time buyer households can buy an own flat
 - lower demand on the rental market
 - downward pressure on ROI

CREDIT AVAILABILITY (CA)



Credit availability (Kelly et al. 2018)

- What is the most restrictive constraint for a household to buy a fair, „justifiable” flat?
- „Justifiable”: average flat in the region and income decile of a given household

Home owners

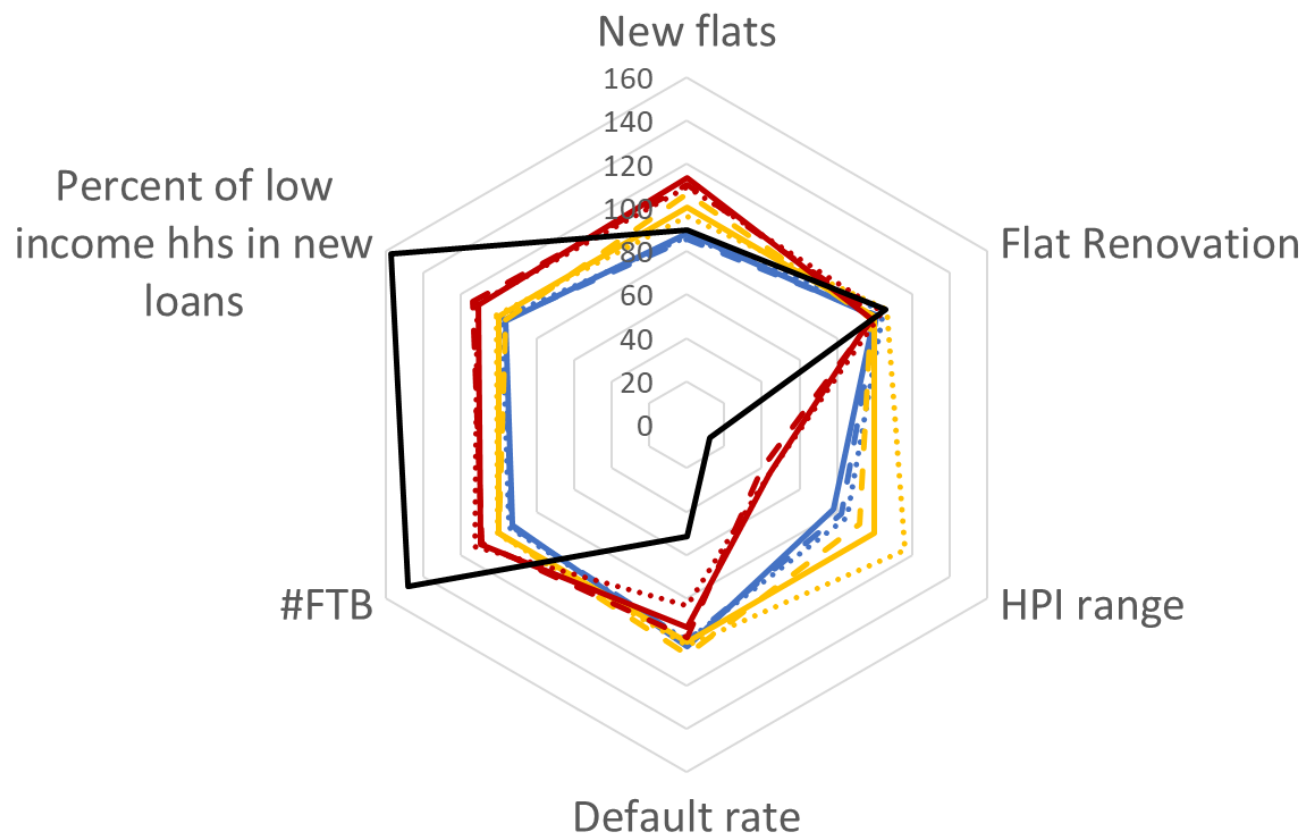
- They can mostly buy their „fair” flat.
- LTV/consumption constraints only below median income.

First-time buyers

- **Without LTV/DSTI** → First 3 deciles: not eligible for credit. Even in the 7th decile only 50% eligible.
- **With LTV/DSTI** → Barely anyone is eligible for credit. (Even in the 10th decile 50% is not eligible.)

Figure 4-5: Credit availability in the baseline (upper) and in the no limit scenario disaggregated based on income deciles and on FTB-OO categories, aggregated between 2018-2024.

OPTIMAL POLICY MIX



--- LTV70DSTI40 — LTV70DSTI50 LTV70DSTI60 --- LTV80DSTI40 — LTV80DSTI50 LTV80DSTI60 --- LTV90DSTI40 — LTV90DSTI50 LTV90DSTI60 — NoLimit



CONTACT DETAILS

András Borsos

Magyar Nemzeti Bank (Central Bank of Hungary)

borsosa@mnb.hu



APPENDICES

DEFAULT RATES

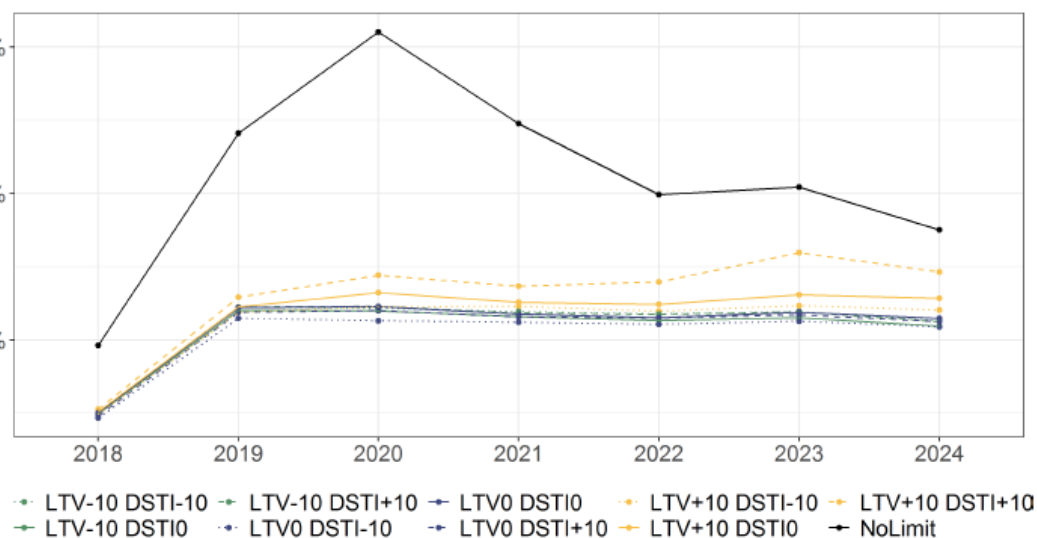


Figure 3: Annual average default rates of mortgage loans in the 10 different scenarios.

- No limit scenario →
 - 2-3 times higher default rate
- Loose LTV →
 - Considerably higher default rate for the end of the time horizon
- Stricter LTV →
 - No relevant effect
- Looser LTV + stricter DSTI →
 - Only 0.1 percentage point increase in default
 - BUT large jump in transaction numbers and credit flow (without additional risk)

HOUSING STOCK QUALITY



- Energy efficiency and social wellbeing considerations
- Large difference on the time horizon
- The effect is limited in all cases, but
- In this case **DSTI is similarly influential than the LTV**
- This is because there are households, who cannot buy a flat with any policy mix, but looser DSTI can help them to renovate at least.

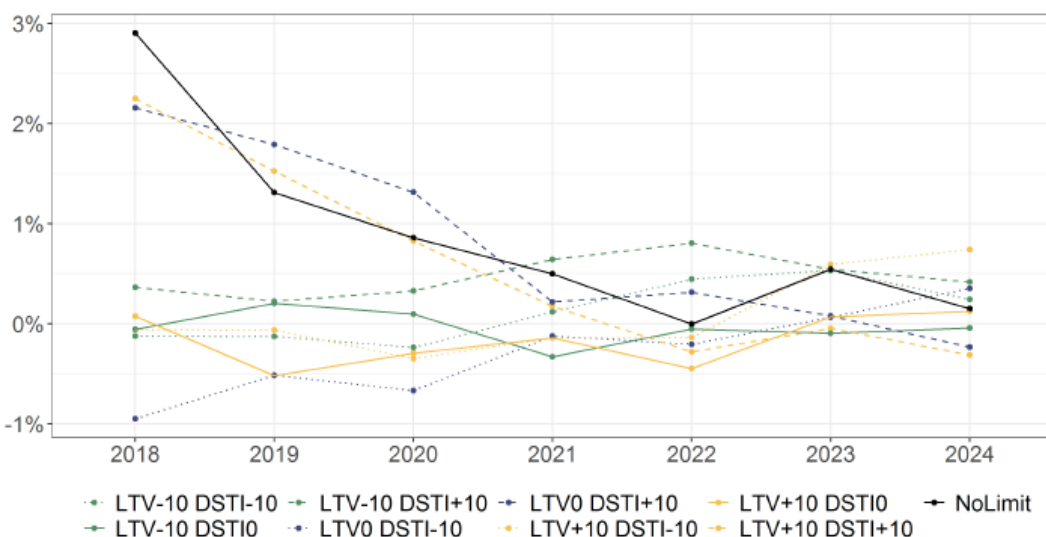
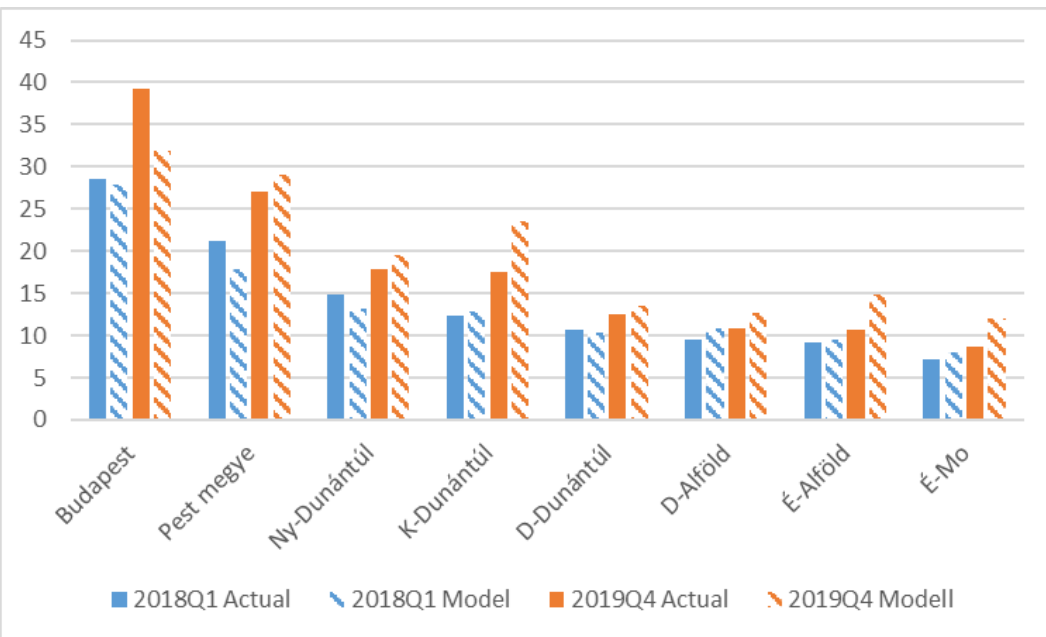


Figure 6: Percentage change of the renovated square meters (by one „state unit”) relative to the baseline scenario.



House prices in million HUF

- Parameters are calibrated such that the dynamics of the observable variables match the empirical data:
 - average regional prices,
 - the number of transactions
 - newly built housing stock
- We used data from 2018/19.
- In the evaluation of the simulation results one can disregard this first two years.

Monthly averages	2018Q1-2019Q2	
	Actual	Model
Number of transactions on the housing market	15 148	14 752
Number of transactions of newly built flats	1 966	1 897

VALIDATION

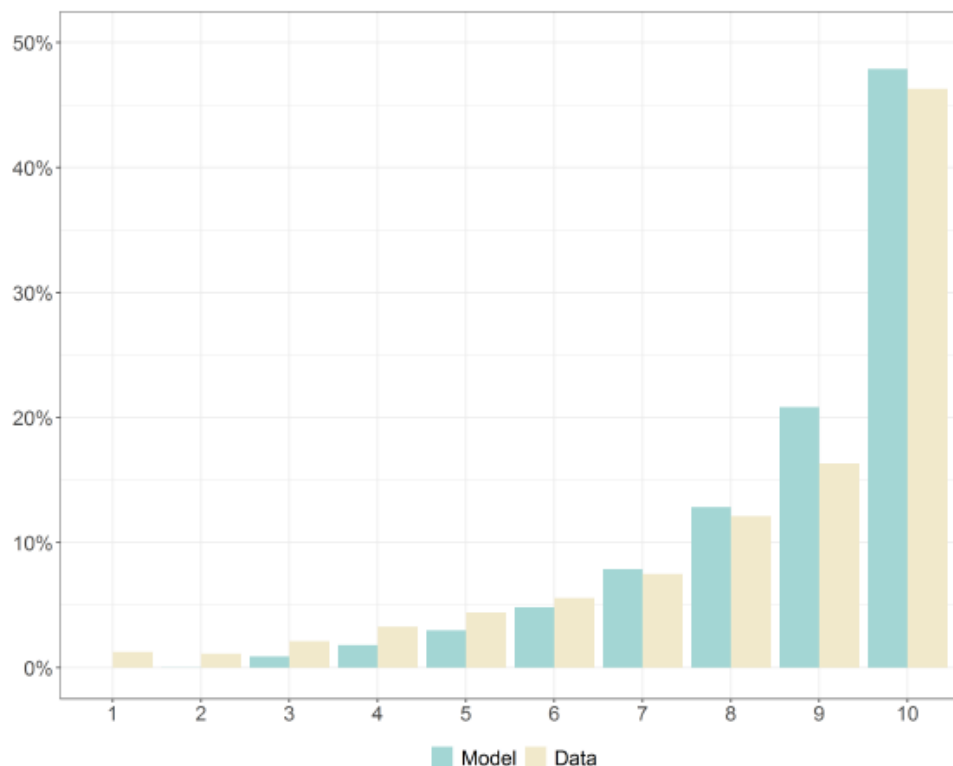


Figure 4: Distribution of the volume of newly issued housing loans in 2018 and 2019 based on the income deciles of the households. (Source: MNB.)

Yearly averages	New credit flow (billion HUF)		Number of contracts	
	Actual	Model	Actual	Model
2018-2020	895	1136	79744	75967

- We tested whether the variables of the model which were not calibrated follow the empirical data.
- We used mainly lending market variables:
 - Number of loan contracts,
 - New credit flow,
 - Distribution of loans based on income deciles, LTV and DSTI categories.
- But also some disaggregated housing market statistics:
 - # of transactions at the regional level
 - Average neighborhood quality of flats in transactions