



The effect of house prices on bank risks: Empirical evidence from Hungary

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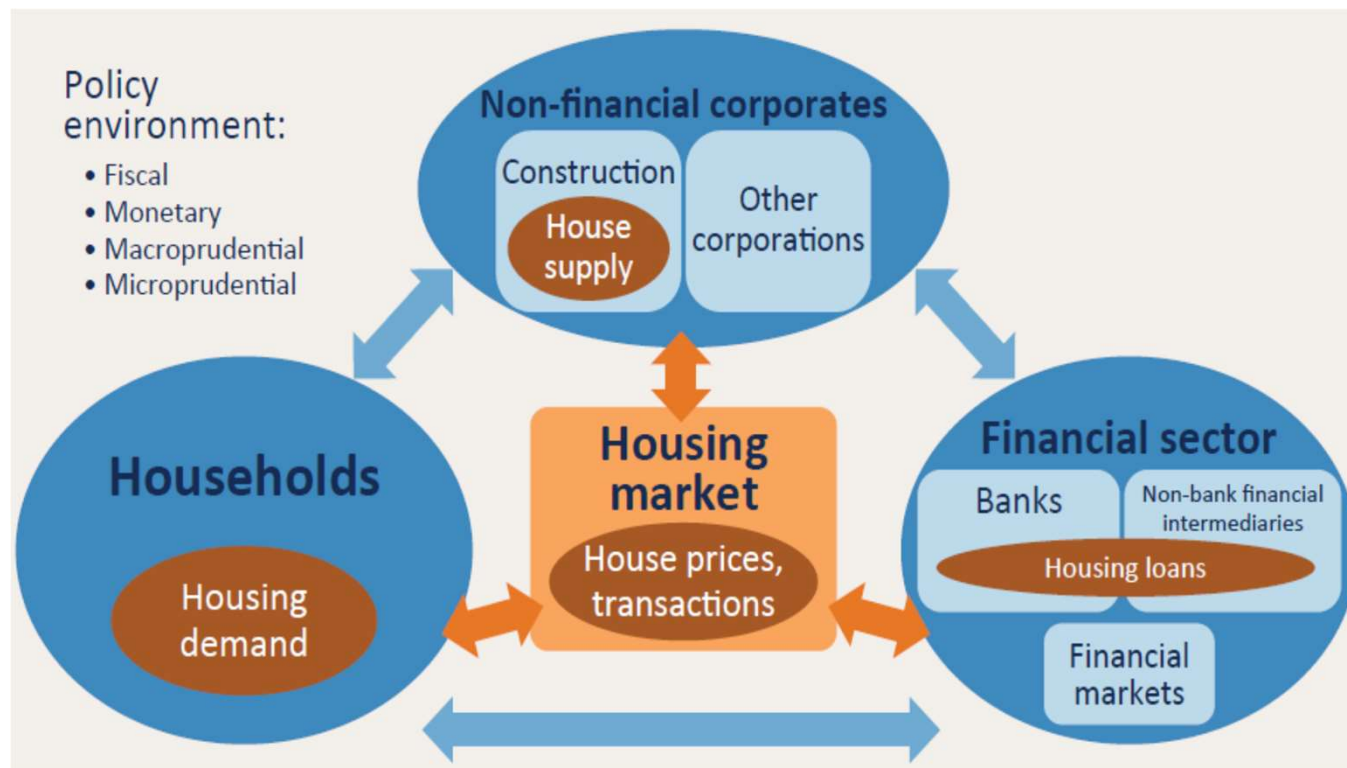
Motivation

Macroprudential policy:

- mitigating real estate related risks
- possible implementation of sector specific instruments

Household sector:

- main asset in Hungary: residential property
- consumption and saving decision



Construction sector:

- through demand for new investments

Banking sector:

- through the performance of mortgage loans
- change in collateral value influences expected loss (LGD, PD)



Motivation

- Collateral value hypothesis:
 - increasing house prices reduce bank risk
 - due to more favourable credit risk parameters
- Deviation hypothesis:
 - deviation from the equilibrium value increase bank risk
 - rising house prices → more attractive: property purchases and mortgage lending → increasingly risky loan schemes, worse and worse borrowers (US: subprime market, HU: FX lending)
- Literature:
 - empirical evidence for both hypothesis
 - Koetter and Poghosyan (2010): underline the importance of examining each country separately



Research questions

- How the level of bank risk is influenced by developments in housing prices?
 - Mortgage lending activity influences the nexus?
 - Difference between pre-crisis and post-crisis period?
 - Both simultaneous and lagged effects matter?
- Testing whether the followings influence the results:
 - Controlling for other macro variables
 - Definition of house price indicator
 - Definition of bank risk indicator
- Focusing on the housing market:
 - different lending developments in the household and corporate sector (HU before 2008: 1.5 times larger credit gap in the household sector)
 - different risk characteristics on residential and commercial market



Database

- Data types:
 - bank characteristics
 - macroeconomic variables
- Cross section: Hungarian banks (N=13)
- Period: 1998 Q4 – 2016 Q2 (T=71)
- Dependent variable: bank risk indicator
 - In the focus: EBA risk measure
 - Broadly applied in the literature: Z-risk

$$Z\ risk_t = \frac{\overline{ROA}_{t-5,t} + Capital\ indicator_t}{\sigma_{ROA_{t-5,t}}}$$

Note: $\overline{ROA}_{t-5,t}$ is the average return on assets over the past 1.5 years, $\sigma_{ROA_{t-5,t}}$ is its standard deviation, $Capital\ indicator_t$ is the capital adequacy ratio.



EBA risk measure

- all 6 bank characteristics are assigned a risk rating between 0 and 100 based on thresholds defined for the Hungarian market
- aggregation of the six risk ratings derived by rescaling the bank variables
- higher value → higher bank risk

Variable name	Bank characteristics	Definition	Weight (%)
Capital	Leverage ratio	Total capital / Total assets	14
	Capital adequacy ratio	Regulatory capital / Risk-weighted assets	14
Liquidity	Liquidity ratio	Liquid assets / Total assets	29
Asset quality	Non-performing loans ratio	Non-performing loans / Total loans	22
Business model and management	Riskiness of assets	Risk-weighted assets / Total assets	10
	Return on assets	Average Net income / Total assets	10



Methodology

Fixed effect panel model:

$$y_{it} = x_{it}'\beta + z_{it}'\varphi + \eta_i + \gamma_t + \epsilon_{it}$$

y_{it} : bank risk measure

x_{it} : bank-level controls

z_{it} : housing market exposure, house price index, housing market exposure # house price index

η_i : cross-sectional fixed effect

γ_t : period fixed effect

ϵ_{it} : idiosyncratic error

Hausman test confirms the FE specification.



Methodology

- Results of testing FE assumptions:
 - Heteroskedasticity
 - Autocorrelation
 - Cross-sectional dependence



Driscoll–Kraay (1998) standard errors
S.E. calculation method matters



Results: benchmark specification

	(1)	(2)	(3)	(4)	benchmark
mortgage ratio >20%		-0.0637 (0.7180)		-11.74** (5.8420)	
mortgage ratio	-0.0228 -0.0434		-0.0228 (0.0434)		-0.665*** (0.0777)
house price index		0.323*** (0.1090)	0.330*** (0.1060)	0.294*** (0.1000)	0.169** (0.0769)
mortgage ratio >20% * house price index				0.0968* (0.0498)	
mortgage ratio * house price index					0.00519*** (0.0007)
Observations	864	864	864	864	864
Number of groups	13	13	13	13	13
Bank FE	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES
within R2	0.645	0.645	0.645	0.649	0.680

- Deviation hypothesis: rising house prices → banks lend to increasingly worse customers
- HU before the crisis: deteriorating quality of customers (indebtedness, wider base)

Regressions includes the following bank-level controls: capital adequacy ratio, the ratio of liquid assets to total assets, the ratio of non-performing loans, the return on total assets, the logarithm of total assets, the share of foreign funds within the balance sheet, the cost-to-income ratio. The corresponding standard errors are computed using the Driscoll–Kraay method. *** significant at 1%, ** significant at 5%, * significant at 10%.



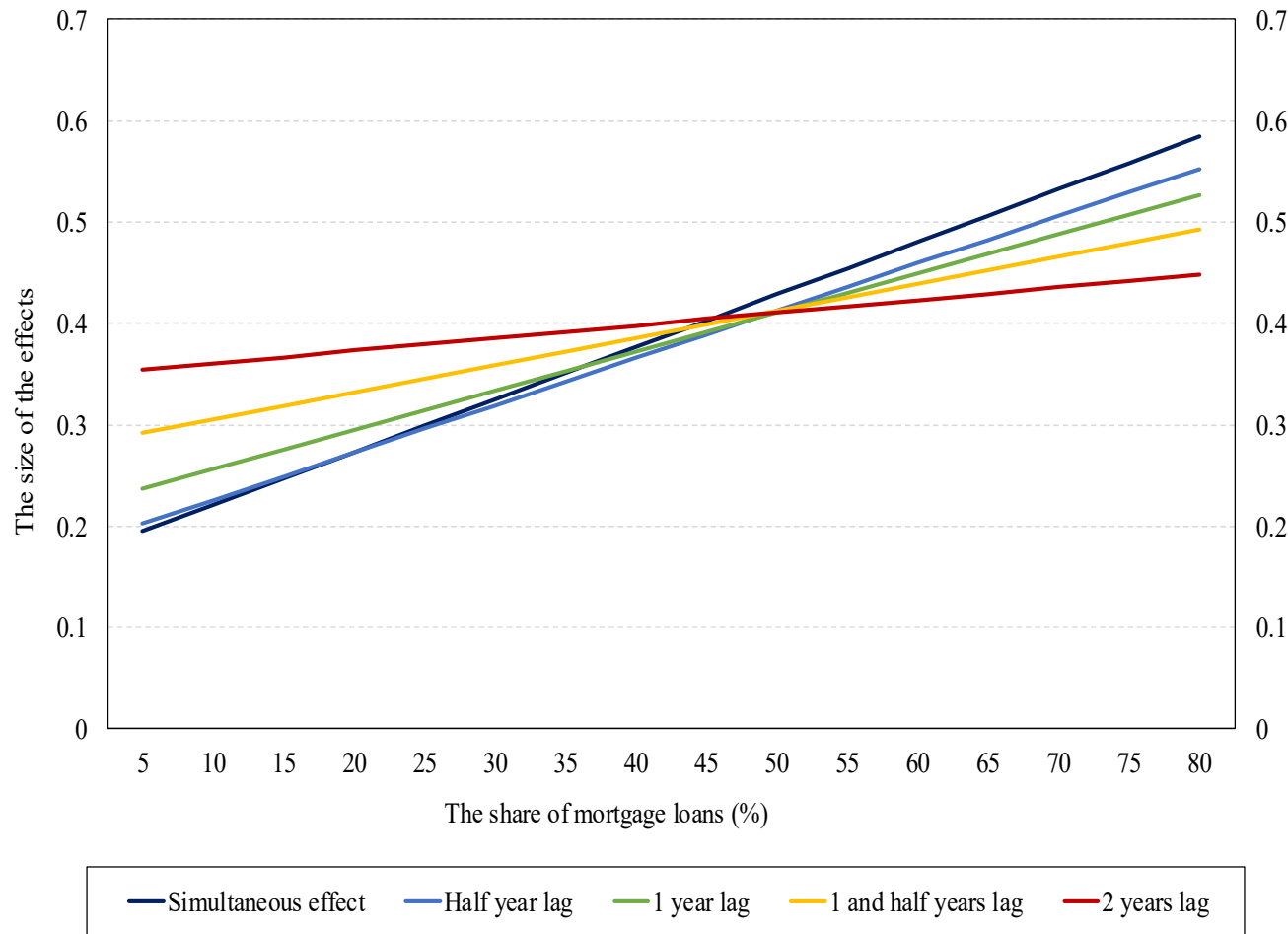
Results: the effect of house prices on bank risks in case of various lags

	benchmark no lag	(2) lag 2	(3) lag 4	(4) lag 6	(5) lag 8
mortgage ratio	-0.665*** -0.0777	-0.579*** (0.0816)	-0.455*** (0.0813)	-0.276*** (0.0948)	-0.0692 (0.1060)
house price index	0.169** (0.0769)	0.179** (0.0808)	0.217** (0.0925)	0.279** (0.1080)	0.348*** (0.1180)
mortgage ratio * house price index	0.00519*** (0.0007)	0.00467*** (0.0007)	0.00388*** (0.0007)	0.00267*** (0.0008)	0.00125 (0.0008)
Observations	864	864	852	826	800
Number of groups	13	13	13	13	13
Bank FE	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES
within R2	0.680	0.675	0.662	0.641	0.619

- Possible protracted effect: collateral value not reviewed so often
- Different time profile by mortgage lending activity



Results: the effect of house prices on bank risks in case of various lags



Higher activity:

- stronger immediate effect
- subsequently diminishing effect

Lower activity:

- later reaction to housing market developments
- intensifying effect over time



Results: the effect of house prices on bank risks before and during the crisis

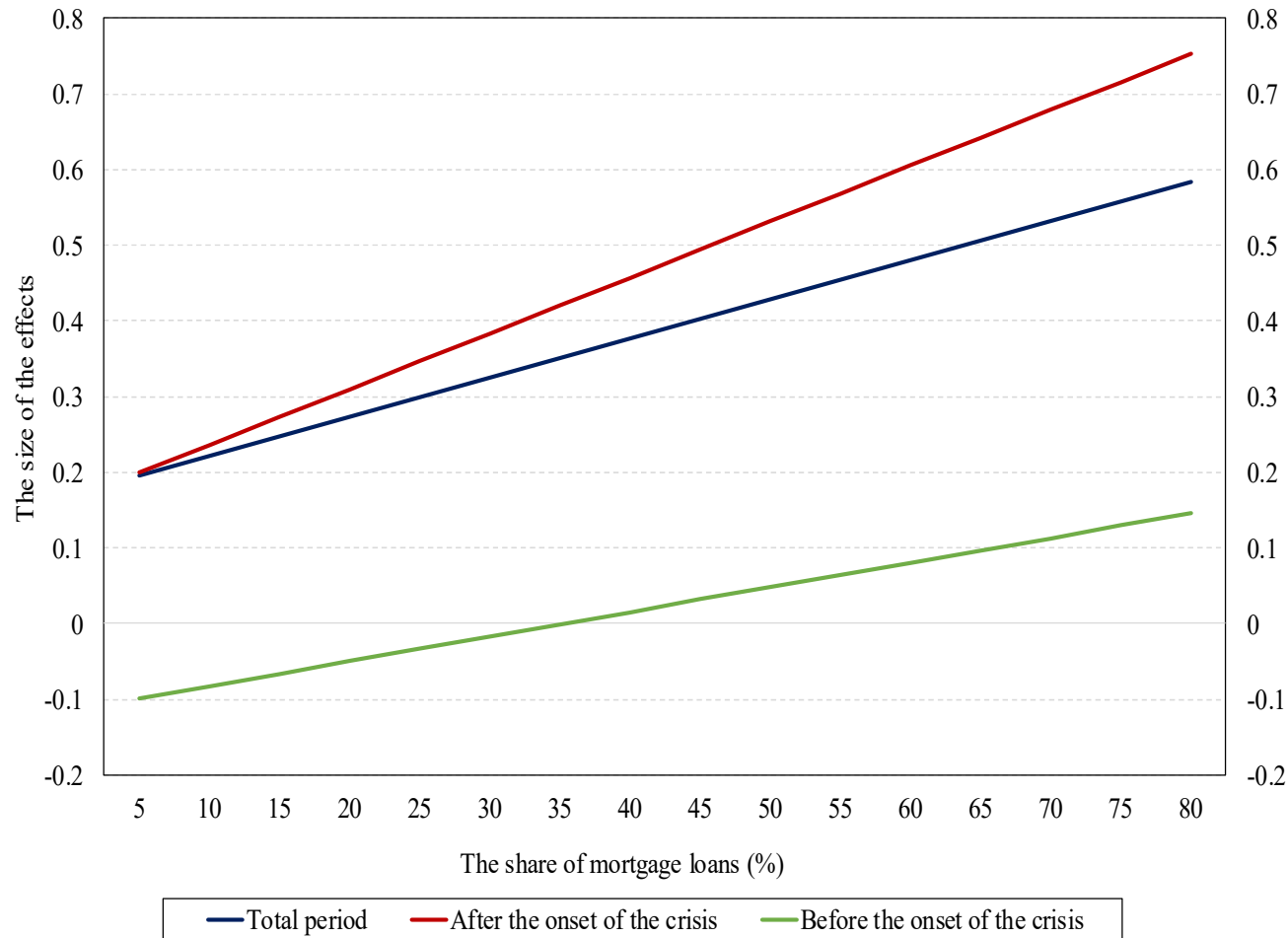
	benchmark	(2)	(3)
	Total period	Before the onset of the crisis	After the onset of the crisis
mortgage ratio	-0.665*** (0.0777)	-0.643*** (0.1320)	-0.997*** (0.1870)
house price index	0.169** (0.0769)	-0.115 (0.1380)	0.162 (0.2220)
mortgage ratio * house price index	0.00519*** (0.0007)	0.00326*** (0.0012)	0.00739*** (0.0015)
Observations	864	474	390
Number of groups	13	13	13
Bank FE	YES	YES	YES
Time FE	YES	YES	YES
within R2	0.68	0.648	0.629

- In Hungary: structural break may alter the impact mechanism

Regressions includes the same bank-level controls as the previous model specifications. The corresponding standard errors are computed using the Driscoll–Kraay method. *** significant at 1%, ** significant at 5%, * significant at 10%.



Results: the effect of house prices on bank risks before and during the crisis



Pre-crisis:

- Less specialized banks: stronger collateral value effect
- More specialized banks: deviation effect

Post-crisis:

- Deviation effect for all banks
- Large difference in the size of the effect



Robustness test: macro variables

	benchmark	(2)	(3)	(4)
mortgage ratio	-0.665*** (0.0777)	-0.678*** (0.0829)	-0.676*** (0.0762)	-0.675*** (0.0816)
house price index	0.169** (0.0769)	0.239* (0.1250)	0.189* (0.0945)	0.227* (0.1200)
mortgage ratio * house price index	0.00519*** (0.0007)	0.00530*** (0.0007)	0.00526*** (0.0007)	0.00525*** (0.0007)
unemployment ratio		-0.0788 (0.0683)		-0.166 (0.1140)
mortgage ratio * unemployment ratio		-8.03e-05 (0.0010)		1.76e-05 (0.0011)
disposable income			-0.355 (0.2340)	-0.459 (0.3100)
mortgage ratio * disposable income			0.000832 (0.0025)	0.000857 (0.0025)
Observations	864	853	853	853
Number of groups	13	13	13	13
Bank FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
within R2	0.68	0.681	0.681	0.681

- Mortgage lending could affect bank risk also through the labour market
- Unemployment and disposable income do not influence the significance of the housing market variables

Regressions includes the same bank-level controls as the previous model specifications. The corresponding standard errors are computed using the Driscoll–Kraay method. *** significant at 1%, ** significant at 5%, * significant at 10%. Unemployment ratio and disposable income are annual growth rates.



Robustness test: bank risk indicators

	benchmark	(2)	
	EBA-risk	Z-risk	
mortgage ratio	-0.665*** (0.0777)	-0.814 (0.5580)	<u>EBA-risk:</u> higher value, lower stability
house price index	0.169** (0.0769)	-1.658*** (0.4670)	
mortgage ratio * house price index	0.00519*** (0.0007)	0.00279 (0.0057)	<u>Z-risk:</u> higher value, higher stability
Observations	864	835	
Number of groups	13	13	
Bank FE	YES	YES	
Time FE	YES	YES	
within R2	0.680	0.307	

- Increasing house prices result in higher bank risk also in case of Z-risk
- Insignificant interaction term → the definition of bank risk indicator matters



Robustness test: house price measure

	benchmark	(2)	(3)
	Level (real)	Gap (real)	Level (nominal)
mortgage ratio	-0.665*** (0.0777)	-0.0699** (0.0334)	-0.171 (0.1070)
house price index	0.169** (0.0769)	0.0796* (0.0446)	0.222*** (0.0776)
mortgage ratio * house price index	0.00519*** (0.0007)	0.00650*** (0.0011)	0.000964 (0.0006)
Observations	864	864	864
Number of groups	13	13	13
Bank FE	YES	YES	YES
Time FE	YES	YES	YES
within R2	0.68	0.673	0.648

- Deviation of house prices from the equilibrium: same result
- Nominal house price: insignificant interaction



Conclusion

- Relationship between housing market and bank risk in Hungary:
 - Deviation hypothesis
 - Banks' mortgage exposure influence the partial effect: housing market boom cause higher risk in case of higher mortgage loan share
- Different nexus before and after the onset of the crisis:
 - Before: collateral value effect was stronger in case of less specialized banks, deviation effect for the others
 - After: heterogeneity remains by mortgage lending activity, but relation between bank risk and housing market is positive for everyone
 - It is worth examining different periods separately
- Different time profile:
 - larger activity: strong simultaneous effect, diminishing over time
 - smaller activity: bank risk appear later
- Bank risk measure influence the results:
 - focusing on only solvency can be misleading



Thank you for your attention!