

Distributional Effects of Borrower-Based Macroprudential Measures

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Why is This Important?

- **Balancing the economic costs and benefits** of the measures, both at implementation and over time.
 - ▶ Macroprudential policy has real economic effects (e.g. Richter *et al.*, 2019; Fidrmuc & Lind, 2020).
 - ▶ Do these real effects undermine the intended stabilizing effects?
 - ▶ CBol after MaPP review (2022): “...*the economic costs of the measures have increased since 2015, primarily due to structural developments...*” and “...*a targeted recalibration of the measures can relieve some of the costs without unduly reducing their benefits.*”
- Should the measures be set as **structural or cyclical**?
- **Higher inequality affects macroeconomic stability**: A larger share of credit-constrained households can amplify the effects of shocks, making the economy more sensitive to booms and busts.

What Do We Expect and What Does the Literature Say?

- MaPP can, in principle, either **increase or decrease inequality**.
 - MaPP aims to **reduce the probability of financial crises**, which can lower income inequality by mitigating financial losses and unemployment effects.
 - ★ During the GFC, higher unemployment was found to be a significant driver of rising market income inequality in Europe and the US (Jenkins *et al.*, 2012; Vacas-Soriano & Fernández-Macías, 2018).
 - ★ Bridges *et al.* (2021) show that **inequality rises after recessions**; these effects are exaggerated if preceded by rapid credit growth and associated with low bank capital and financial crises.
 - Bank capital requirements and financial sector taxes might reduce inequality by **shrinking the high-wage financial sector**.
 - MaPP can **smooth credit market and asset price fluctuations**, reducing wealth redistribution caused by credit delinquencies and asset valuation changes.
 - + Borrower-based limits (LTV, DTI, DSTI) can **restrict low-income, low-wealth households from buying homes** and using them as collateral, potentially limiting income growth (+) but also providing **protection from price crashes** (–).
 - ★ Peydro *et al.* (2020) show that macroprudential borrowing limits **affect low-income borrowers more** than high-income borrowers.

Part of the Broader Research Agenda

Malovaná *et al.* (2024):

- Empirical analysis of 105 countries between 1990–2019.
- MaPP affects income inequality through:
 - ▶ **Crisis prevention & mitigation:** MaPP tightening *decreases* inequality.
 - ★ Stronger in EMDEs and in countries with less capitalized banking sectors.
 - ▶ **Credit redistribution:** MaPP tightening *increases* income inequality (via credit and house price growth).
 - ★ Stronger in AEs and during periods of highly accommodative monetary policy.
 - ▶ **BBM** mainly raises inequality (via credit redistribution).
 - ▶ **CLBM** mainly reduces inequality (via crisis prevention).

This paper:

- What are the differential effects of BBM on individual household incomes and assets?

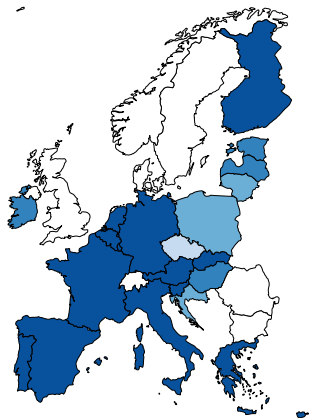
Follow-up papers:


- The role of non-banks in transmission, microprudential regulation, monetary policy, and effects on regional inequality.

Main Takeaways

- Household-level survey data on 22 European countries from 2010–2022 shows **distributional effects** of BBM.
- BBM tightening **makes mortgages less available for lower-income households and first-time buyers**, increasing **reliance on renting**.
- Tightening impacts both
 - ▶ **Extensive margin** by cutting off risky borrowers from the mortgage market, mitigating the risks for the banking sector, and
 - ▶ **Intensive margin** by reducing average loan amount.
- Higher-income households benefit from **lower borrowing costs** due to **reduced risk**.
- **BBM easing** does not fully reverse the effects of tightening.

Data: Household Finance and Consumption Survey (HFCS)



No. of waves:  0 1 2 3 4

- **Four waves:**
 - ▶ 2010–2011: released in 2013; 15 countries
 - ▶ 2013–2015: released in 2016; 20 countries
 - ▶ 2017: released in 2020; 22 countries
 - ▶ 2020–2022: released in 2023; 22 countries
- **Cross-sectional data:** Households are usually observed once across waves.

Data: Propensity Score Matching

- **BBM can affect:**
 - ▶ The decision to get a mortgage or not (extensive margin)
 - ▶ Lending conditions for those who get a mortgage (intensive margin)
- **Propensity score matching** used to obtain two comparable groups of households: those with and without a new mortgage, both before and after BBM tightening.
- **Matching** households from pre- and post-BBM tightening periods **based on household characteristics**: income, wealth, creditworthiness, and other factors (age, education, employment status, size of the household, and home ownership).
 - ▶ Matching similar households reduces selection bias by controlling for pre-existing differences, creating a balanced comparison group.

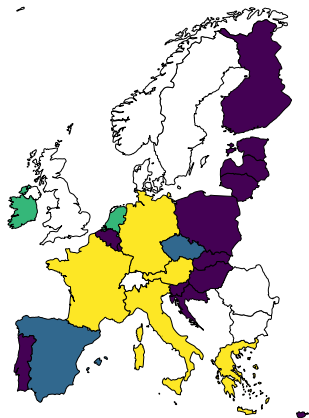
Data: Matching Results and Sample Characteristics

- Propensity score matching with **nearest neighbor method** (1:2 ratio, caliper width 0.05).
- **Matching results:**
 - ▶ Standardized mean differences for covariates reduced to <0.1 .
 - ▶ Variance ratios between 1 and 1.1.
 - ▶ Good balance, significant overlap in propensity scores.
 - ▶ Matched sample: 92,729 treated and 178,289 control units.
 - ▶ 50,427 (16%) of households unmatched.

Table: Household Characteristics

Female (% share)	33.1
Average age	48.7
Employed/Self-employed (% share)	81.9
Secondary education (% share)	94.2
Tertiary education (% share)	50.2
Household type (% share):	
Two adults younger than 65Y	17.2
Two adults, at least one aged 65Y and over	7.7
Three or more adults	6.3
Single parent with dep. children	4.4
Two adults with one dep. child	14.6
Two adults with two dep. children	19.6
Two adults with three or more dep. children	8.3
Three or more adults with dep. children	5.8
One adult, younger than 64Y	12.1
One adult, older than 65Y	4.0

Data: Integrated Macprudential Policy (iMaPP) Database



- Developed by Alam *et al.* (2019) and maintained by the IMF.
- **Dummy-type indicators** for BBM tightening or loosening (LTV and DSTI limits), monthly frequency.
- **Aggregated** iMaPP data to match the HFCS waves.

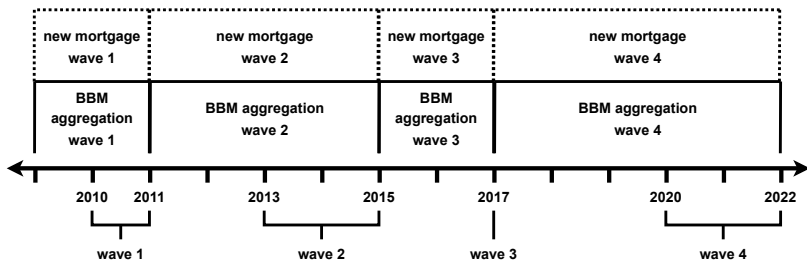


Data: iMaPP and HFCS

Table: Number of Countries That Tightened or Loosened BBM

Wave	Total	Any BBM tightened	LTV limit tightened	DSTI limit tightened	Any BBM loosened	LTV limit loosened	DSTI limit loosened
1	15	2	2	0	1	1	0
2	20	4	3	3	1	0	1
3	22	10	9	6	1	1	0
4	22	14	10	9	9	3	8

Figure: Combining iMaPP and HFCS



New Mortgages and Renting

	Any new mortgage	First new HMR mortgage	Second and third new HMR mortgage	New mortgage using other property	Renting
Total	9,504	6,755	1,159	2,751	43,664
Income deciles (share in %)					
1	2.8	3.0	2.4	2.0	21.4
2	4.2	4.6	3.5	3.1	16.2
3	5.8	6.5	5.4	3.6	12.7
4	7.7	8.6	7.6	5.1	10.3
5	9.7	10.6	10.2	7.3	9.5
6	11.6	12.5	12.9	8.9	9.4
7	12.5	13.0	12.8	11.6	7.4
8	14.4	14.3	15.2	14.4	5.4
9	16.0	15.0	16.5	19.7	3.8
10	15.3	11.9	13.5	24.2	3.9

- HFCS records **up to three mortgages on household main residence (HMR)**, a place where household live for most of the year.
- HFCS record also **mortgages on using other property** as collateral (both residential and commercial real estate).

New Mortgage on the First HMR: Characteristics

	No. Properties	Loan amount (EUR)	LTV (%)	Lending rate (%)	Maturity (years)	Down-payment (% of collateral)	Coowning (% share)
Mean	1.77	118,570	50.9	3.06	21.0	50.0	2.13
Income deciles							
1	1.34	75,377	53.1	3.51	20.7	49.7	5.00
2	1.40	86,673	54.0	3.43	21.2	47.2	3.42
3	1.47	96,946	56.5	3.19	21.8	44.2	2.62
4	1.50	105,938	52.0	3.22	21.1	48.4	1.88
5	1.60	107,581	52.3	3.13	21.1	48.0	1.89
6	1.64	120,632	51.2	2.96	21.6	49.1	1.49
7	1.76	128,268	50.0	2.92	21.0	50.2	1.43
8	1.93	136,739	48.5	2.80	21.1	51.8	1.55
9	2.17	148,674	47.4	2.77	20.4	53.0	1.15
10	2.92	179,807	43.4	2.71	19.6	58.9	0.80

- **Loan amount** increases with borrower's income while **lending rate** decreases.
- The share of households with a new mortgage **having a co-applicant** (i.e., not owning 100% of the property they are buying) is much higher for low income households.

Methodology

$$Y_{l,i,c,t} = \beta BBM_{c,t} + \gamma X_{i,c,t} + \alpha_c + \alpha_t + \epsilon_{l,i,c,t}$$

$$Y_{l,i,c,t} = \beta BBM_{c,t} \times IncomeDecile_{i,c,t} + \gamma X_{i,c,t} + \alpha_{c,t} + \epsilon_{l,i,c,t}$$

- Where $Y_{l,i,c,t}$ is
 - ▶ dummy for obtaining a new mortgage (extensive margin), or
 - ▶ log-amount and other characteristics of new mortgage (intensive margin)
- $BBM_{c,t}$ is dummy for BBM tightening action.
- $IncomeDecile_{i,c,t}$ is income deciles within-country.
- $X_{i,c,t}$ are controls for household characteristics:
 - ▶ Household income and wealth deciles, the gender, age (in linear and quadratic terms), education, and employment status of the household's reference person, and the type of household in terms of its size and composition.
- α_c and α_t are country and time fixed effects.
- Bootstrap standard errors (1,000 replications) and survey weights used.

Road-map of the Results

- Probability of getting a new mortgage
- Renting vs. owning a house
- Loan amount
- Borrowing costs, maturity, and downpayment
- Robustness tests and future steps

Probability of Getting a New Mortgage

	(1) Any new mortgage	(2)	(3) HMR first mortgage	(4)	(5) HMR second and third mortgage	(6)	(7) Mortgage on other property	(8)
BBM	-0.0344*** (0.0026)		-0.0239*** (0.0023)		-0.0032*** (0.001)		-0.012*** (0.0012)	
BBM × Decile		-0.0091*** (0.0007)		-0.0055*** (0.0006)		-0.0016*** (0.0003)		-0.0042*** (0.0003)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country FEs	Y	N	Y	N	Y	N	Y	N
Time FEs	Y	N	Y	N	Y	N	Y	N
Ctry × Time FEs	N	Y	N	Y	N	Y	N	Y
Obs.	207,039	207,039	207,039	207,039	207,039	207,039	207,039	207,039

- **BBM tightening reduces the probability of obtaining a new mortgage by 3.4%**, with the strongest effect on first-time buyers.
- **Low-income households are less likely to get the first HMR mortgage**, while high-income households are less likely to obtain mortgages for other properties, with stronger effects at income extremes (next slide).

Probability of Getting a New Mortgage: Breakdown by Income Groups

Panel A: Below- vs. Above-Median Income

	(1) Any new mortgage	(2)	(3) HMR first mortgage	(4)	(5) HMR second and third mortgage	(6)	(7) Mortgage on other property	(8)
BBM	-0.0341*** (0.0029)	-0.0319*** (0.005)	-0.0281*** (0.0026)	-0.0157*** (0.0045)	-0.005*** (0.0011)	0.0009 (0.0022)	-0.0068*** (0.0013)	-0.0185*** (0.0024)
Income group	≤5th decile	>5th decile	≤5th decile	>5th decile	≤5th decile	>5th decile	≤5th decile	>5th decile
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country FEs	Y	Y	Y	Y	Y	Y	Y	Y
Time FEs	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	103,584	103,455	103,584	103,455	103,584	103,455	103,584	103,455

Panel B: Below 3rd Decile and vs. Above 8th Decile

	(1) Any new mortgage	(2)	(3) HMR first mortgage	(4)	(5) HMR second and third mortgage	(6)	(7) Mortgage on other property	(8)
BBM	-0.0265*** (0.0029)	-0.0295*** (0.0067)	-0.0225*** (0.0026)	-0.0049 (0.0059)	-0.0049*** (0.0009)	0.0026 (0.0027)	-0.0038*** (0.0014)	-0.0251*** (0.0035)
Income group	≤2nd decile	≥9th decile	≤2nd decile	≥9th decile	≤2nd decile	≥9th decile	≤2nd decile	≥9th decile
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country FEs	Y	Y	Y	Y	Y	Y	Y	Y
Time FEs	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	62,158	62,057	62,158	62,057	62,158	62,057	62,158	62,057

Probability of Getting a New Mortgage: High DTI Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Any new mortgage		HMR first mortgage		HMR second and third mortgage		Mortgage on other property	
BBM	-0.1364*** (0.0124)	-0.0199*** (0.0024)	-0.123*** (0.0116)	-0.0094*** (0.002)	-0.0225*** (0.0056)	-0.0006 (0.0009)	-0.0237*** (0.0054)	-0.0107*** (0.0012)
DTI	>9th decile	≤9th decile	>9th decile	≤9th decile	>9th decile	≤9th decile	>9th decile	≤9th decile
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Country FEs	Y	Y	Y	Y	Y	Y	Y	Y
Time FEs	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	22,259	184,780	22,259	184,780	22,259	184,780	22,259	184,780

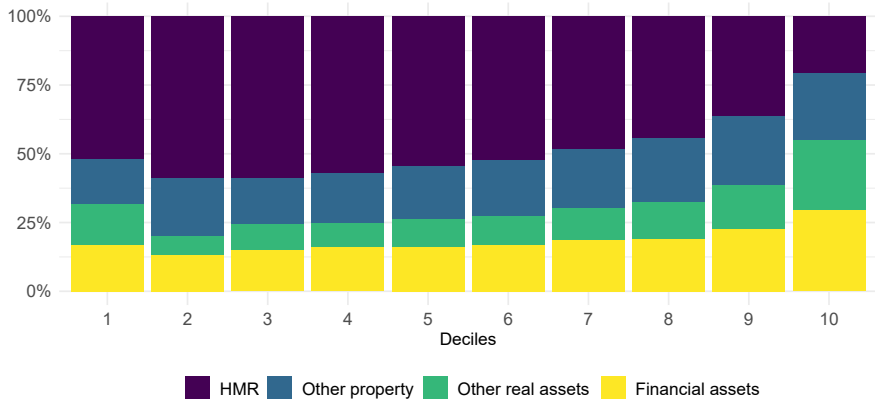
- Households with **higher debt-to-income ratios** are significantly less likely to obtain a new mortgage.
 - BBM regulation is **primarily cutting off risky borrowers** from the mortgage market, mitigating the risks for the banking sector.

Renting vs. Owning a House

	(1) Renting: All HHs	(2)	(3) Renting: Below-median income	(4) Renting: Above-median income
BBM	0.0214*** (0.0064)		0.0241*** (0.0088)	0.0112 (0.0082)
BBM × Decile		-0.0055*** (0.0011)		
Controls	Y	Y	Y	Y
Country FEs	Y	N	Y	Y
Time FEs	Y	N	Y	Y
Ctry × Time FEs	N	Y	N	N
Obs.	207,039	207,039	103,584	103,455

- “Sanity checks” of the extensive margin results – impact on households’ probability of renting vs. owning and the change in their real assets.
- BBM tightening **increases the probability of renting** by about 2%, mainly affecting low-income households.

Real vs. Financial Assets



Change in Real Assets

	(1)	(2)	(3)	(4)
	Real assets (ln): All HHHs		Real assets (ln): Below-median income	Real assets (ln): Above-median income
BBM	-0.0676*** (0.0209)		-0.0993*** (0.0296)	0.0213 (0.0204)
BBM × Decile		-0.0255*** (0.0038)		
Controls	Y	Y	Y	Y
Country FEs	Y	N	Y	Y
Time FEs	Y	N	Y	Y
Ctry × Time FEs	N	Y	N	N
Obs.	207,039	207,039	103,584	103,455

- **Real assets decrease** by 6.8% on average after BBM tightening, with below-median income households experiencing a 10% reduction.

Loan Amount

	(1)	(2)	(3)	(4)	(5)	(6)
	New loan (ln): HMR mortgages		New loan (ln): Only first HMR mortgage		New loan (ln): Other mortgages	
BBM	-0.009 (0.0306)		-0.0004 (0.0314)		-0.0762 (0.1054)	
BBM × Decile		-0.0113 (0.0113)		-0.011 (0.0117)		-0.0061 (0.0173)
Controls	Y	Y	Y	Y	Y	Y
Country FEs	Y	N	Y	N	Y	N
Time FEs	Y	N	Y	N	Y	N
Ctry × Time FEs	N	Y	N	Y	N	Y
Obs.	17,248	17,248	16,422	16,422	7,620	7,620

- Average new mortgage amounts **do not significantly change** post-BBM tightening.
- There is a negative effect, but it is weak and not statistically significant.

Loan Amount: Below and Above Median

	(1)	(2)	(3)	(4)	(5)	(6)
	New loan (ln): HMR mortgages		New loan (ln): Only first HMR mortgage		New loan (ln): Other mortgages	
BBM	-0.057* (0.0298)	0.1014* (0.0537)	-0.059* (0.0307)	0.075 (0.0518)	0.0265 (0.1454)	-0.1989 (0.147)
Income group	≤5th decile	>5th decile	≤5th decile	>5th decile	≤5th decile	>5th decile
Controls	Y	Y	Y	Y	Y	Y
Country FEs	Y	Y	Y	Y	Y	Y
Time FEs	Y	Y	Y	Y	Y	Y
Obs.	8,234	8,188	8,649	8,599	3,839	3,781

- Significant drop in loan amounts for below-median income households (5.7% decrease).
- Increase in loan amounts for above-median income households (10% increase).

Loan Amount: Top and Bottom 20%

	(1)	(2)	(3)	(4)	(5)	(6)
	New loan (ln): HMR mortgages		New loan (ln): Only first HMR mortgage		New loan (ln): Other mortgages	
BBM	-0.0634 (0.0501)	0.1765 (0.1261)	-0.098* (0.0501)	0.1627 (0.1225)	0.011 (0.2036)	-0.0585 (0.1917)
Income group	≤2nd decile	≥9th decile	≤2nd decile	≥9th decile	≤2nd decile	≥9th decile
Controls	Y	Y	Y	Y	Y	Y
Country FEs	Y	Y	Y	Y	Y	Y
Time FEs	Y	Y	Y	Y	Y	Y
Obs.	3,301	3,275	3,465	3,430	1,541	1,504

- For borrowers in the tails of the income distribution, the direction of the effects remains similar but loses some statistical significance.
- High-income households increase mortgage amounts for HMR but decrease for other properties, aligning with the lower likelihood of obtaining such mortgages (extensive margin effects).
- This suggests a [preference for alternative investments or substituting higher mortgages on HMR](#); results are economically meaningful but not statistically significant.

Change in Borrowing Costs

	(1) Lending rate: All	(2) Lending rate: All	(3) Lending rate: Below- median income	(4) Lending rate: Above- median income	(5) Lending rate: Low income	(6) Lending rate: High income
BBM	-0.2163** (0.1002)		-0.0747 (0.1548)	-0.358*** (0.1196)	-0.1027 (0.2729)	-0.1126 (0.2233)
BBM × Decile		0.0300* (0.0167)				
Controls	Y	Y	Y	Y	Y	Y
Country FEs	Y	N	Y	Y	Y	Y
Time FEs	Y	N	Y	Y	Y	Y
Ctry × Time FEs	N	Y	N	N	N	N
Obs.	12,381	12,381	6,217	6,164	2,447	2,398

- **Lending rates decrease significantly**, especially for above-median income households.
 - ▶ Middle-income households benefit the most from reduced lending rates, while low- and high-income groups see less impact.

Change in Maturity

	(1) All	(2) All	(3) Below median	(4) Above median	(5) DSR < 40%	(6) DSR > 40%	(7) DSR > 50%
BBM	0.4479 (0.5848)		0.638 (0.8767)	0.2519 (0.7273)	0.1974 (0.6067)	3.2809* (1.7115)	4.9876*** (1.8708)
BBM × Decile		0.0198 (0.0857)					
Controls	Y	Y	Y	Y	Y	Y	Y
Country FEs	Y	N	Y	Y	Y	Y	Y
Time FEs	Y	N	Y	Y	Y	Y	Y
Ctry × Time FEs	N	Y	N	N	N	N	N
Obs.	12,993	12,993	6,542	6,451	12,039	913	612

- **Mortgage maturity increases significantly** for households with higher debt service ratios.
 - ▶ Households with already high debt service may need to stretch out the repayments over a longer period to meet the new tighter regulation, i.e., lower DSR limits.
 - ▶ DSR: Ratio between total HMR mortgage debt payments and household gross income.

Change in Downpayment

	(1) All	(2) All	(3) Below median	(4) Above median	(5) DSR < 40%	(6) DSR > 40%	(7) DSR > 50%
BBM	-1.1948 (2.6037)		-1.8447 (4.0369)	-0.0957 (2.9366)	-1.7951 (2.6082)	6.8729 (8.4095)	6.7229 (10.9399)
BBM × Decile		-0.5106 (0.508)					
Controls	Y	Y	Y	Y	Y	Y	Y
Country FEs	Y	N	Y	Y	Y	Y	Y
Time FEs	Y	N	Y	Y	Y	Y	Y
Ctry × Time FEs	N	Y	N	N	N	N	N
Obs.	16,352	16,352	8,234	8,118	15,083	946	622

- The downpayment is calculated as the value of HMR minus mortgage debt, as a percentage of the HMR value.
- **No significant average effect** on downpayment amounts.
 - ▶ No significant results, even when differentiating between less and more liquid households based on their savings.

Additional Tests

- Easing of borrower-based measures
 - ▶ BBM easing effects are generally opposite to BBM tightening but often not statistically significant.
 - ▶ Probability of obtaining a mortgage increases and probability of renting decreases, but effects are weak.
 - ▶ Loan amounts increase for low-income households, but borrowing costs rise, reflecting riskier borrowers, with limited significance.
- Controlling for interaction between monetary policy shocks and household income
 - ▶ Monetary policy could have distributional effects (Berisha *et al.*, 2018; Auclert, 2019; Albert & Gómez-Fernández, 2021).
- Controlling for interaction terms with household characteristics
 - ▶ Results are not driven by other household characteristics correlated with income.

What We Plan to Do Next

- Improve identification of effects by **comparing predicted and actual LTV ratios** (Van Bakkum *et al.*, 2019).
 - ▶ Use pre-BBM data to predict LTV and DSTI ratios based on household characteristics.
 - ▶ Implement difference-in-differences analysis to identify treated households.
- Control for **other macroprudential measures** and their interactions with income.
- Extend the analysis for **BBM intensity**, i.e., using distance to LTV and DSTI limits rather than a dummy, and exploring different nuances of the regulation (targeting buy-to-let, exceptions for young borrowers, etc.).
- Control for **country-level characteristics** (beyond the fixed effects).
- Analyze the impact on **different components of household wealth**.

Conclusions

- BBM tightening **reduces the likelihood of obtaining new mortgages**, particularly for lower-income households and first-time buyers.
- For these households, BBM tightening **increases reliance on renting** and decreases the average value of their real assets.
- Tightening impacts both the **extensive margin** (cutting off risky borrowers from the mortgage market) and the **intensive margin** (reducing the average loan amount; less significant effect).
- Higher-income households benefit from **lower borrowing costs** due to **reduced risk**.
- **BBM easing** shows opposite effects but is not statistically significant.
- Macroprudential policy effectively **targets risky borrowers**, potentially reducing inequality by increasing financial system resilience.

Thank you for your attention!

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