Measuring the effects of borrower-based policies on new housing loans

Natalia Levenko*, Merike Kukk, Nicolas Reigl

*Tallinn University of Technology, Bank of Estonia

All viewpoints are personal

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AIM OF THE PAPER

Aim of the paper is to assess the efficacy of borrow-based macroprudential instruments, namely debt service-to-income (DSTI) ratio cap.

What is the impact of the DSTI limit on loan growth?

Does the effect change over time?

TYPES OF MACROPRUDENTIAL POLICIES

Macroprudential policy aims at strengthening financial stability by increasing resilience of financial system to shocks.

Three categories of macro-prudential regulations:

- supply-side credit policies → ability of commercial banks to issue loans (capital-based and liquidity-based measures)
- demand-side or borrow-based credit policies → ability of households to borrow funds
- housing-market-related tax policies → housing prices, e.g. through the user cost of home ownership

BORROW-BASED POLICY MEASURES

Demand-side or borrow-based credit policies = limits on:

- loan-to-value
- loan-to-income
- debt-to-income
- debt service-to-income (DSTI) ratios

BORROW-BASED POLICY IN ESTONIA

No borrower-based policy measures before March 2015

Limits were placed on three indicators:

1) Loan-to-value ratio: 85% (special cases 90%)
2) Debt service-to-income ratio: 50%
3) Loan maturity: 30 years

Exceptions allowed for 15% of quarterly loan volumes.

BORROW-BASED POLICY IN EUROPE

European Systemic Risk Board
(https://www.esrb.europa.eu/home/html/index.en.html)

1) Loan-to-value ratio limit is used in 20 European countries
2) Debt-service-to-income ratio limit is used in 13 European countries
3) Loan maturity limit is used in 10 countries

LITERATURE (1/3)

(1) Using macro data

- panel of countries
- country-specific models → VAR or BVAR

(2) Using micro data

- propensity-score matching
- diff-in-diff methods
- distributional approach [from tax policy analysis: kinks & notches]
  (Kleven & Waseem 2013 in QJE, Kleven 2016 in ARE)

LITERATURE (2/3)

Distributional approach means that distributions with and without policy measure are compared.

- compare distributions before and after
- use a smoothing function as a counterfactual distribution

  DeFusco & Paciorek (2017, in AEJ), Caloia et al. (2022), and Eerola et al. (2022)

LITERATURE (3/3)

Gross & Poblacion (2017) → DSTI is more effective than LTV in containing household risk

Malovana et al. (2022): meta-analysis on 34 studies from 2010-2020:

- DSTI (DTI) limit has been slightly more effective in constraining credit growth than LTV limit
- The studies with micro-founded evidence offers more precise estimates of the policy effects
- The short-term effect of borrower-based measures are smaller than the long-term effect

STRATEGY

Quantify the impact of the DSTI limit on the growth of loan stock

- Analysis at the aggregate level
  - Break-point analysis
  - Dummy regression

- Analysis at micro level using distributional approach ← main contribution

DSTI RATIO

$$DSTI = \frac{(Mortgage\ payment + Other\ debt\ payments)}{Net\ income} \times 100\%$$

Stressed DSTI is computed with annual interest rate 6% or base rate + risk margin + 2%

Limit is put on the stressed DSTI.

Loan-level data for the pre-treatment period is not available.

Sample includes 2016Q2 – 2021Q4.

CHOICES OF A BORROWER

What if DSTI limit is binding for a borrower:

- refuse (or postpone) of taking loan → loss
- take a smaller loan such as the new DSTI <=50% → loss
- take the same loan with new DSTI <=50%, reporting higher income
- take the same loan with the desired DSTI, which is >50% = exception

ASSUMPTIONS

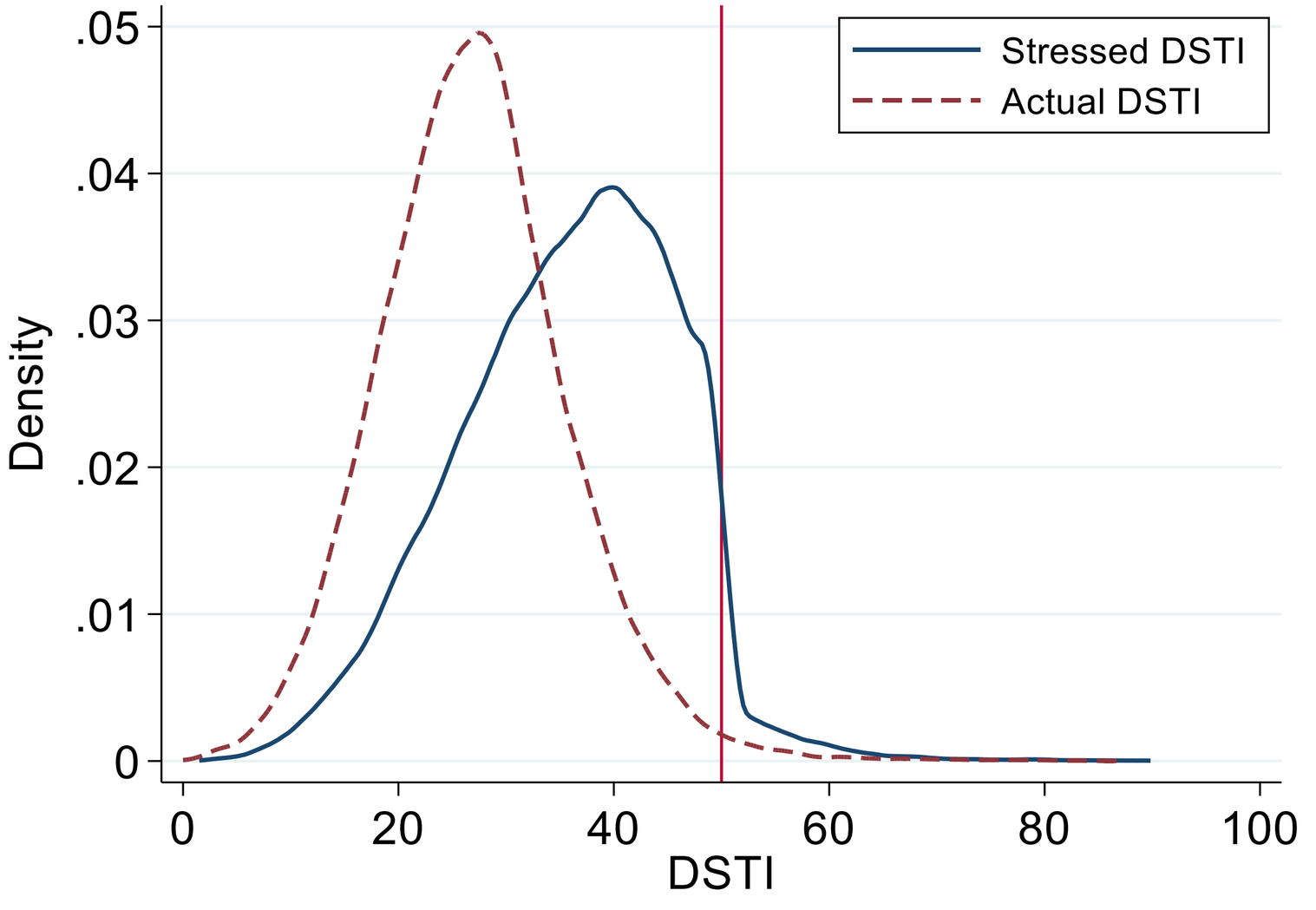
Three assumptions:

- counterfactual distribution of DSTI could be approximated as normal;

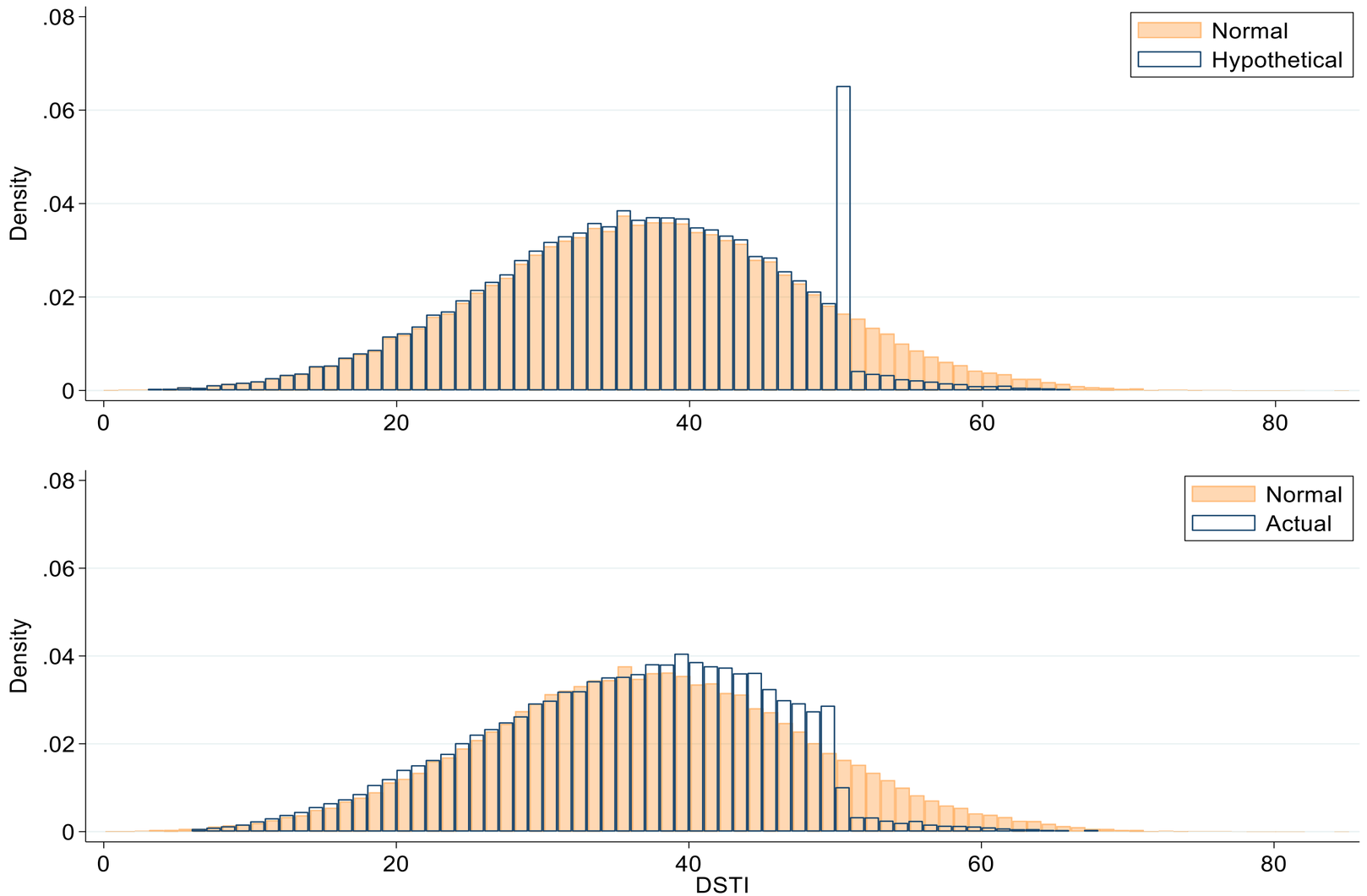
  [aside: DeFusco & Paciorek (2017) → do not allow for extensive margin response]

- behaviour of borrowers with DSTI below or equal to the limit is not affected by the implemented restrictions;
- restricted borrowers, who adjust their DSTI, land up somewhere between median and the limit ← more relaxed assumption than in the literature.

STRESSED VS ACTUAL DSTI



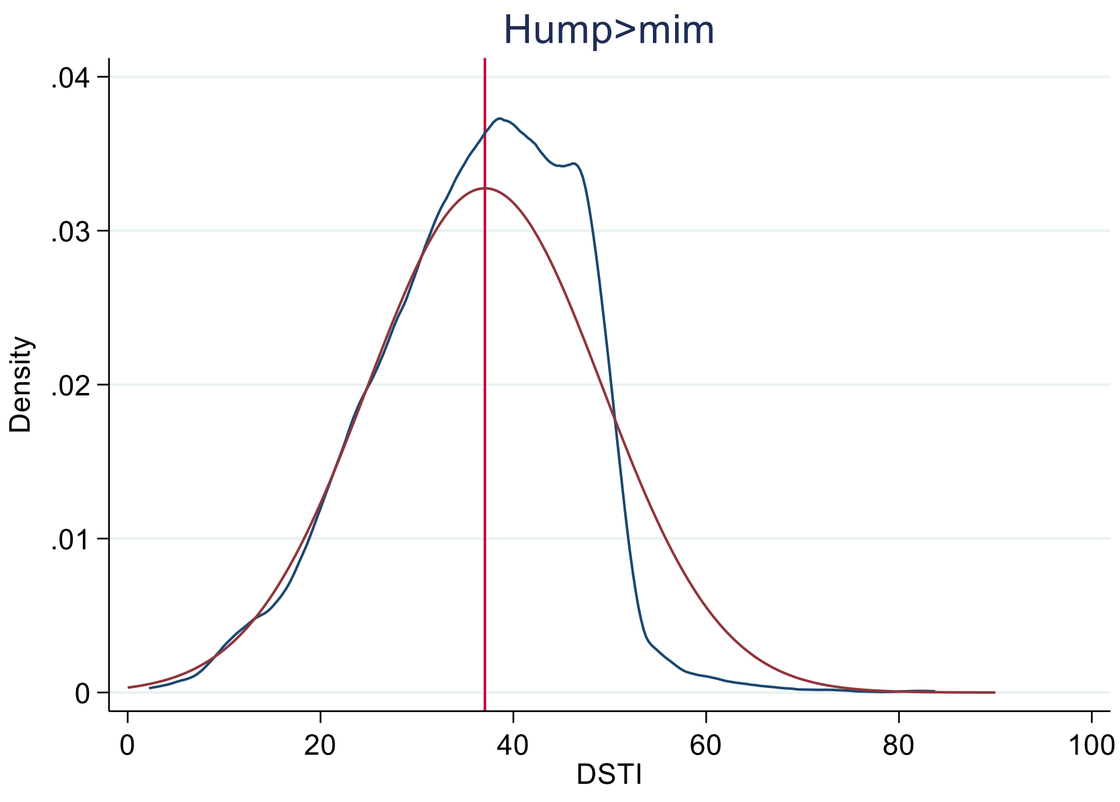
HYPOTHETICAL VS ACTUAL DISTRIBUTION

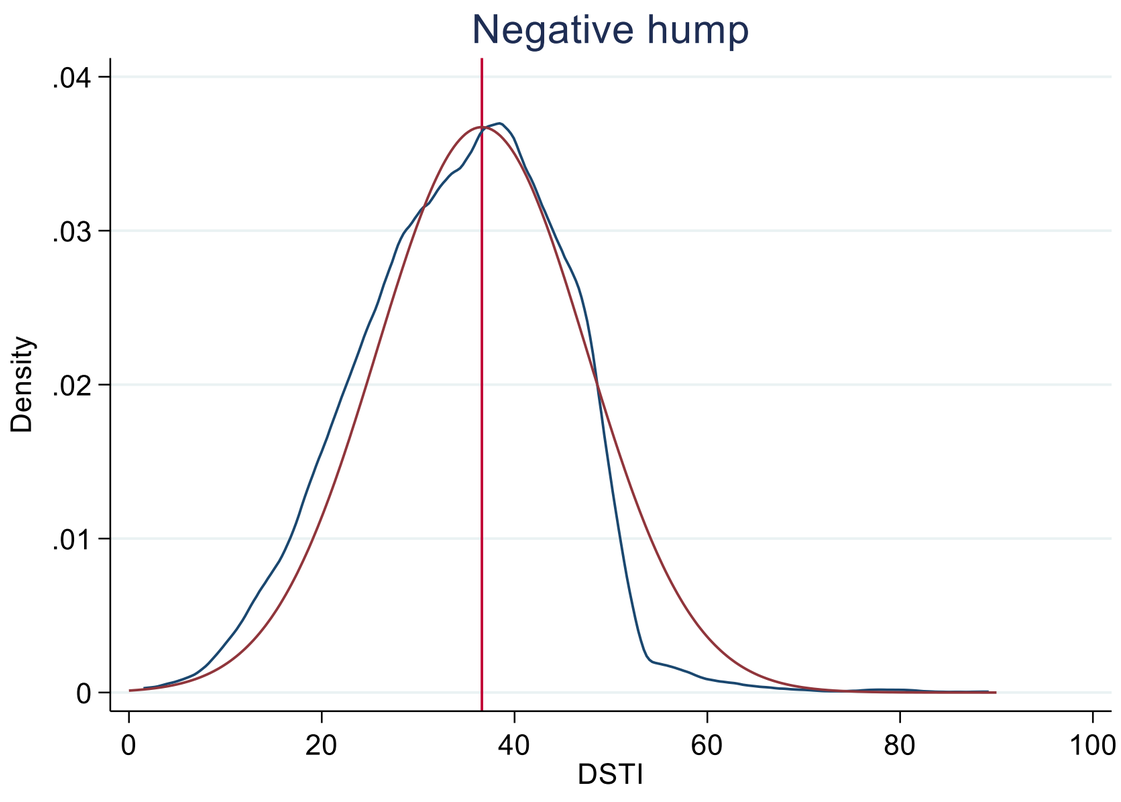


STEPS OF THE ANALYSIS

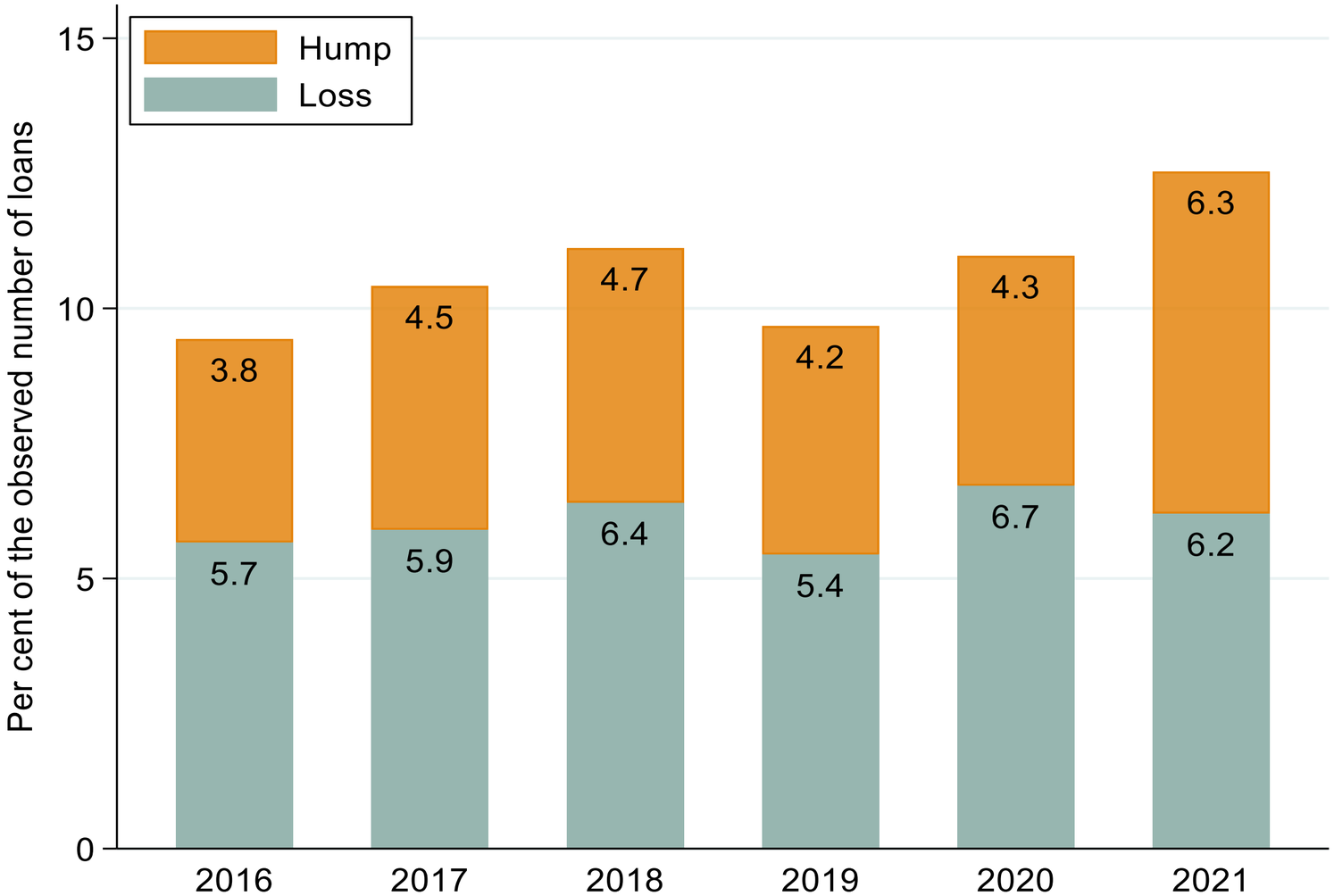
- Generate a set of normal distributions with different parameters for each quarter; current estimations are based 256 distributions for each quarter
- Validate them using second assumption [behaviour of borrowers with the DSTI ≤ 50% is not affected]:
  for each of simulated distribution we compute relative size of the right tail and relative size of the hump and compare them to the actual data; do not use counterfactual distributions if (1) excessive mass (hump) is negative, (2) hump is larger than the missing mass at the right tail
- Validated distributions are averaged → number of the borrowers in the hump and number of those who left the market
- Compute the loss in the volume of loans

EXAMPLES OF BAD DISTRIBUTION





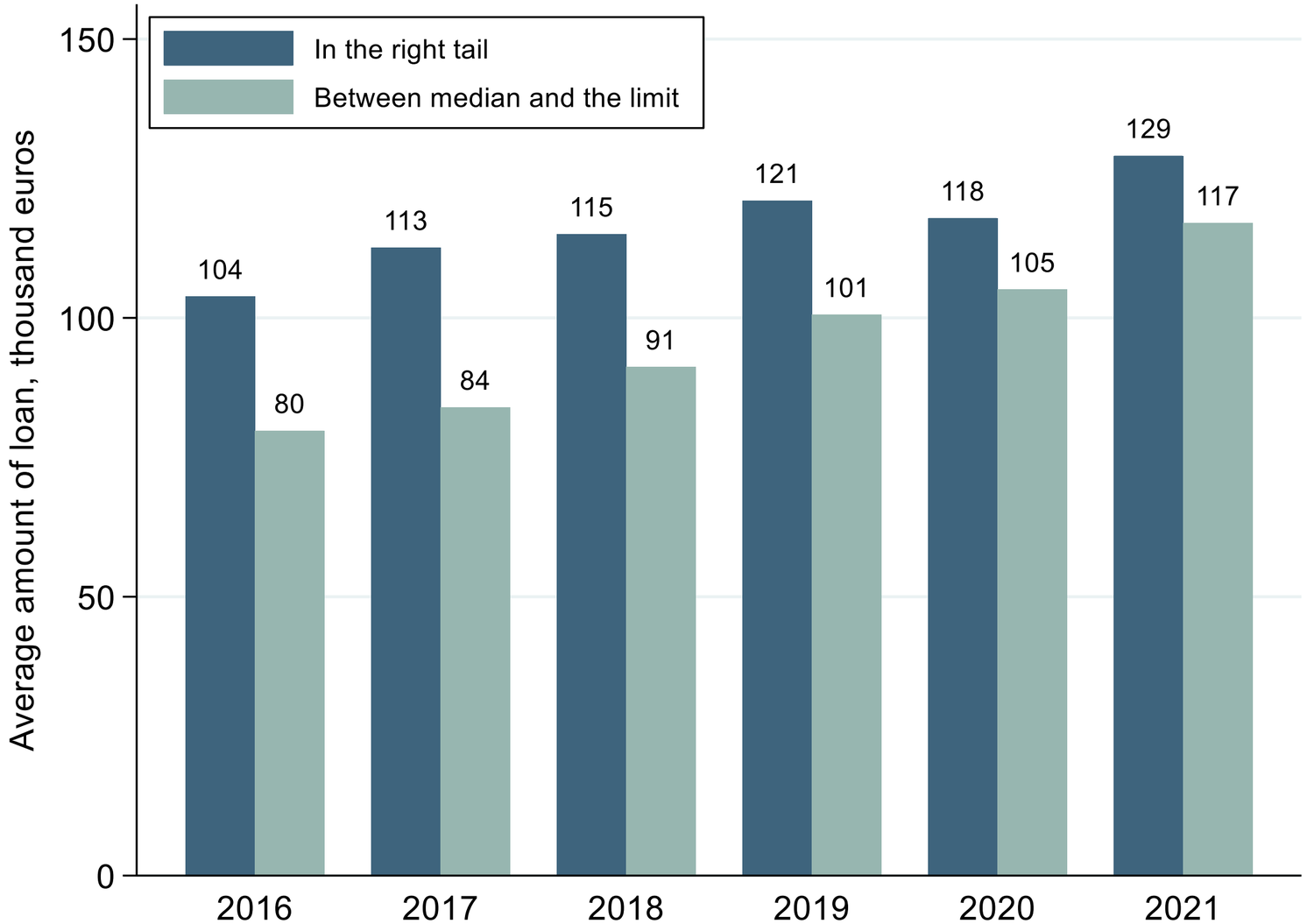
SHARE OF AFFECTED BORROWERS



Average loss in the number of loans is 5-6% and around 4-5% adjust their loans.

The results are stable over several years.

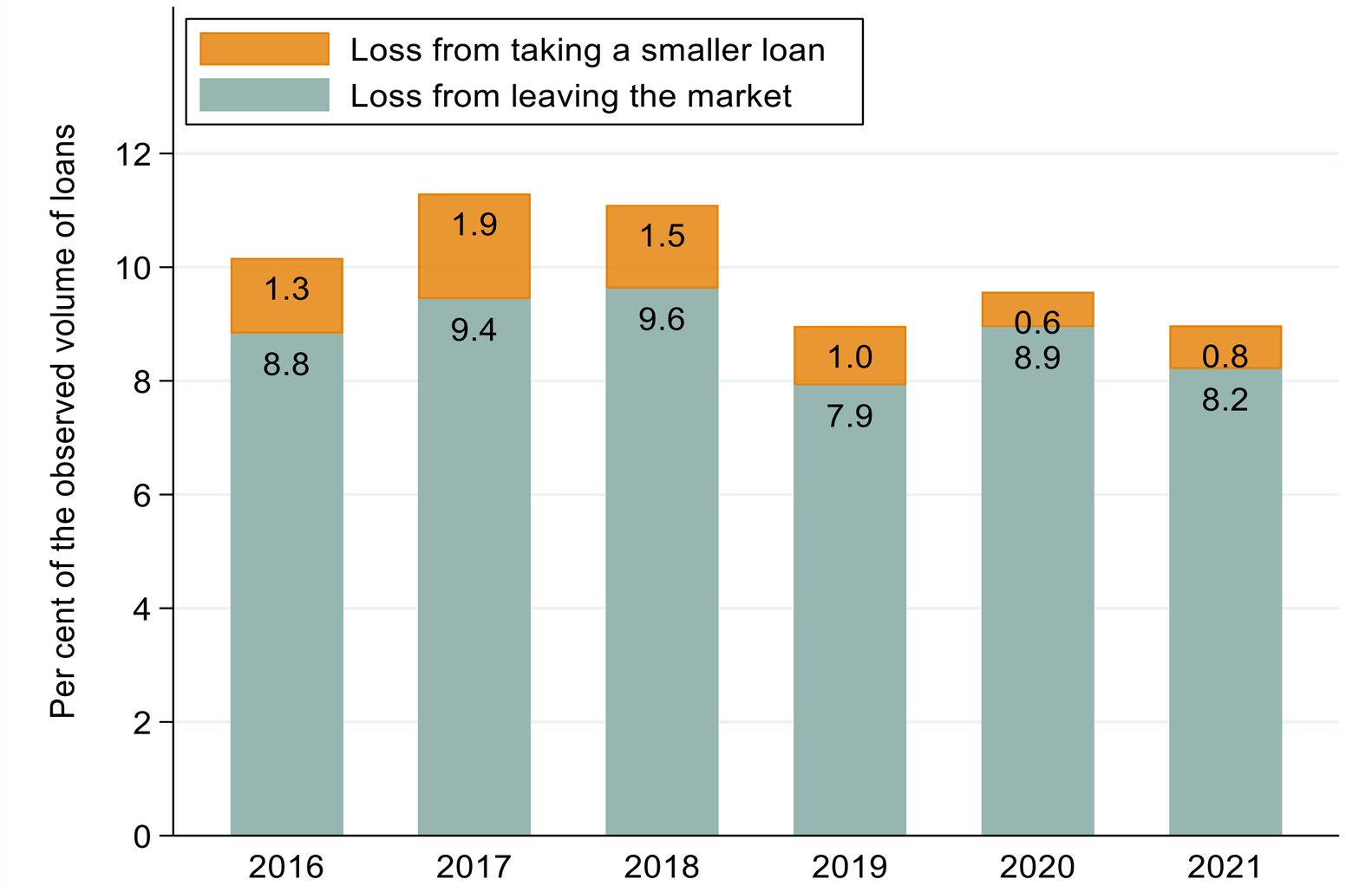
AVERAGE AMOUNT OF LOAN



On average, the amount of loan in the interval between median and the limit is smaller than the amount of loan in the right tail by 17.5%.

In 2016, the difference is 23%; 2021, it is around 10%.

LOSSES IN THE VOLUME OF LOANS

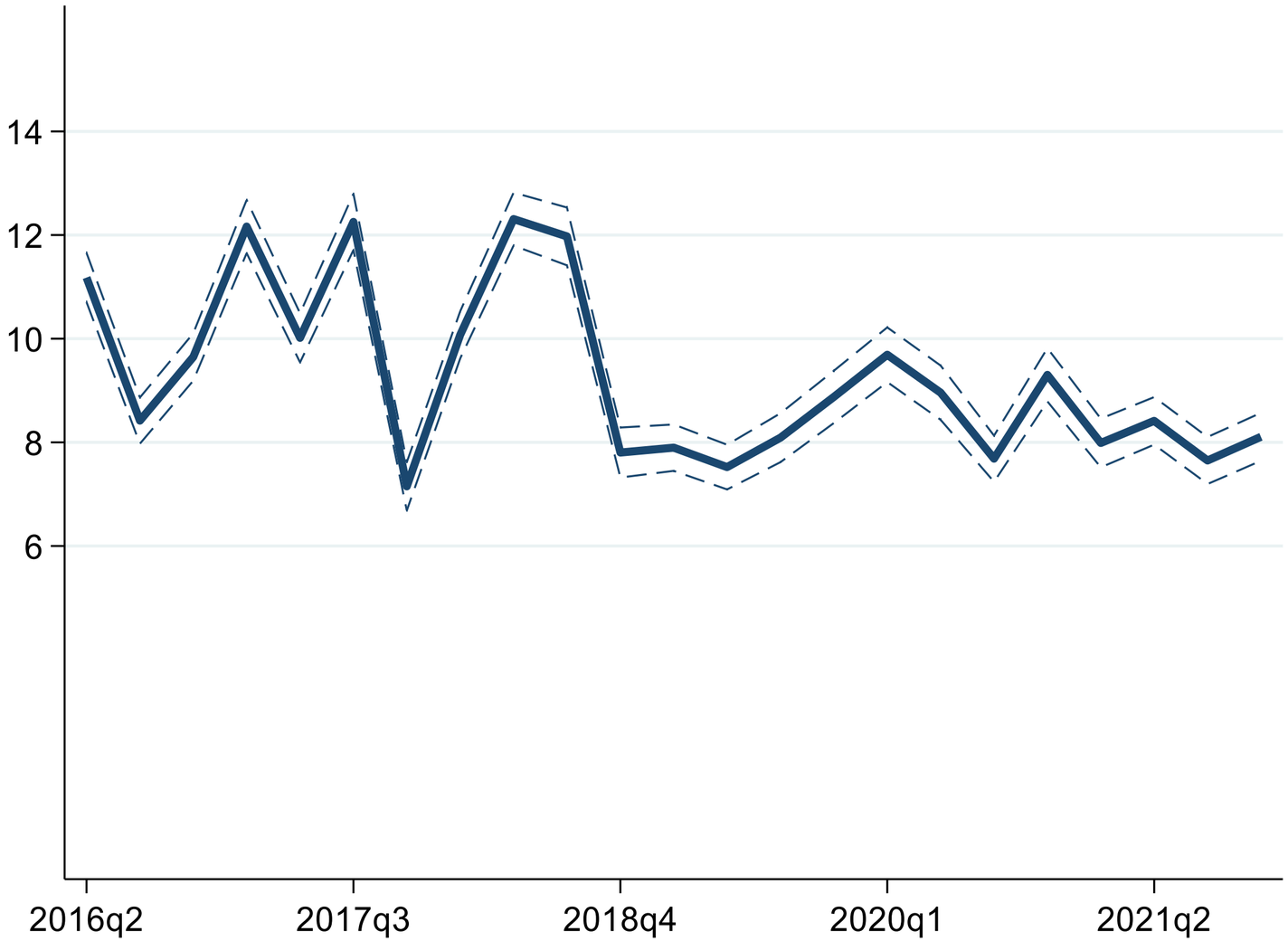


Average loss in the volume of loans is around 10%.

Losses in the volume of loans might be overestimated.

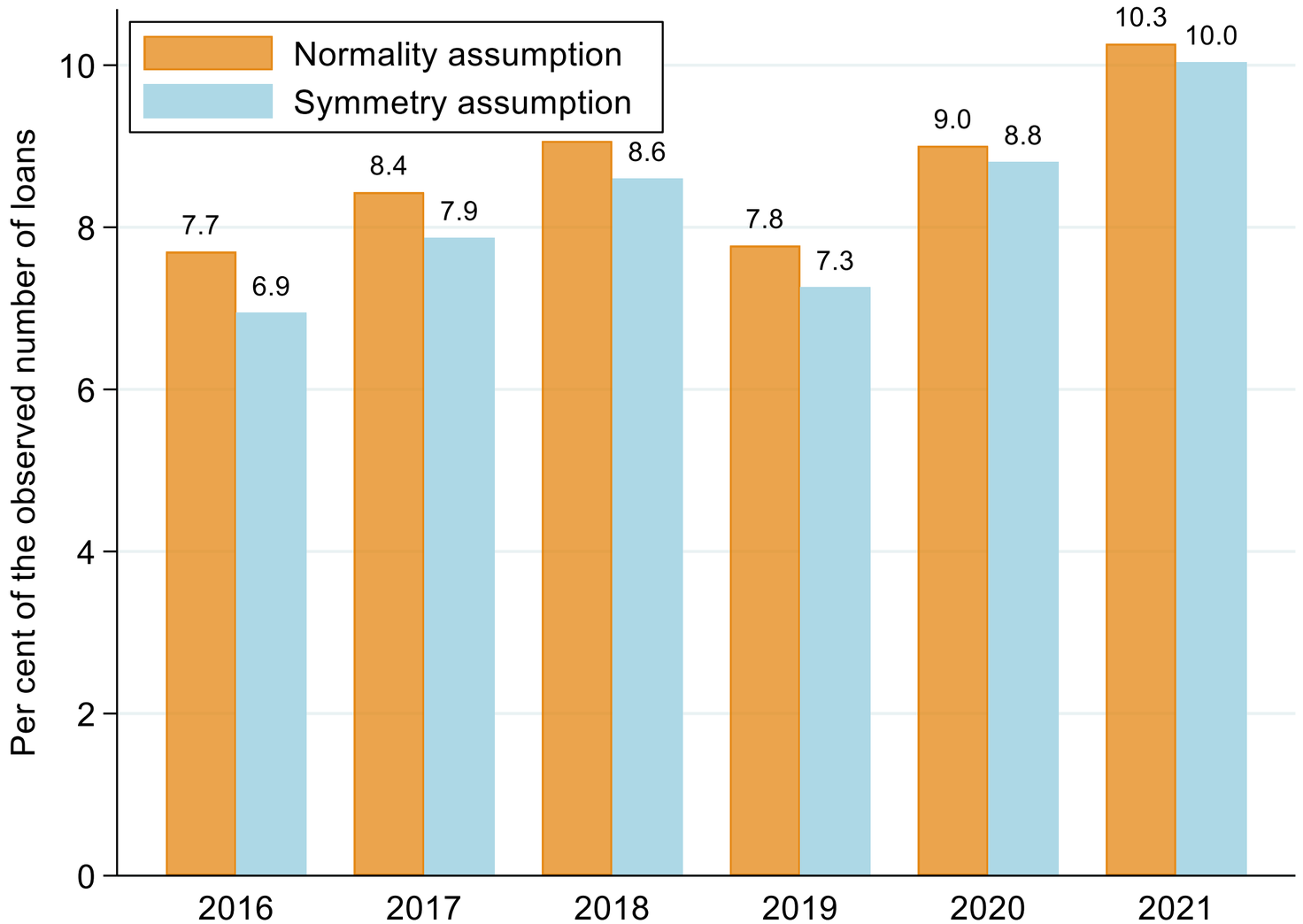
Aastveit et al. (2022) & Eerola et al. (2022): very close estimates.

UPPER AND LOWER BOUNDS OF LOSSES IN VOLUMES

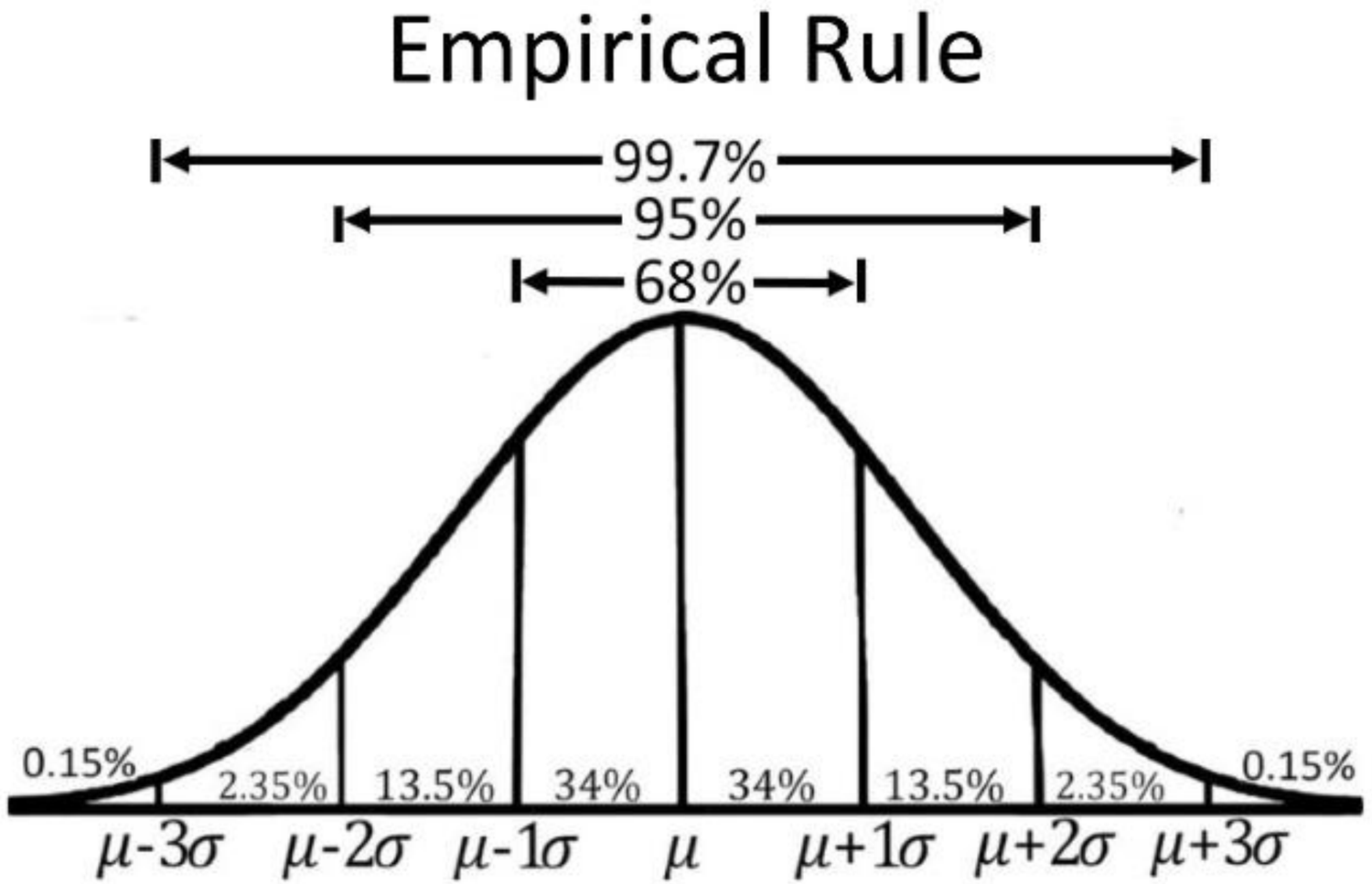


The losses in the volume of loans is on average around **10.0%** over the whole period, lower and upper bounds being 9.5 & 10.4% respectively.

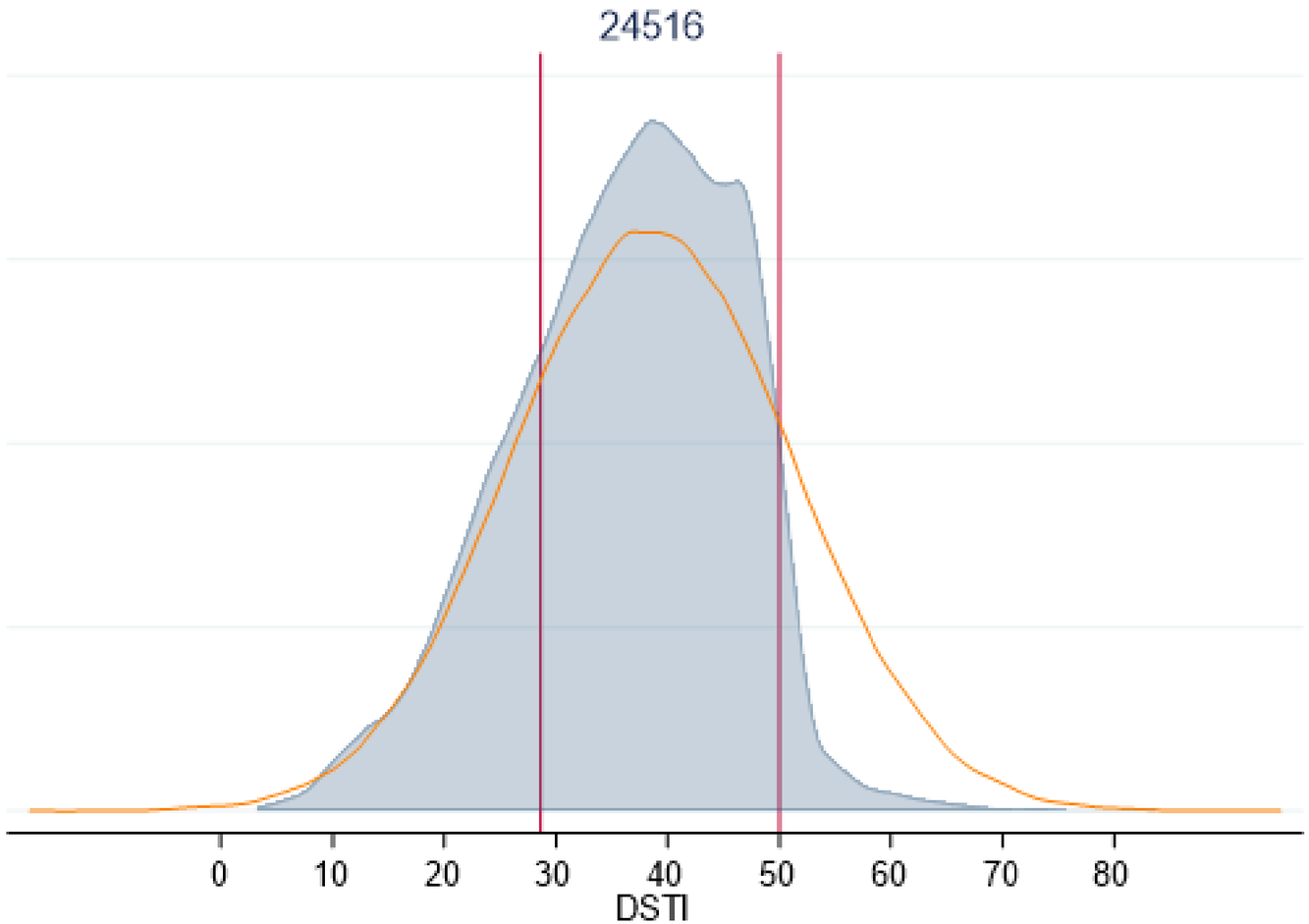
ROBUSTNESS: NORMALITY VS SYMMETRY



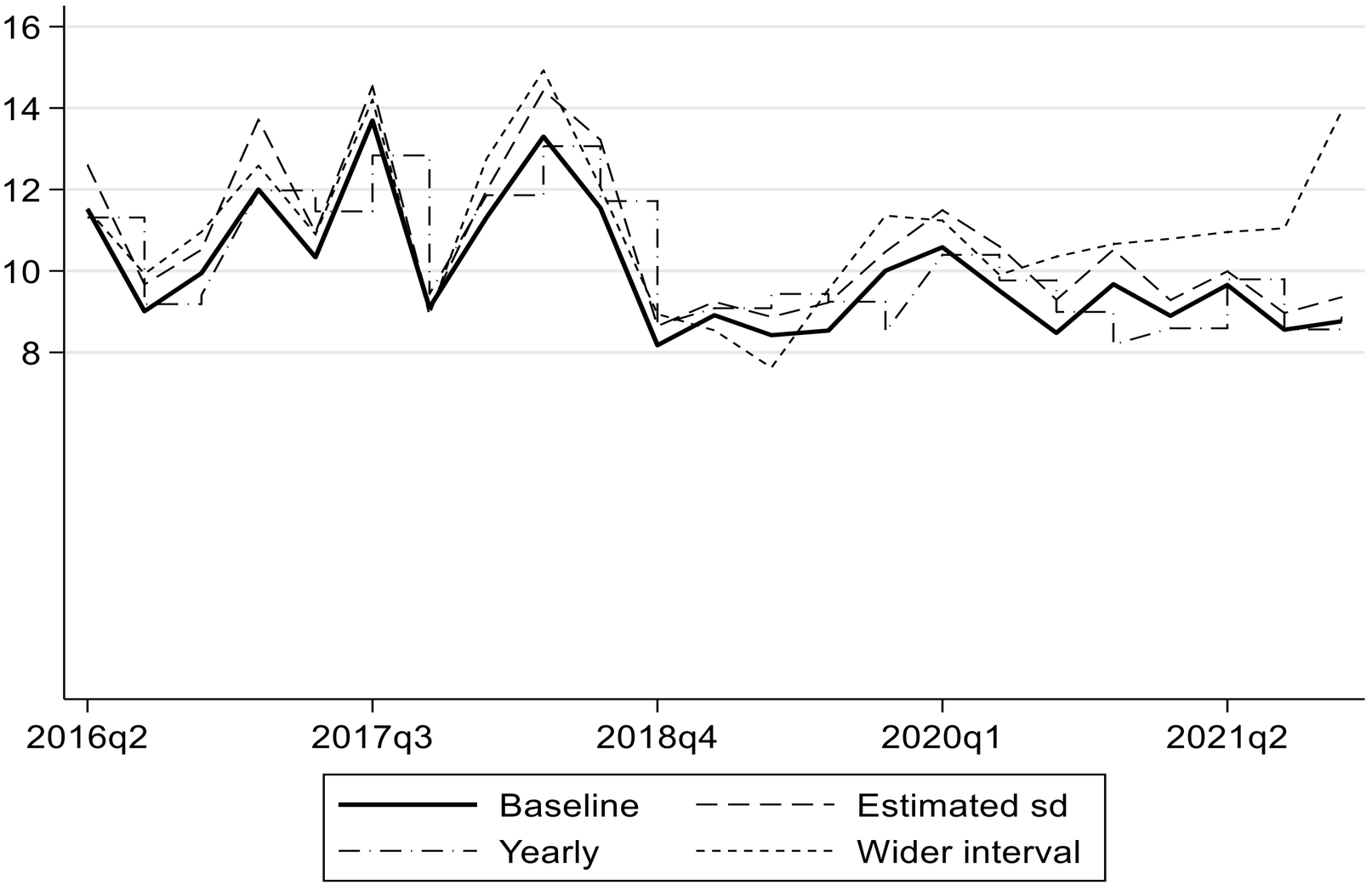
ROBUSTNESS: ESTIMATED STANDARD DEVIATION



ROBUSTNESS: WIDER INTERVAL FOR THE HUMP



ROBUSTNESS ANALYSES

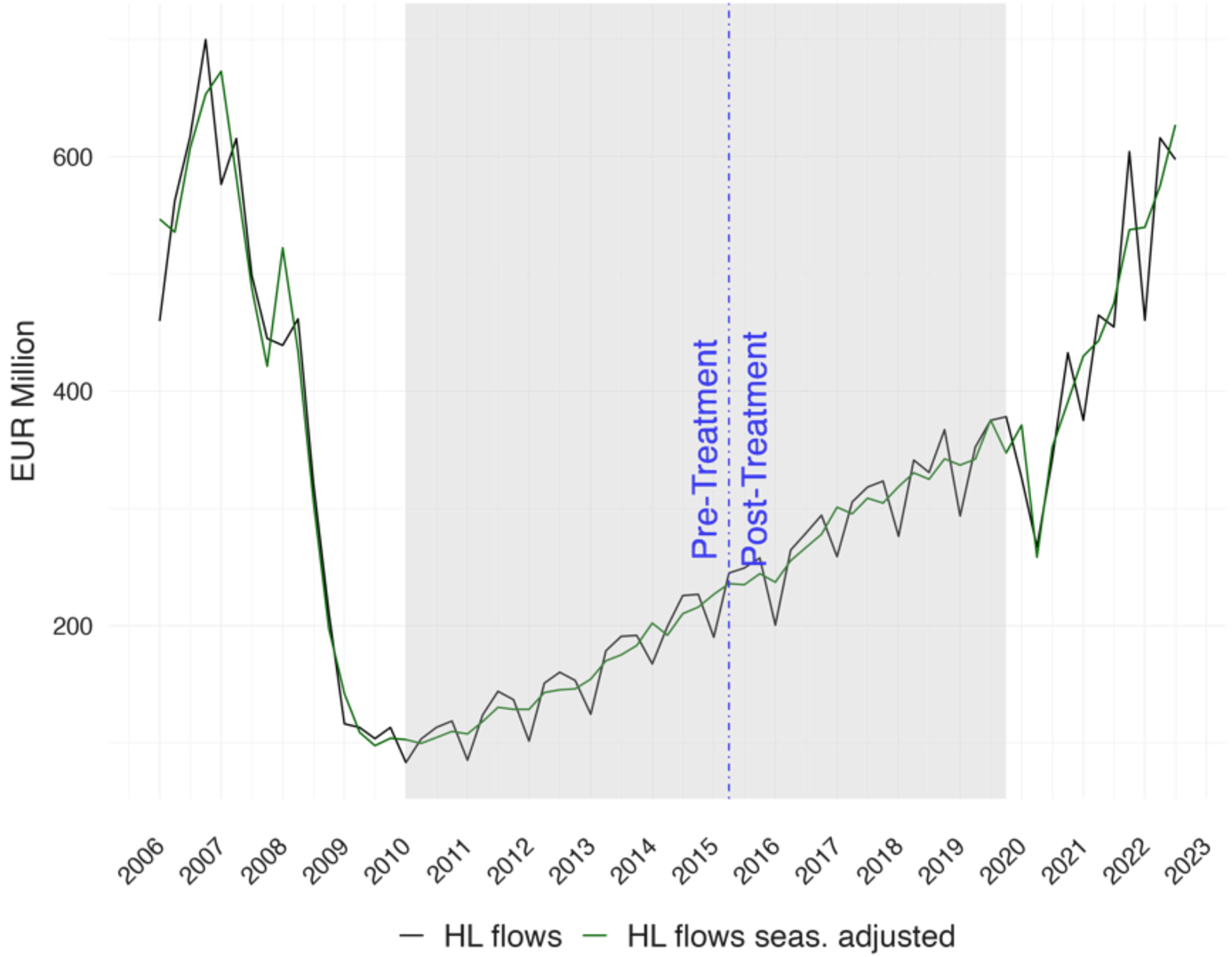


FINAL REMARKS

- Aggregate data provide only limited evidence for the effects of the DSTI limit
- Loan-level data give a clearer picture of what is happening in the credit market
  - No piling up at the limit, but spreading over a wide interval
  - Restricted borrowers either leave or adjust: roughly 50-50
  - The main loss in volumes due to extensive margin
  - The quarterly/yearly loss is around 11% from total number of loans and around 10% of the total volumes of new loans
  - The losses are rather stable over 2016-2021

APPENDIX

FLOWS OF HOUSING LOANS: AGGREGATE DATA



Break point analysis:

- 2010Q1 – 2019Q4
- SA series in logs
- Bai-Perron test: one break point in 2015Q1
- Break point method and seasonal adjustment can affect break point detection

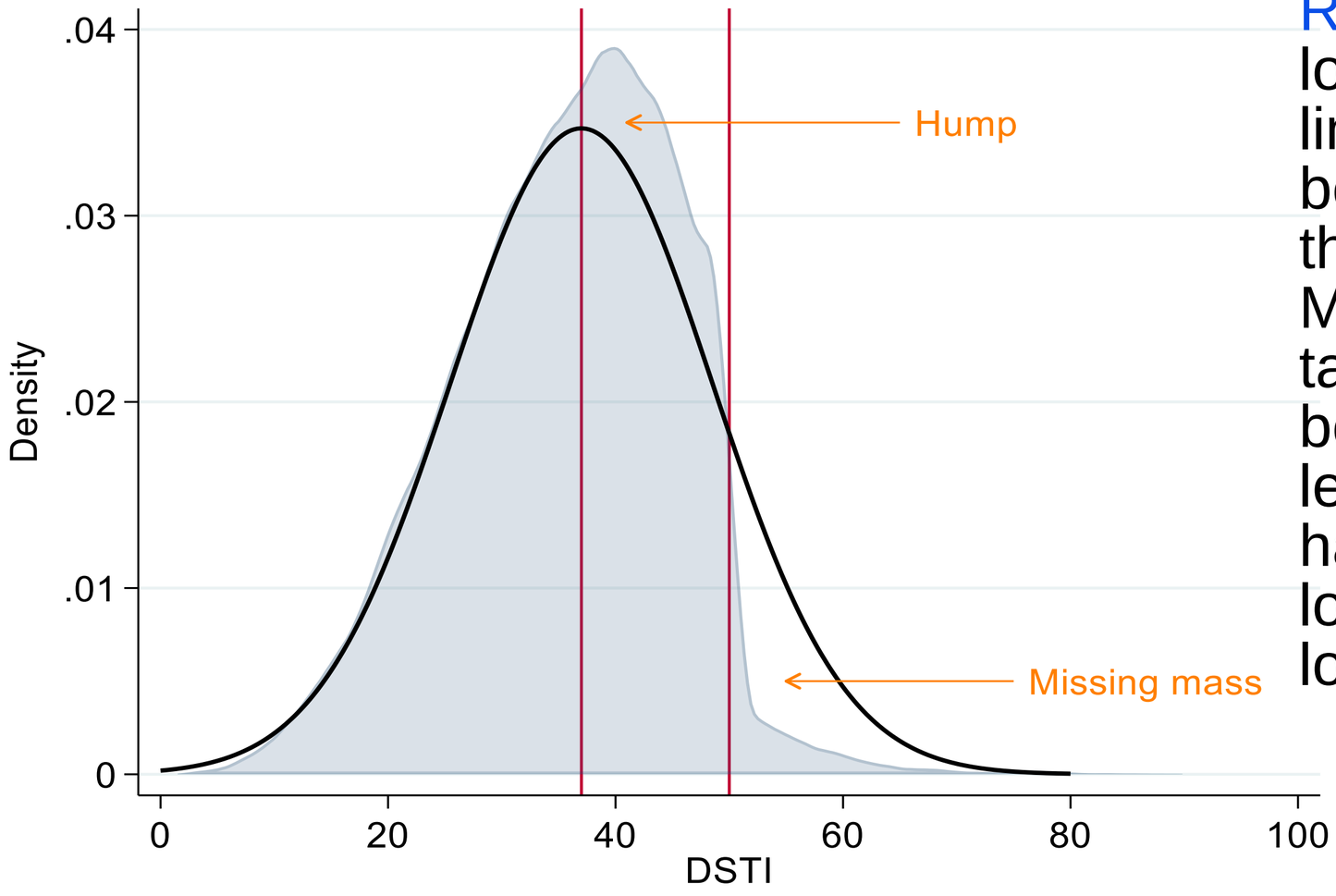
YoY /2011Q1-2022Q3	Real housing loan growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.097***	0.099***	0.126***	0.099***	0.101***	0.128***
	(0.017)	(0.020)	(0.035)	(0.018)	(0.021)	(0.042)
Borrower-based dummy	**-0.046****	**-0.045****	**-0.052****	**-0.048****	**-0.047****	**-0.053****
	(0.018)	**(0.018)**	**(0.024)**	**(0.019)**	**(0.019)**	**(0.025)**
Announcement dummy				-0.018	-0.018	0.017
				(0.033)	(0.032)	(0.051)
Covid dummy	0.040	0.039	0.058	0.040	0.039	0.062
	(0.080)	(0.080)	(0.086)	(0.080)	(0.080)	(0.091)
real HL flow growth	0.371***	0.396***	0.534**	0.374***	0.398***	0.542*
	(0.095)	(0.128)	(0.234)	(0.096)	(0.130)	(0.271)
real GDP growth		-0.167	-0.563		-0.167	-0.556
		(0.472)	(0.672)		(0.474)	(0.810)
real MIR change			-0.001			-0.001
			(0.002)			(0.003)
real HPI growth			-0.499			-0.565
			(0.623)			(0.749)
Num.Obs.	46	46	46	46	46	46
R2	0.208	0.209	0.223	0.209	0.210	0.220
R2 Adj.	0.151	0.132	0.104	0.132	0.112	0.076
* p < 0.1, ** p < 0.05, *** p < 0.01						
Robust Std. Errors in parenthesis						

- Macroprudential policy dummy:
  - Approx. 4.8pp. decline in real HL flows over 4 quarter period
- Announcement dummy:
  - Not stat. significant

QoQ /2011Q1-2022Q3	Real housing loan growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.059***	0.059**	0.080**	0.058***	0.057**	0.079**
	(0.018)	(0.027)	(0.033)	(0.019)	(0.027)	(0.033)
Borrower-based dummy	**-0.034****	**-0.034****	**-0.045***	**-0.033***	**-0.033***	**-0.044***
	(0.016)	**(0.017)**	**(0.023)**	**(0.018)**	**(0.018)**	**(0.024)**
Announcement dummy				0.011	0.011	0.012
				(0.019)	(0.025)	(0.045)
Covid dummy	0.030	0.030	0.046	0.030	0.030	0.046
	(0.072)	(0.086)	(0.079)	(0.072)	(0.087)	(0.079)
real HL flow growth	-0.449	-0.469	-0.283	-0.451	-0.470	-0.283
	(0.345)	(0.342)	(0.336)	(0.347)	(0.344)	(0.338)
real GDP growth		0.161	-0.040		0.153	-0.048
		(2.109)	(1.910)		(2.132)	(1.935)
real MIR change			-0.002			-0.002
			(0.008)			(0.008)
real HPI growth			-1.402			-1.402
			(1.204)			(1.209)
Num.Obs.	46	46	46	46	46	46
R2	0.233	0.233	0.317	0.233	0.234	0.317
R2 Adj.	0.178	0.158	0.211	0.159	0.138	0.191
* p < 0.1, ** p < 0.05, *** p < 0.01						
Robust Std. Errors in parenthesis						

- Robustness:
  - Alternative periods
  - Nominal terms
  - Exclude lagged dependent variable
  - MIR levels
  - Real income growth
- Sample size, dummy construction, and deflators matter most for the results

TERMINOLOGY: RIGHT TAIL, HUMP, AND MISSING MASS



Right tail is the number of loans with DSTI over the limit. Excessive mass between the median and the limit is the hump. Missing mass at the right tail = all affected borrowers. Missing mass less hump are those, who have left the market, i.e. loss in the number of loans.

LOSS IN THE VOLUME OF LOANS

Two groups of affected borrowers:

- leaving the market

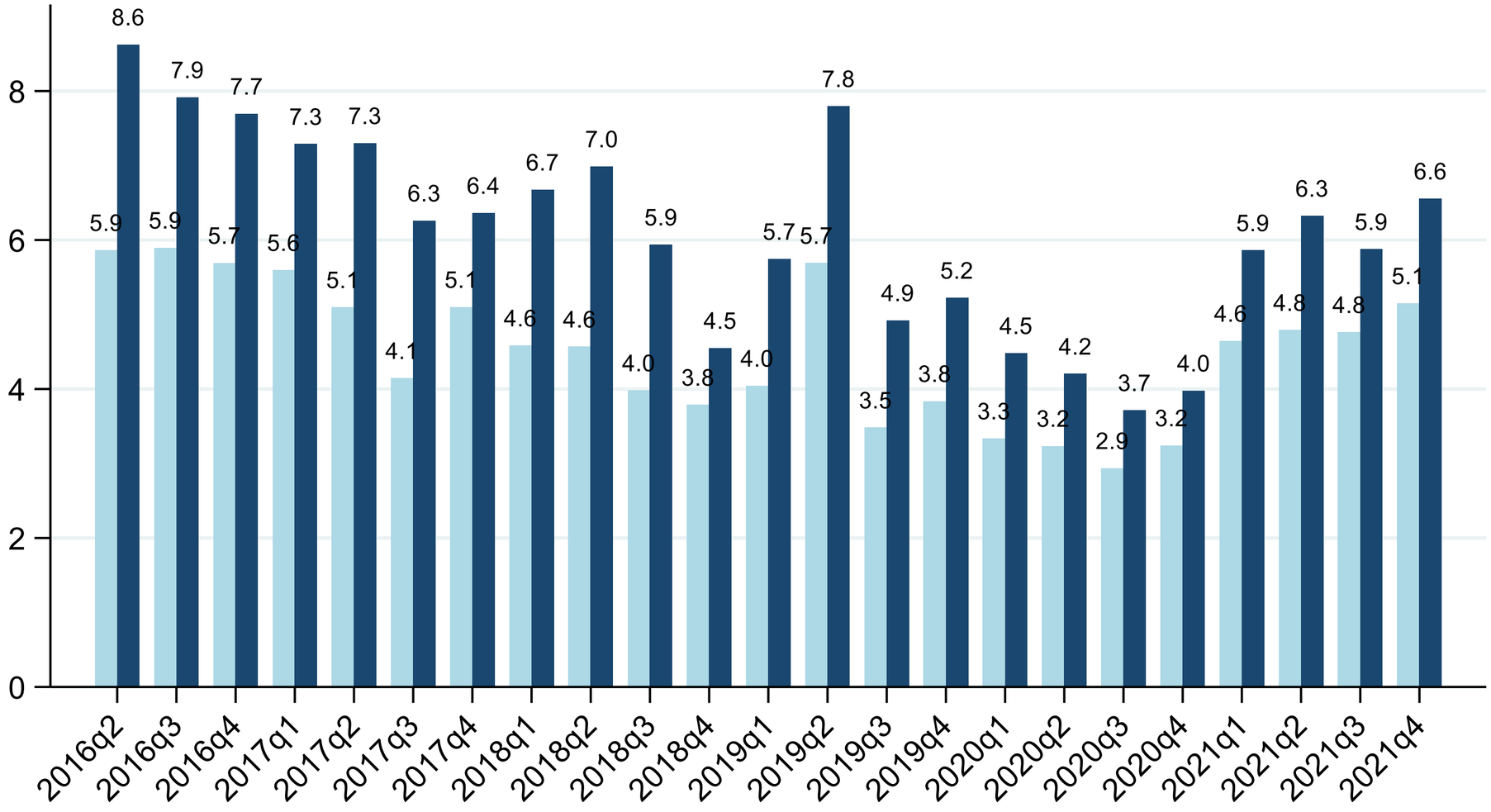
$$Loss1 = Loss\ in\ the\ number\ of\ loans\ \times Average\ loan\ in\ the\ rigth\ tail$$

- adjusting their loans

$$Loss2$$
$$= \ Number\ of\ loans\ in\ the\ hump$$
$$\times Difference\ in\ the\ average\ loan\ with\ high\ and\ low\ DSTI$$

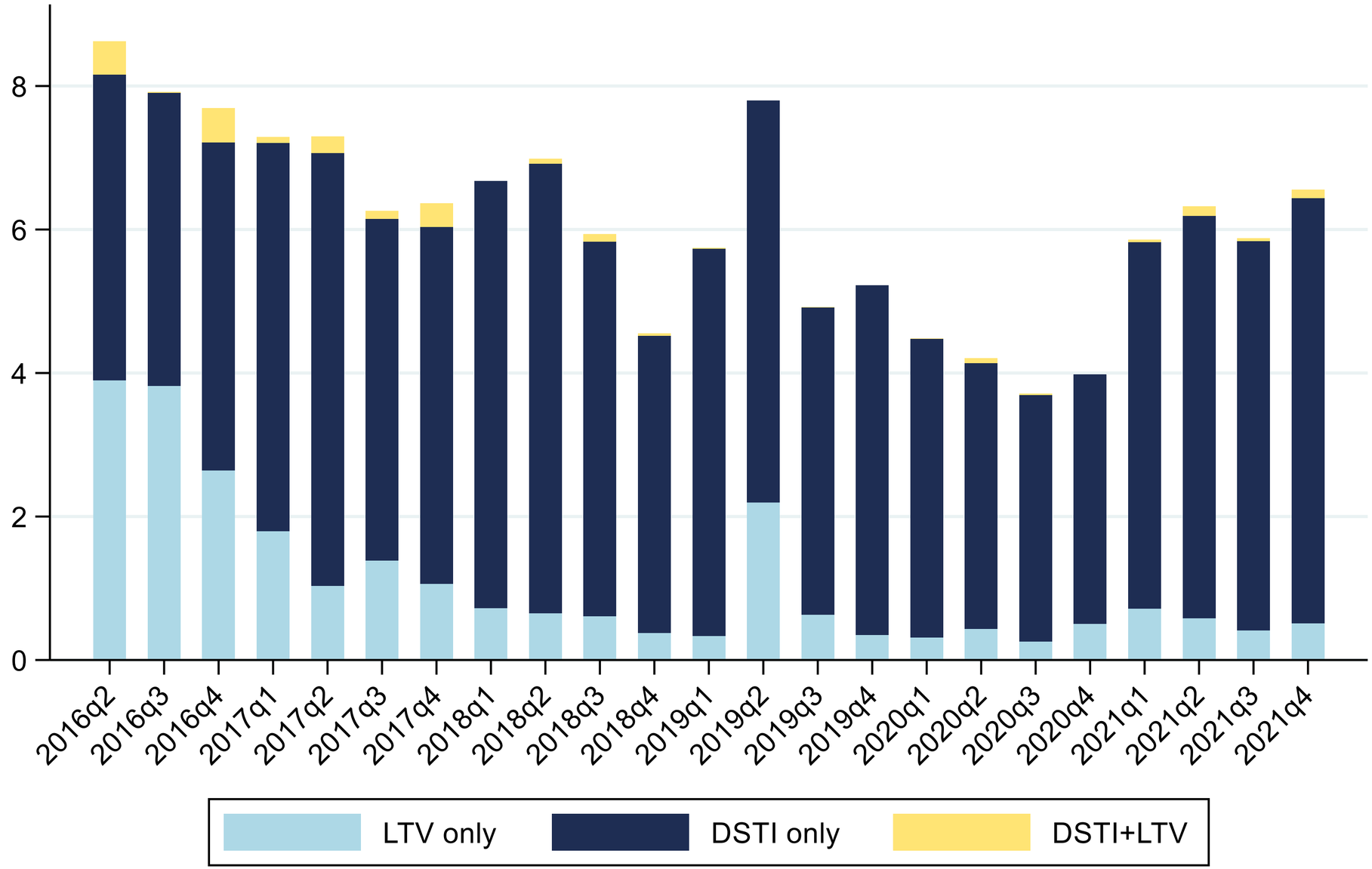
Two measures for the difference in the average loan. We compare the right tail and the fraction of the distribution between the median and the limit (and also over the median).

New housing loans over the introduced limits (%)

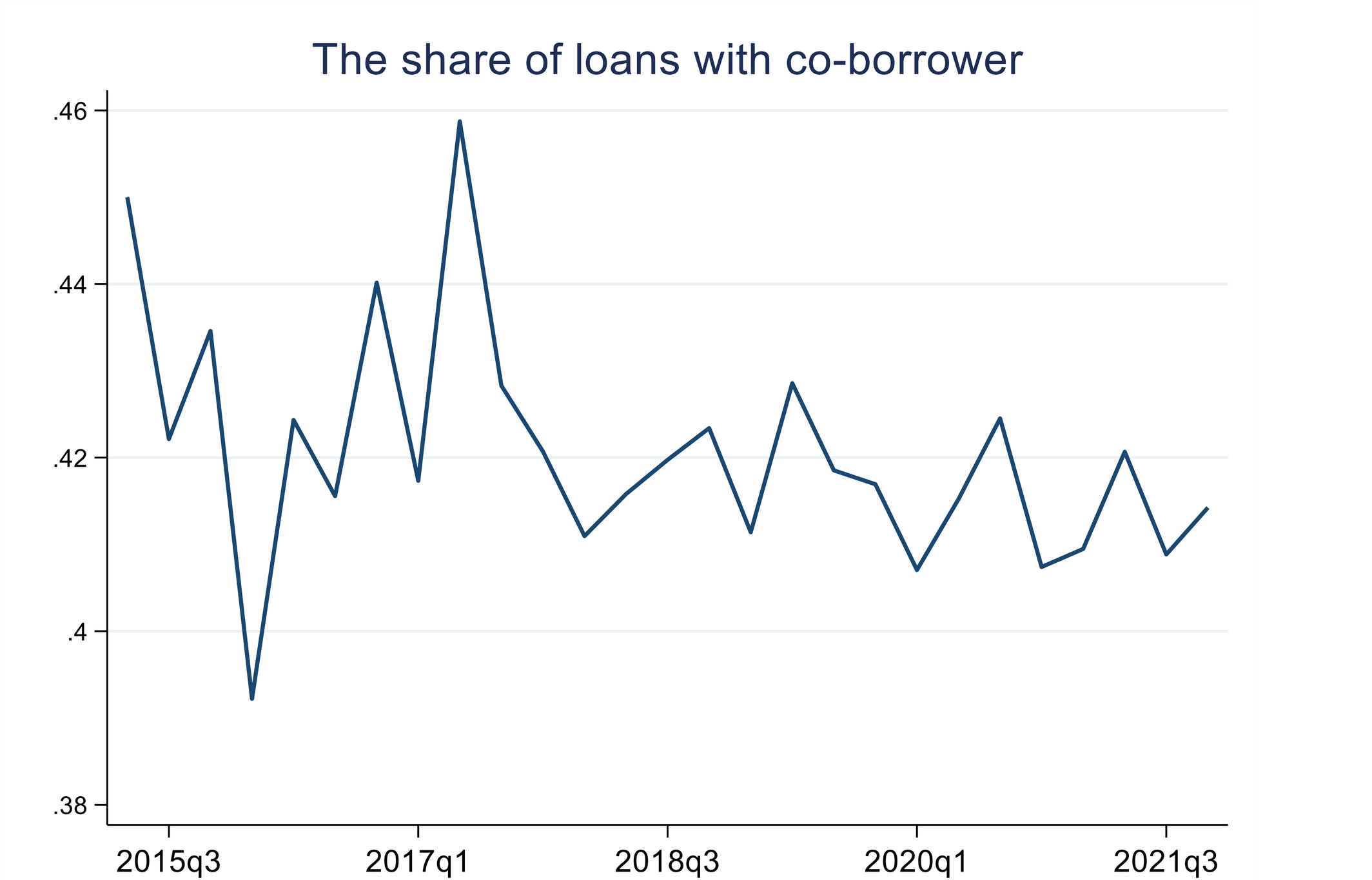


The share of new loans that are over the limits:
stressed DSTI >=50%, LTV >=85%(90%)

Volume of new housing loans over the limits (%)



The limits: stressed DSTI >50%, LTV >85%(90%)


The share of loans with co-borrower
.46
.44
.42
.4
.38
2015q3
2017q1
2018q3
2020q1
2021q3

BREAK POINTS IN THE MACRO DATA

Are break points visible in the macro data?

1. Break point analysis
2. Break point dummy regression

$$y_t = \alpha + \beta\, y_{t-1} + \eta\, \mathrm{Covid_t} + \gamma\, \mathrm{Treatment}t_t + \sum_{n=1}^{N} \delta_n\, Control_{t-1} + \epsilon_t \quad (1)$$

- Baseline specification:
  - Sample: 2011Q1-2022Q3
  - Seasonally adjusted; variables in real terms
  - YoY growth rates (real MIR YoY change)