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The Amortization Elasticity of Mortgage Demand

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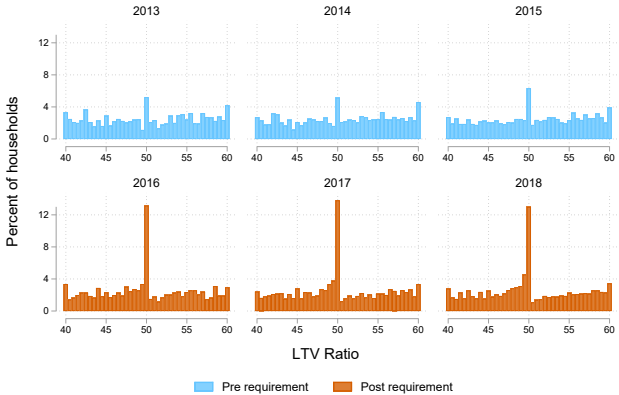

Motivation

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Research question: Do amortization payments affect borrowing decisions?

- One answer: Amortization payments are not a cost

However, under a number of standard scenarios amortization payments are costly

- E.g. suboptimally high savings rate, portfolio allocation and credit constraints

This paper: Amortization payments affect credit demand

- 1 percentage point increase in amortization payments leads to a 0.25 percent decline in leverage

Implication: Possible to use amortization requirements as macroprudential policy to target debt growth directly

A little history of amortization payments

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Sweden and the Netherlands used higher amortization rates as a macroprudential policy

- Sweden temporarily removed the requirement in response to the pandemic

Mortgages with low(er) amortization payments constituted 52 percent of new origination in US in 2005 (Justiniano *et al.* , 2017)

- “Complex mortgages” used by households with high income (Amromin *et al.* , 2018)

However, limited attention on the effect of amortization payments on borrowing

Institutional setting and the amortization requirement

The Swedish amortization requirement

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As of June 2016, mandatory amortization depends on loan-to-value (LTV) ratio:

- 1 percent of entire mortgage if LTV $>$ 50%
- 2 percent of entire mortgage if LTV $>$ 70%

Trade-off: higher borrowing vs lower mortgage payments

- Borrowers can strategically choose a lower LTV to reduce their amortization payments if they are close to the threshold
- We use the non-linear jumps in amortization rates to estimate the behavioral response (Chetty *et al.* , 2011; Kleven & Waseem, 2013; DeFusco & Paciorek, 2017; Best *et al.* , 2020; DeFusco *et al.* , 2020)

Swedish mortgage contracts prior to 2016

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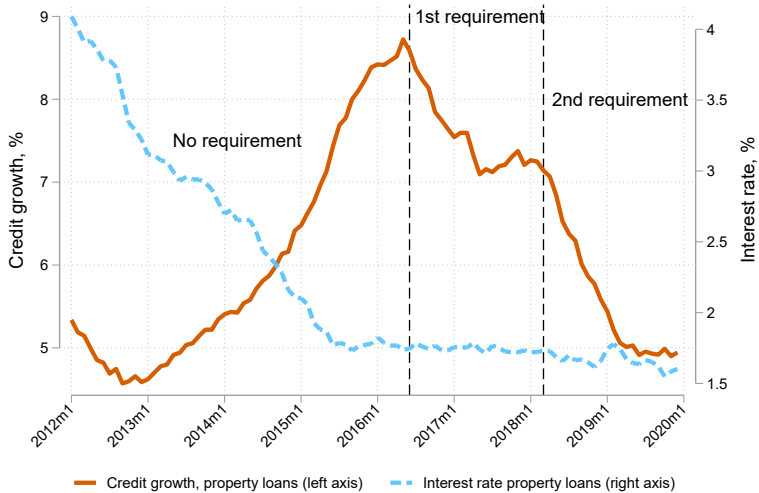
- LTV-cap at 85%
- Payment to Income (PTI) constraint
- Adjustable rates or short fixed rate periods
- Deferred amortization, durations 40-50 years
- Full recourse with lifetime garnishing

Credit growth in Sweden



Why is (forced) amortization costly?

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Several reasons why amortization payments are costly

- Life-cycle motive: Current income low relative to permanent income (Cocco, 2013)
- Portfolio allocation: Lower rate of return on amortization compared to risky assets and preference for liquid vs illiquid savings (Larsen *et al.* , 2018)
- Credit supply: Amortization payments included in payment-to-income calculation (Grodecka, 2017; Greenwald, 2017)
- Illiteracy, mistakes: Borrowers care about total payments

Data and Methodology

Data

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- Microdata reported by 8 largest banks in Sweden from Swedish FSA's "Mortgage survey" *(Bolåneundersökningen)*, 2011 - 2018
  - Survey covers all issued mortgage loans within a two-week window during the period August - October
  - 15,000 - 30,000 households per year
- Variables:
  - Loan-level: size, interest rate, amortization, collateral
  - Household-level: size, age, income, location, total debt (secured, unsecured)

Intuition behind empirical methodology

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We use the discontinuous jump in average payments at the requirement threshold(s) to identify the trade-off between borrowing and amortizing

- You can trade lower borrowing for lower payments by placing yourself at the threshold

We use years prior to the requirement to estimate the counter-factual distribution and compare it to the empirical (actual) distribution

- Bunching estimate: The relative increase in number of households placing themselves at the threshold
- Maps directly into an estimate of the change in LTV

Simulated densities

Results

Results: Bunching at 50% threshold

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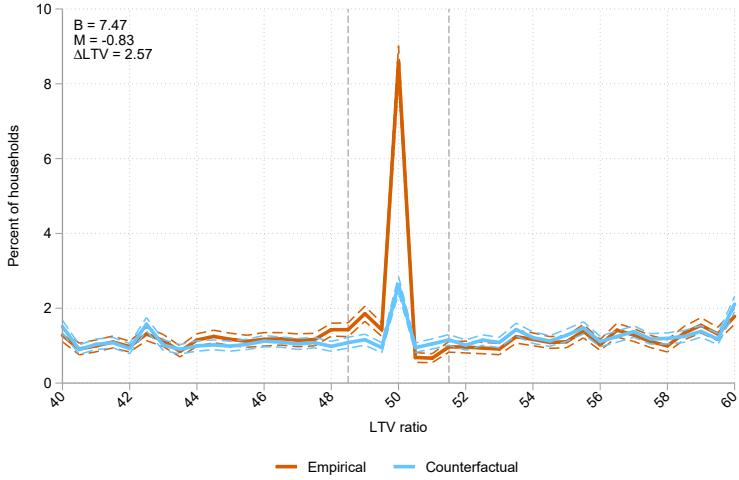
7.5 percent of households bunch ($p < 0.01$)

Leverage reduced by 2.57 p.p. ($p < 0.01$)



Results: Bunching at 70% threshold

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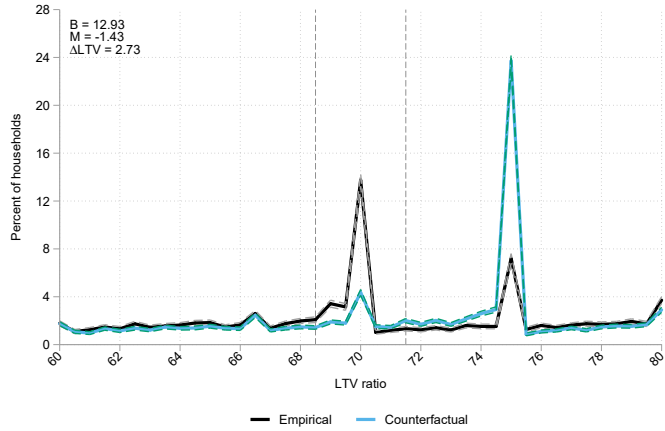
13 percent of households bunch ($p < 0.01$)

Marginal buncher reduces leverage by 2.73 p.p. ($p < 0.01$)



Elasticity of borrowing with respect to amortization payments

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Elasticity for the marginal buncher:

$$e^{\gamma} = \frac{\Delta LTV}{\gamma^*(\overline{LTV} + \Delta LTV) - \gamma}$$

ΔLTV is estimated using bunching

- Reduction of LTV by 2.57 p.p $\approx$ 5% reduction in LTV

Marginal amortization rate: $\gamma^*(\overline{LTV} + \Delta LTV) - \gamma$

- For the buncher at notch 50: $\gamma^*(52.57) = 20.5\%$
- For the buncher at notch 70: $\gamma^*(72.73) = 27.6\%$

Resulting elasticity:

- Lower threshold: Reduction in LTV per unit of amortization of 0.25
- Upper threshold: Reduction in LTV per unit of amortization of 0.14

Do credit supply constraints explain the results?

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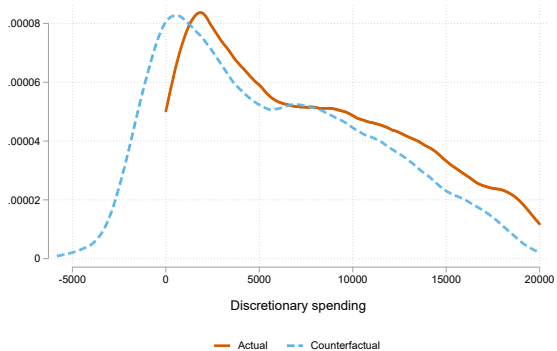
How many households would not be able to afford higher payments?

- 12.8 percent of borrowers with LTV=50 and amortization = 0
- 15.8 percent of borrowers with LTV=70 and amortization = 0



Do credit supply constraints explain the results?

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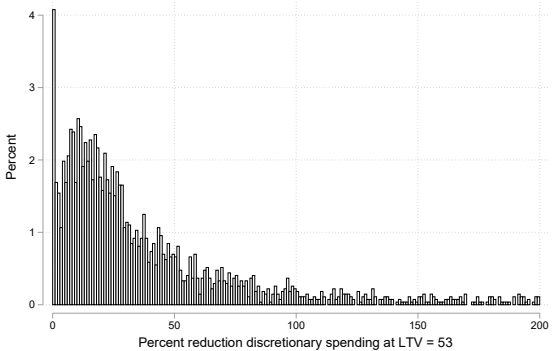
Higher amortization would entail a large reduction in discretionary income for many households

28 percent of borrowers would have a reduction of more than 50 percent

- Anecdotally, this also seems to explain reluctance to amortize



Threats to identification

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Estimation of counter-factual distribution:

- Placebo test: estimate bunching using only pre-requirement data Placebo tests

Maybe borrowers bunch for other reasons, not the amortization requirement?

- Interest rates around the thresholds are flat Interest rates around 50 threshold
- Amortization rates higher above notch only after requirement is in effect
  Amortization rates around 50 threshold
- We also rule out bank incentives, potential manipulation of collateral assessments, and salience
- Borrowing *more* in response to requirement (Svensson, 2016) would not lead to bunching from above

Conclusion

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Summary: We provide evidence that borrowers avoid making amortization payments

- Borrowing reduced directly in response to the amortization requirement
- Borrowing reduced even for households with low leverage

Key takeaway: Amortization payments affect household borrowing

- Why likely matters for understanding effect of the Swedish amortization requirement on macroeconomic stability
- Relevant for understanding effect of macroprudential policies and for understanding credit growth in the financial crisis
- Relevant for extensive and growing theoretical literature that tries to incorporate realistic features of mortgage contracts

Thank you!

Amortization requirement increased payments for new loans

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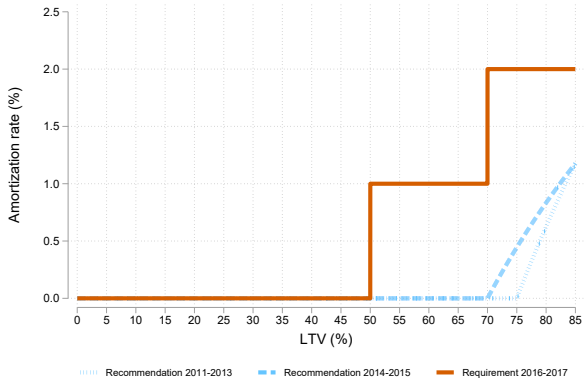
- New loans: required amortization if LTV $>$ 50%
- Amortization rate applies to entire mortgage, not just the part above the threshold
- Effective June 2016
- Some exceptions (newly constructed properties, switch bank)



Actual amortization rates over time

Share of households that amortize a certain percentage

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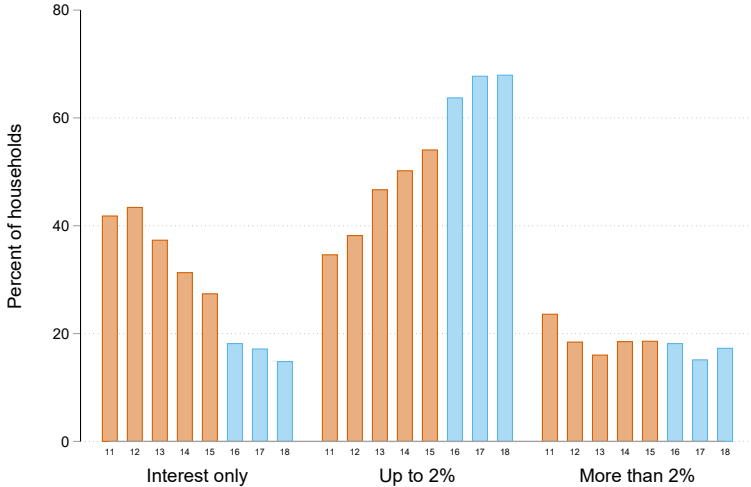

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Simple 3-period model

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$$\max_{c_1,c_2,c_3} u(c_1) + \beta u(c_2) + \beta^2 u(c_3)$$
$$A_0 \sim F(\mu, \sigma)$$
$$c_1 + p = A_0 + L + y_1$$
$$c_2 = y_2 - (r + \alpha)L$$
$$c_3 = y_3 + p - (1 + r)(1 - \alpha)L$$

Linear schedule: $\alpha = \alpha_0$

Notched schedule: $\alpha = \alpha_0 + \mathbb{1}(LTV > \overline{LTV})\Delta\alpha$

Back

$$0 = u'(c_1)\frac{\partial c_1}{\partial L} + \beta u'(c_2)\frac{\partial c_2}{\partial L} + \beta^2 u'(c_3)\frac{\partial c_3}{\partial L} \tag{2}$$

$$u(c) = ln(c) \tag{3}$$

$$\frac{1}{c_1} = \frac{\beta(r+\alpha)}{(A_0 + y_1 - p - c_1)(r+\alpha) + y_2} + \frac{\beta^2(1+r)(1-\alpha)}{y_3 + p - (1+r)(1-\alpha)(c_1 + p - A_0 - y_1)} \tag{4}$$

Simulated densities with and without a requirement in a simple model

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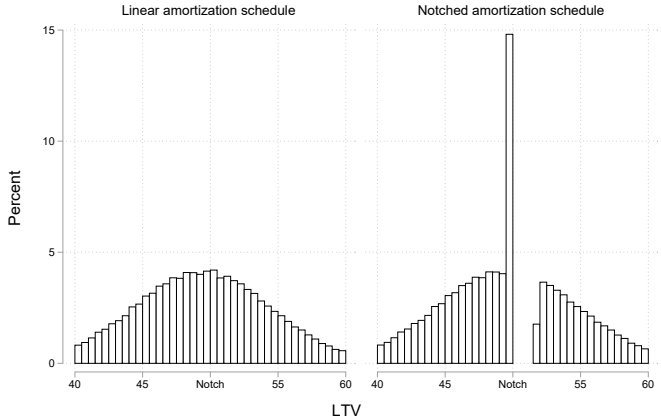

Linear schedule: $\alpha = \alpha_0$

Notched schedule: $\alpha = \alpha_0 + \mathbb{1}(LTV > \overline{LTV})\Delta\alpha$

Back

Buncher characteristics

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- We compare the amortizers ($\gamma > 0$) to the non-amortizers to (amortization $\gamma = 0$) just below the notch
- Non-amortizers have:
  - Around € 100,000 higher debt and housing values
  - Around € 750 higher monthly income
  - 130 percentage points higher DTI
  - Debt service $\approx$ half of households who amortize, but higher interest payments to income
- If the non-amortizers would amortize 1% of their mortgage, their debt service would increase from 4.8 to 8 percent of income

Amortization rates by LTV ratio over time

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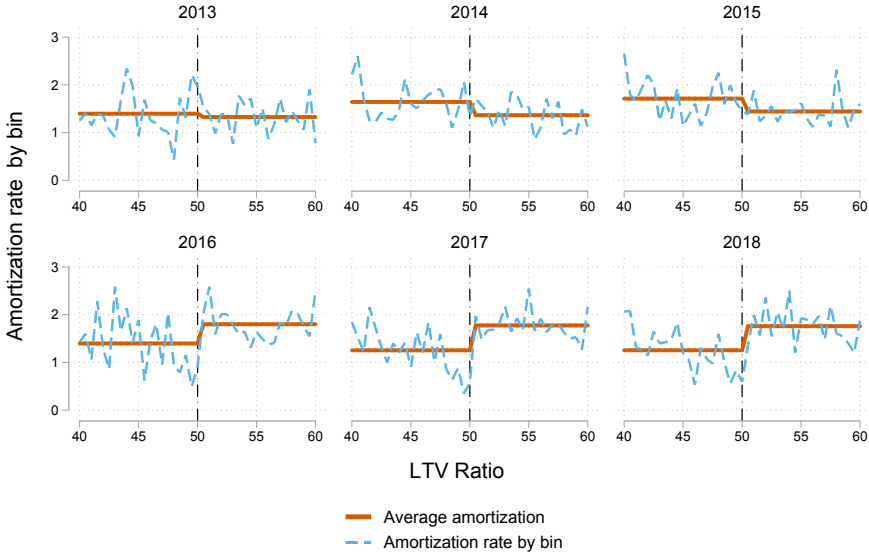

Interest rates by LTV ratio over time

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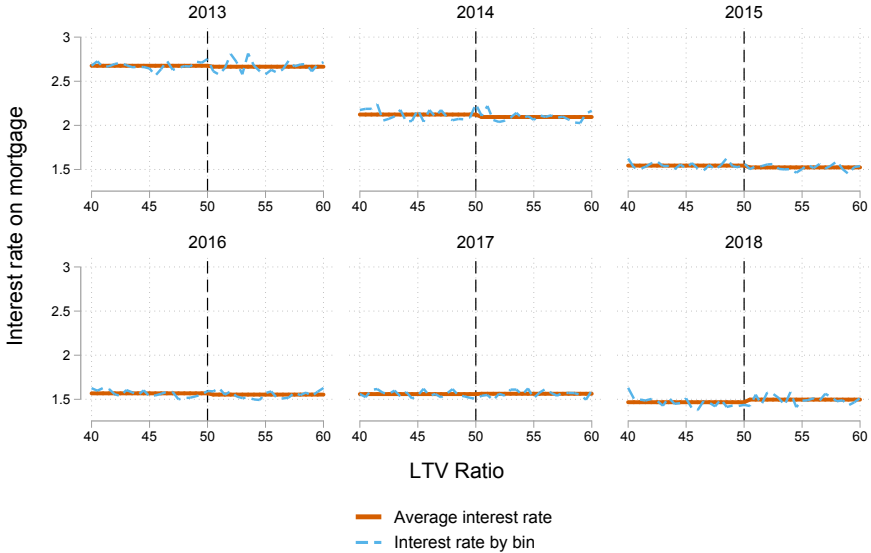

The interest-rate elasticity of mortgage demand

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How large is the amortization elasticity compared to the interest rate elasticity?

- Exploit 75% notch to estimate the behavioral response to higher mortgage rates
- Use standard, polynominal approach instead of previous years to form counter-factual

Comparing the rate for top and bottom loans around the 75% notch directly gives us the change in the marginal rate

- Estimates suggest interest rates on top loans is about 1 percentage point higher

Bunching estimates at higher interest rates

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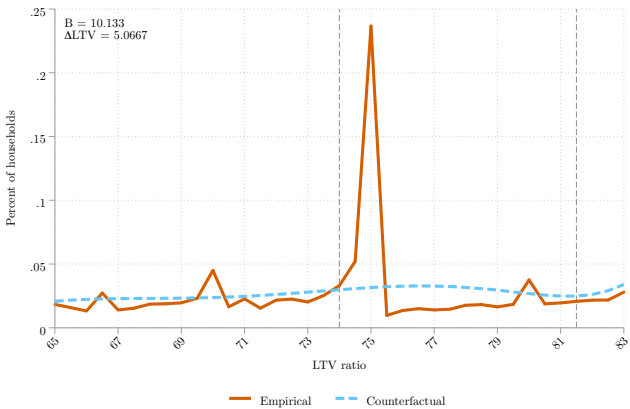

Bunching estimate: 10 times as many households bunch as counter-factual

Marginal buncher reduces leverage by 5 percentage points or 6.7 percent

Resulting elasticity: 0.24

But: we are picking up some round number bunching here. There is bunching even in years with no top-loan system

Calculating the change in the marginal amortization rate

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Given you now amortize on the entire mortgage, what is the change in rate from going just above the threshold?

- We convert the average rate jump at the notch into a marginal implicit rate (DeFusco & Paciorek, 2017; Kleven, 2016)

$$\gamma^*(LTV) = \gamma + \Delta\gamma + \Delta\gamma \cdot \frac{\overline{LTV}}{(LTV - \overline{LTV})}$$

- γ is the amortizaton rate, $\overline{LTV}$ is the treshold where γ jumps, LTV is the LTV for the marginal buncher
- For the marginal buncher at notch 50:
  $\gamma^*(52.57) = 0 + 0.01 + 0.01 \times \frac{50}{52.57-50} = 20.5\%$

Empirical and Counter-factual distribution in 2014

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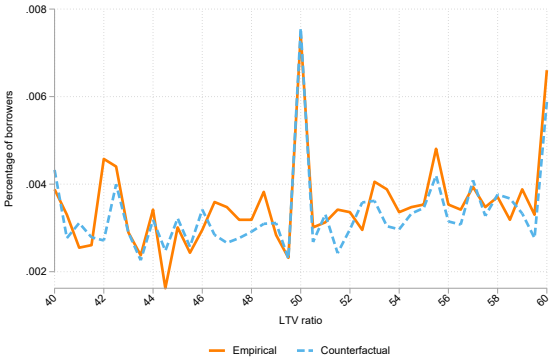
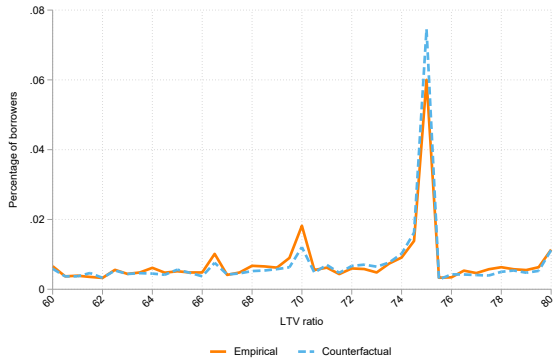


a) LTV50: Placebo reform in 2014



a) LTV70: Placebo reform in 2014

Ratio between counter-factual and empirical distribution in placebo years

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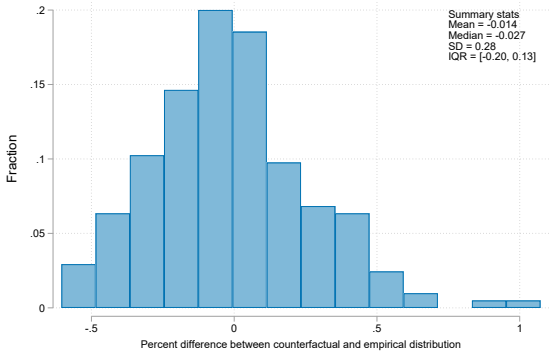
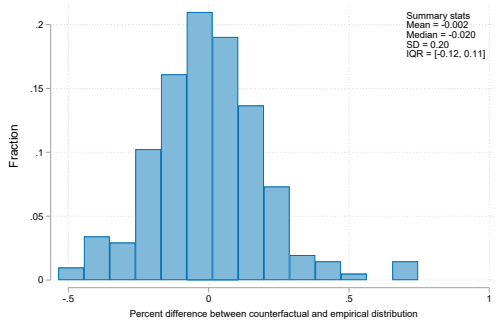


b) LTV50: Ratio between empirical and counterfactual



d) LTV70: Ratio between empirical and counterfactual

Amortization rates by LTV ratio over time

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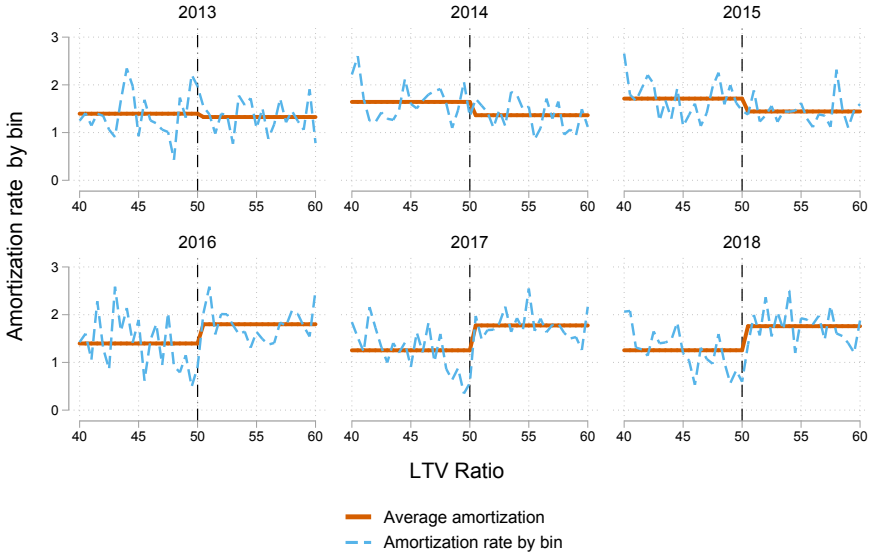

Interest rates by LTV ratio over time

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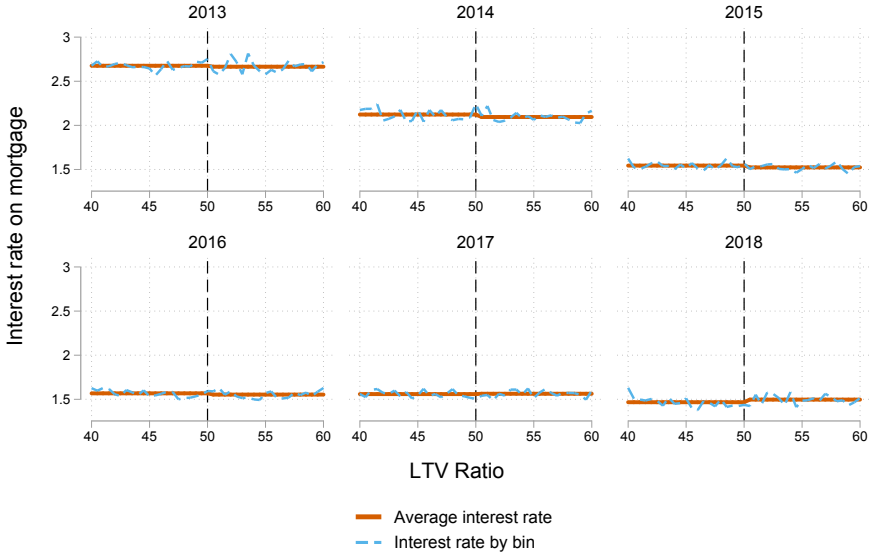

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