Consumer Debt Moratoria

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Motivation, why is it important?

- **Debt moratorium:** payment suspension of a debt instrument.
- One of the oldest policy recommendations, references in Abrahamic religions.
  - *"If it is difficult for someone to repay a debt, postpone it until a time of ease."* –Qur'an 2:280
- A world of record-high debt levels, both public and private
  - Navigating such world record of debt levels is now at the forefront of macroeconomic debates.
  - Debt moratorium plays a central role in these discussions.

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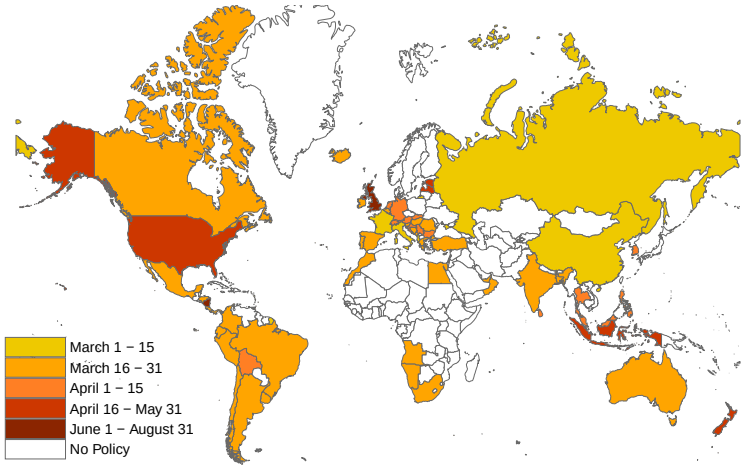
Motivation, why is it important?

- Moratorium policies gained prominence in the wake of the 2020 pandemic.
  - DEBT MORATORIA remains largely unexplored in both empirical and theoretical contexts.



What do we do? Related Literature

Two main contributions:

1. (Empirical) Estimate the causal impact of mortgage moratorium on households.
   - We use administrative credit registry data from Colombia.
   - Exploit a discontinuity in eligibility criteria for households to receive a moratorium on mortgages during 2020.
   - Estimate the local causal effect on consumption, delinquency behavior and debt accumulation for stressed households.
2. (Quantitative) Study the aggregate implications of a debt moratorium policy
   - Use an heterogeneous agent life-cycle incomplete market model (**Arslan, Guler, Kuruscu, 2023**).
   - We use the model for long-run analysis and policy counterfactual comparisons.

What do we find?

1. Moratoria improved economic conditions stressed households
   - ↑ Consumption
   - ↓ Delinquency probability
2. Moratoria mitigates the negative response of the economy to an aggregate productivity shock.
   - Welfare improving for both households and banks.
   - Payment suspension with interest rates not accrued is a better alternative.

Empirical Strategy

Data and Moratorium Policy

Data

- Colombian credit registry from Q1-2019 to Q4-2021.
  - Comprise universe of loans between bank-individual pairs.
  - Borrowing and loan delinquency information at quarterly frequency.
  - We can identify mortgages treated by moratoria in 2020.
- We employ 152,000 existent-mortgages (i.e. originated by 2019Q4) at the end of 2020:Q1

  $\Longrightarrow$ 26 private banks & 149,000 individuals.
- Match treatment information to other household borrowing during 2019Q4-2021Q4
  - 66,000 credit cards, 24,000 short term (personal) loans and 4,100 car loans.

The Debt Moratorium Policy

- Enacted in March 2020 $\Longrightarrow$ mitigate the effects of the COVID-19 Pandemic
- Treatment
  1. Duration $\leq$ 120 days
  2. Grace periods on principal and interest payments
  3. Interest rate accrues
  4. Delinquency days reset
  5. Credit rating remain frozen
- Eligibility: all loans with $\leq$ 60 days past due as of 29/02/2020
  - First covid case: March 6^{th} **NO ANTICIPATION!!!**
- *Existent Mortgage* $\Longrightarrow$ Eligible + apply for Debt Moratorium Policy $\Longrightarrow$ Treated

Empirical Strategy

Identification

- Household "*i*" *existent mortgage* with bank "*j*" (i.e. originated by 2019Q4)

  $\Longrightarrow \text{run}_{ij} = 60 \text{ days} - \text{delinquency days}_{ij}$

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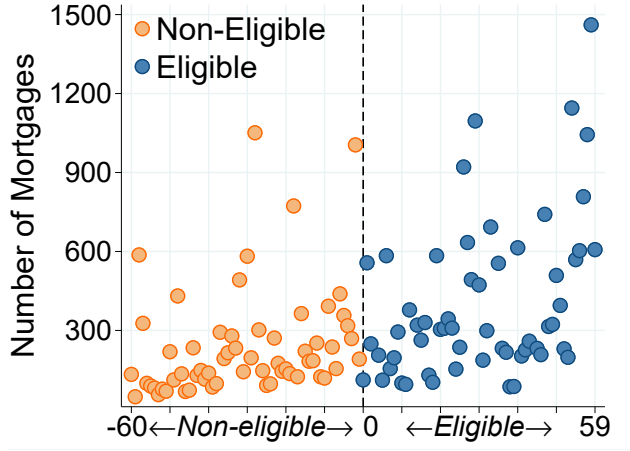
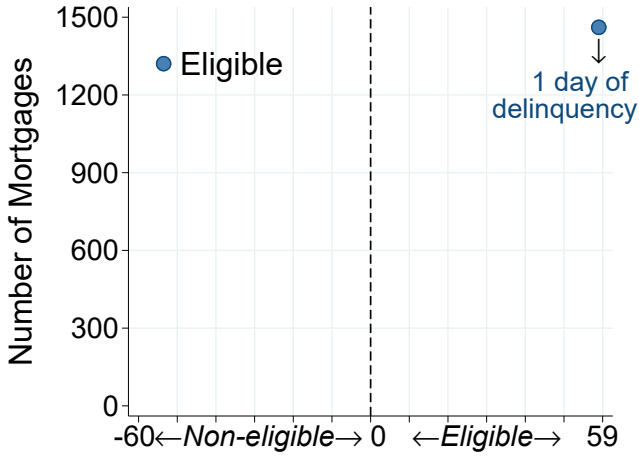


- Stressed households $\Longrightarrow$ at least one day of delinquency on existent mortgage



- Eligible and Ineligible households within 5 days of the threshold.

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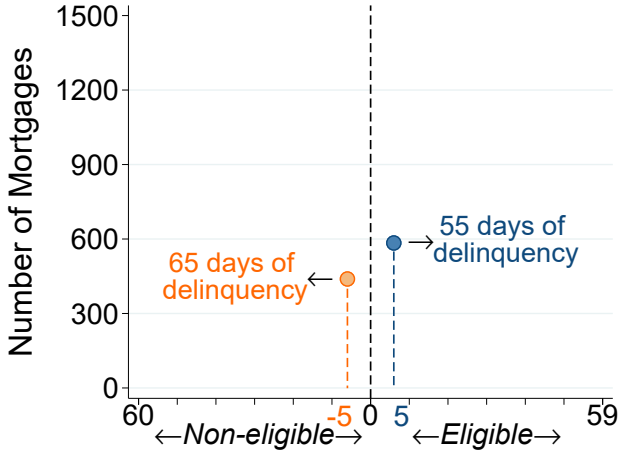

Identification

- IDENTIFICATION $\Longrightarrow$ compare barely eligible and non-eligible households

  $\Longrightarrow$ Non-parametric Local Polynomials (**Calonico, Cattaneo, and Titiunik, 2014**)

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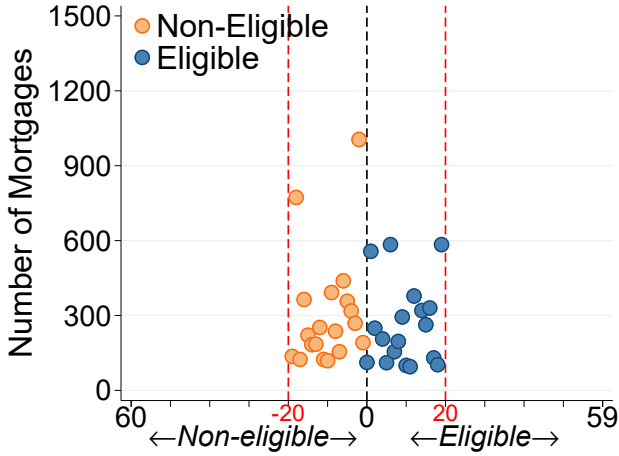


Empirical Strategy

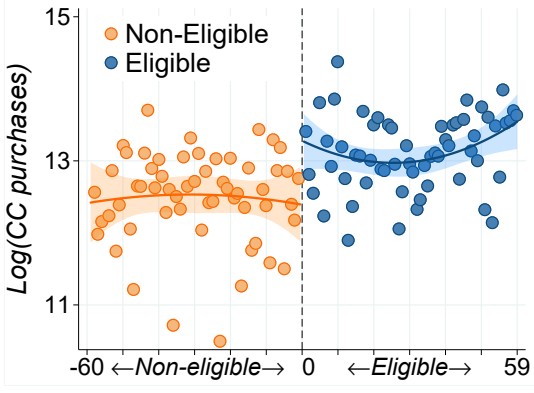
RD Estimates: Household Consumption

Moratoria and CC Expenditures: RD Plots

new carloans | new mortgages | before policy

- We proxy consumption by CC purchases.

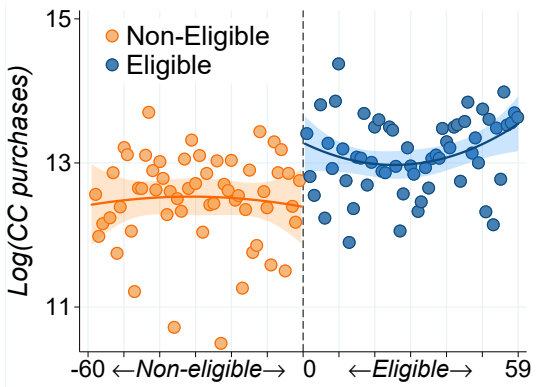
$$\text{CC purchases}_{it} = \Delta\text{CC debt}_{it} + \text{CC repayment}_{it}$$



Moratoria and CC Expenditures: RD Plots

new carloans | new mortgages | before policy

- Upward jump CC purchases when moving along the eligibility cutoff

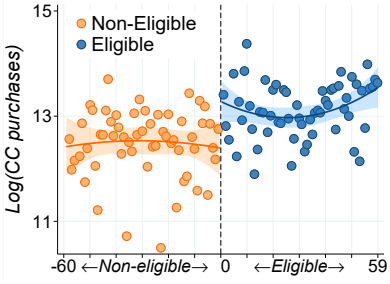


Moratoria and CC Expenditures: RD Plots

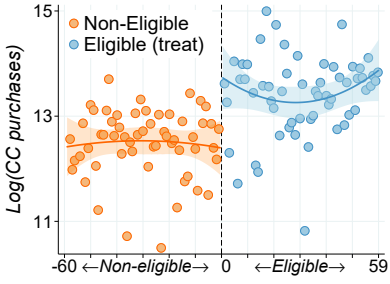
new carloans | new mortgages | before policy

- Upward jump CC purchases when moving along the eligibility cutoff

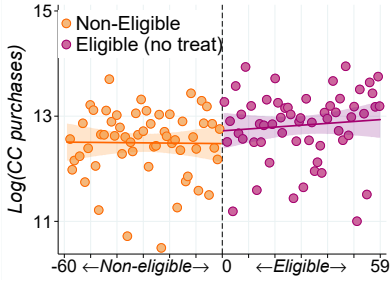
  $\Longrightarrow$ Explained by Eligible-Treated households



(a) Non-Eligible vs Eligible



(b) Non-Eligible vs Eligible-Treated



(c) Non-Eligible vs Eligible Non-Treated

Moratoria and CC Expenditures

- Effect of moratoria on CC at end of the quarter of treatment (**2020-Q2**).

	CC Expenditure		Mortgage Payment
	(log)	(COP)	(COP)
Fuzzy-RD	2.10**	2.39*	-3.09***
	(1.06)	(1.30)	(0.27)
	First Stage		
D_{ij}	0.27***	0.27***	0.18***
	(0.041)	(0.035)	(0.010)
Observations	16,504	16,504	149,867
Bandwidth (in days)	19.2	28.5	22.3

Moratoria and CC Expenditures

- Households receiving moratoria
  - increase CC expenditure by 2.10 %

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Moratoria and CC Expenditures

- Households receiving moratoria
  - increase CC expenditure by 2.4 mill COP ($\approx$ 625 USD)
  - Reduce mortgage payments by 3.1 mill COP ($\approx$ 805 USD)

	CC Expenditure		Mortgage Payment
	(log)	(COP)	(COP)
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Moratoria and CC Expenditures

- Households receiving moratoria increase CC expenditure by
  - 0.77 cents ($= 2.39/3.1$) per dollar of mortgage payment reduction (**semi-elasticity**).
  - 0.12% ($= 0.77 \times 0.16$) if mortgage payment drop by 1% (**elasticity**).

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Empirical Strategy

RD Estimates: Delinquency

Moratoria and Household Delinquency

- Delinquency for existent mortgages, short term, and car loans on **quarter of treatment**.

$$\text{Delinquent}_{ijt} = \mathbb{1}\left\{\text{delinquency days}_{ijt} \geq 30\right\}$$

	Existent Mortgages	Short Term Loans	Car Loans
Fuzzy-RD	-0.98**	-0.09**	-0.36**
	(0.07)	(0.04)	(0.18)
	First Stage		
D_{ij}	0.21***	0.29***	0.18***
	(0.02)	(0.01)	(0.06)
Observations	152,879	28,158	4,187
Bandwidth (in days)	8.2	28.7	22.8

Moratoria and Household Delinquency

- Existent mortgages $\Longrightarrow \downarrow$ delinquency probability:
  - 0.98 pp. in quarter of treatment $\Longrightarrow$ result of delinquency days reset.

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Moratoria and Household Delinquency

- Cross-loan effect $\Longrightarrow \downarrow$ delinquency probability
  - 0.09 pp. and 0.36 pp. for short term and car loans in quarter of treatment.
  - Moratoria mitigate households liquidity problems $\Longrightarrow$ repay debt.

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Quantitative Model

Model

Setup

- RD design generally pick up local effects, so can't capture general equilibrium and long-term effects.
- Benchmark model: **Arslan, Guler, Kuruscu (2023)**
- Five sectors: households, banks, rental companies, firms, and government.
- Household heterogeneity in income, wealth, housing tenure and mortgage debt due to idiosyncratic shocks. But no aggregate uncertainty
- We study the effects moratoria in response to unexpected and persistent shock, but perfect foresight is assumed along transition.

About Households

- All born as young individuals with endogenous inherited wealth, draw their initial labor productivity (z)
- Two idiosyncratic shocks
  - Age: determines transition through life-cycle phases (young, middle, and old) according to $\pi_z(j'|j)$. Old individuals die after age shock, net wealth equally distributed among the newborns.
  - Labor efficiency: affect productivity before retirement, stochastic component $z_j \sim \text{AR}(1)$.
- Once shocks is observed, households decide housing tenure, saving and consumption.

About Households

- All born as young individuals with endogenous inherited wealth, draw their initial labor productivity (z)
- Two idiosyncratic shocks age and labor efficiency.
- Once shocks is observed, households decide housing tenure, saving and consumption.
  - House purchase financed with mortgages (long-term perpetuities with decreasing coupons).
  - If moratoria starts at $t+1$, unpaid coupon is paid (with interest) when payment suspension is over. Plot

Active renter Problem

- Households start active renters with state $\{a, z, j\}$
- Choices are: (i) stay as renters (V^{rr}) or (i) become homeowners (V^{rh})

$$V^r = \max \left\{ V^{rr}, V^{rh} \right\}$$

Active renter Problem

- Households start active renters with state $\{a, z, j\} \Longrightarrow$ if continue renting

$$V^{rr}(a, z, j) = \max_{c,s,a' \geq 0} \{u(c, s) + \beta E V^{r}(a', z', j')\}$$

subject to

$$c + a' + p_r s = w(1 - \tau) y(j, z) + a(1 + r_k)$$

Active renter Problem

- Households start active renters with state $\{a, z, j\} \Longrightarrow$ if purchase a house

$$V^{rh}(a, z, j) = \max_{c,d,h,a' \geq 0} \left\{ u(c, h) + \beta E V^{h}(a', z', j', d, h) \right\}$$

subject to

$$\begin{aligned} c + p_h h + \delta_h p_h h + \varphi_f + a' &= w(1-\tau)\, y(j, z) + a(1 + r_k) + d\left(q^m(a', z, j, d, h) - \varphi_m\right) \\ d &\leq p_h h (1 - \phi) \end{aligned}$$

- Only mortgage pricing is affected by individual default risk.
  - repayment: $m = d(r_l + \delta_m)$
  - debt next period: $d' = (d - m)(1 + r_l)$

Housing Tenure Choices Firms Rental Companies

Active renter Problem

- Once a households is a homeowner, then has four options
  1. Stays as a homeowner see
  2. Refinance mortgage (subject to mortgage origination cost) see
  3. Sell house (subject to transaction cost) see
  4. Defaults see and becomes inactive renter see
- Refinancing or selling the house requires full prepayment of mortgage

- Perfectly competitive risk averse banks. They borrow from the international market (r_t) and lend to households (long-term mortgages) and firms (short-term working capital)

$$\max_{L_{t+1},B_{t+1}} \sum_{t=0}^{\infty} \beta_L^{t-1} \log\left(d_t^B\right)$$

subject to

$$\begin{aligned} d_t^B + L_{t+1} &= \omega_t + B_{t+1} \\ \omega_{t+1} &= L_{t+1}\left(1 + r_{\ell,t+1}\right) - B_{t+1}\left(1 + r_{t+1}\right) \end{aligned}$$

L_t Total lending to firms and households $\Longrightarrow$ Banks make same return on each loan

- Banks don't face aggregate risk
- Law of large numbers apply for households

- Perfectly competitive risk averse banks.

$$\max_{L_{t+1},B_{t+1}} \sum_{t=0}^{\infty} \beta_L^{t-1} \log\left(d_t^B\right)$$

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Endogenous leverage constraint

– Banks can default and steal fraction of assets (**Gertler and Kiyotaki, 2010**)

$$\phi_t = \xi^{1-\beta_L}\left(\left(1 + r_{t+1}\right) / \left(1 + r_{\ell,t+1}\right) - \left(1 - \phi_{t+1}\right)\right)^{\beta_L}$$

Quantitative Model

Model Results

Calibration

external param | internal param

- Model is calibrated to Colombia targeting the averages of 2010 to 2019.

Statistic	Data	Model
Capital- quarterly GDP ratio	8	8
Homeownership rate–aggregate	43%	43%
Mortgage debt to quarterly GDP ratio	112%	112%
Share of housing services in GDP	15%	15%
House price- quarterly rental price ratio	30	30
loan-to-value ratio	70%	70%
Bank leverage ratio	10	10
Lending premium	0.375%	0.375%

Equilibrium Response to Moratoria

- Evaluate the impact of an aggregate productivity shock with moratoria policy in place.
  (1) Economy starts is in steady state before shock.
  (2) Productivity shock replicates output drop around COVID.
  (3) Perfect foresight after the shock hits the economy.
  (4) No mortgage payments for 2 quarters $\Longrightarrow m = 0$ but interest accrues $\Longrightarrow d' = d\,(1 + r_l)$.

Equilibrium Response to Moratoria

Linking the model to RDD

- Evaluate if quantitative model aligns with the empirical estimates. $\Longrightarrow$ PE response
  - Fix wages, lending rate, house prices, rental prices
  - Compute average consumption elasticity at the end of the second quarter relative to economy with no moratoria.

Equilibrium Response to Moratoria

Linking the model to RDD

- Evaluate if quantitative model aligns with the empirical estimates $\Longrightarrow$ PE response
  - Fix wages, lending rate, house prices, rental prices
  - Compute average consumption elasticity at the end of the second quarter relative to economy with no moratoria.

  $\Longrightarrow$ Model elasticity = **0.04**
- We need to consider that model provides average elasticity for all mortgage holders including ricardian households (non-stressed).
- Model matches the average consumption elasticity for stressed households and non-stressed households

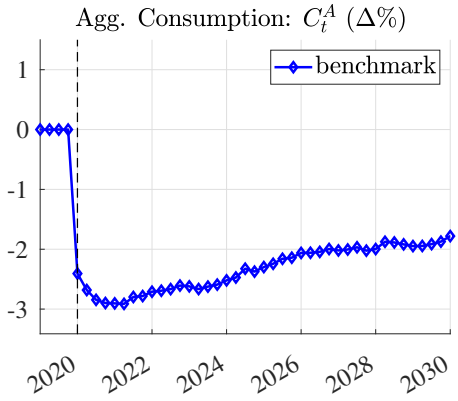
Equilibrium Response to Moratoria

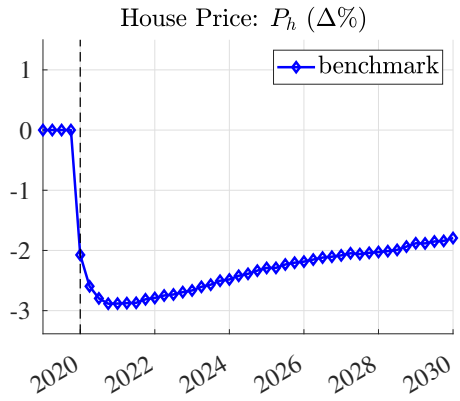
Aggregate impact of debt moratoria

- Turn on GE effect on prices to explore the long-run impacts.
- Compare economy transition path to same productivity shock in absence of moratoria.

Equilibrium Response to Moratoria

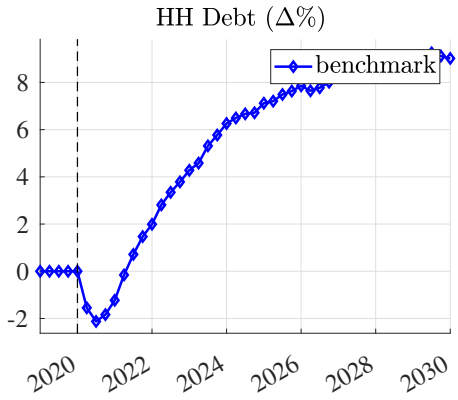
- Aggregate impact without moratoria
  - ↓ labor income (20% on impact) $\Longrightarrow$ ↓ consumption and house prices

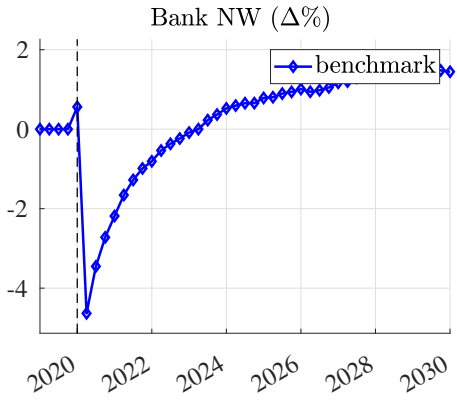




Equilibrium Response to Moratoria

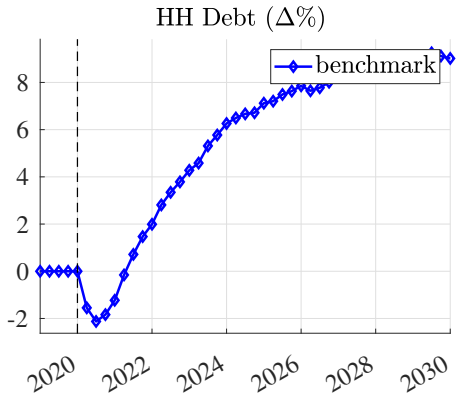
- Aggregate impact without moratoria
  - **In short-run**: ↓ house prices $\Longrightarrow$ ↓ household debt .
  - **In the medium-run**: house prices and income growth $\Longrightarrow$ ↑ household debt

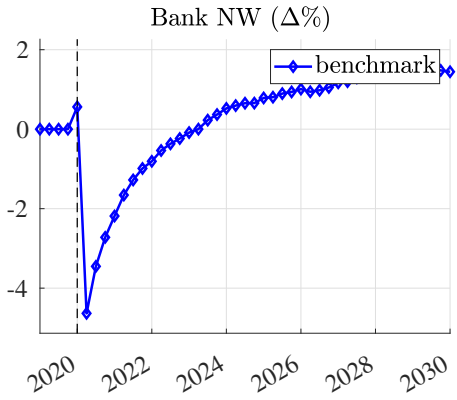




Equilibrium Response to Moratoria

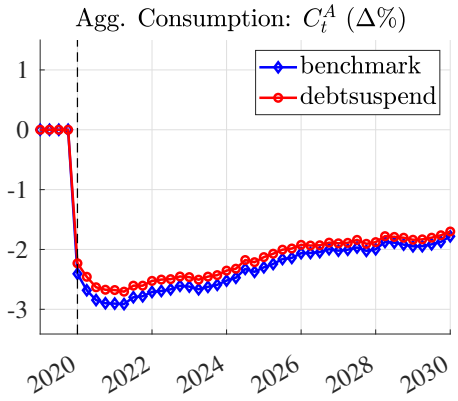
- Aggregate impact without moratoria
  - **On impact:** ↓ lending $\Longrightarrow$ ↑ valuation of existing mortgages $\Longrightarrow$ ↑ bank net worth.
  - ↓ assets liquidation value (prepay mortgages) $\Longrightarrow$ ↓ bank net worth.

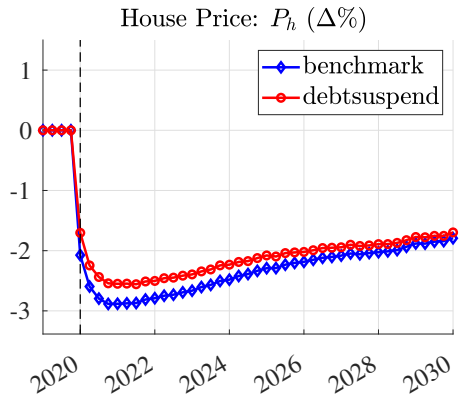




Equilibrium Response to Moratoria

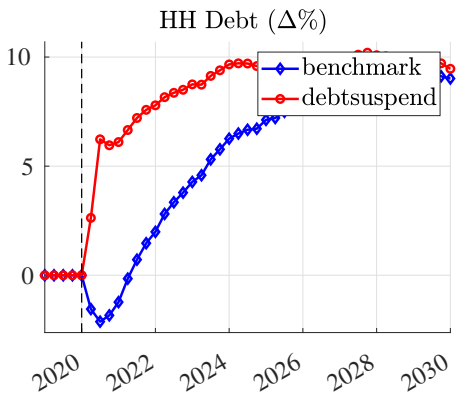
- Aggregate impact with moratoria All Other Moratoria length Decomposition
  - Consumption and welfare ($\approx$ 7%).
  - Housing prices (18%)

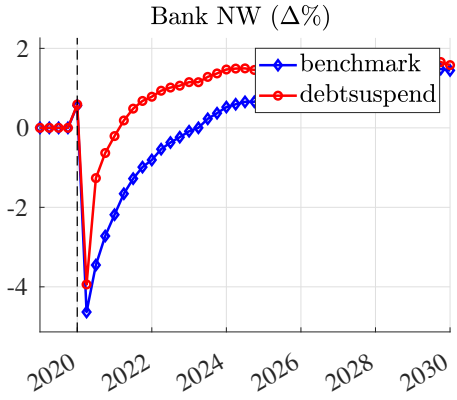




Equilibrium Response to Moratoria

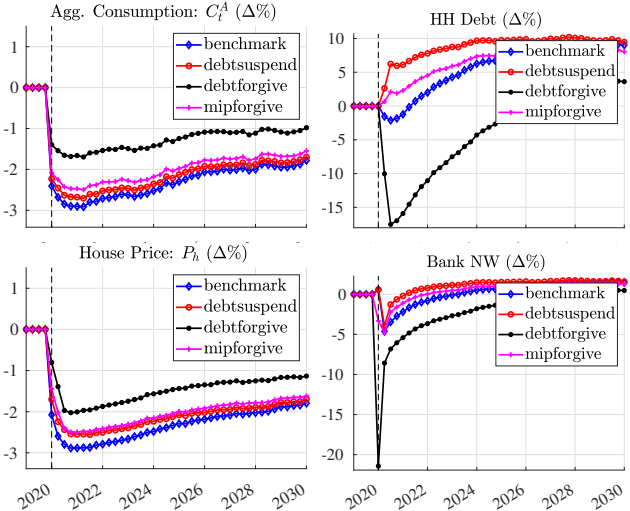
- Aggregate impact with moratoria All Other Moratoria length Decomposition
  - liquidation value and ↑ mortgage debt $\Longrightarrow$ ↑ banks profitability in the long run.





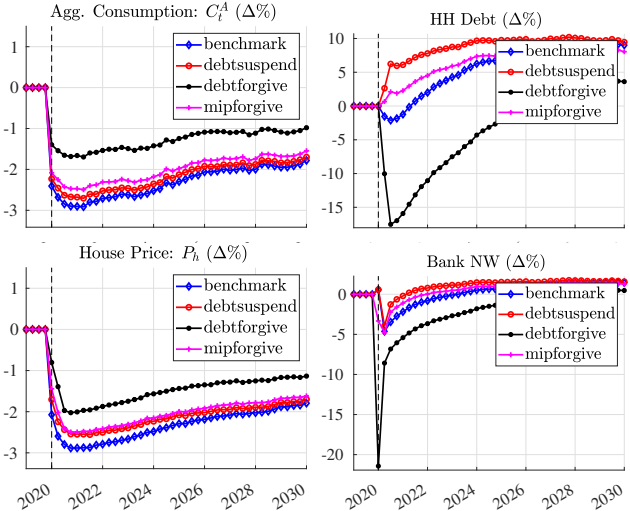
Policy Comparison All

- Compare alternative debt relief policies



Policy Comparison All

- Moratoria + no interests accrued $\Longrightarrow$ welfare improving and beneficial for banks.



Conclusions

- This paper study implications of temporary payment debt suspension for households.
- Empirical strategy $\Longrightarrow$ LATE on **stressed households**
  - Exploit discontinuity in eligibility for Colombia debt moratoria policy.
  - Higher consumption $\Longrightarrow$ credit card purchases, household investment, and new car loans.
  - Drop in delinquency rates on existent mortgages, credit card debt and car loan debt.
- Quantative model $\Longrightarrow$ approximates RDD estimates when eliminating all price effects.
  - Moratoria mitigates the negative response of the economy to an aggregate productivity shock.
  - Long-term effects of the policy is beneficial for banks.
  - Larger welfare gains if policy stipulate debt forgiveness or moratoria with interest rate not accrued.

THANK YOU!!!

APPENDIX

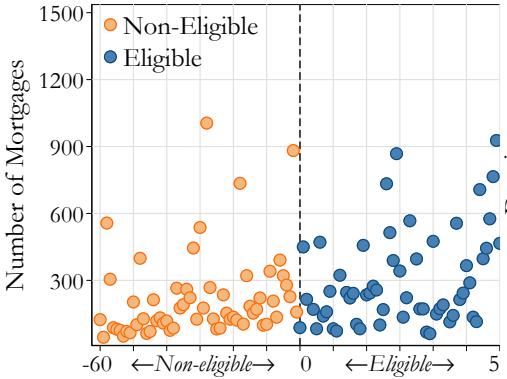
Related Literature back

- Impact of debt relief on financial distress on households
  - Dobbie and Song (2015) (**consumer bankruptcy protection**), Campbell et al.(2021) (**mortgage design and maturity extension**), Ganong and Noel (2020) (**mortgage modifications**), Dinerstein et al. (2024) (**student loan moratoria**)
- Quantitative models with long-term debt and default
  - Hatchondo et al. (2022) (**contingent convertible bonds and sovereign default**), Önder et al. (2023) (**corporate debt moratoria**)

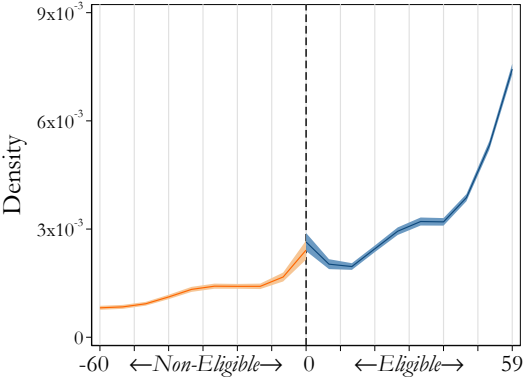
Testing Manipulation

back

- Reject manipulation of the running variable (p-value=0.25)



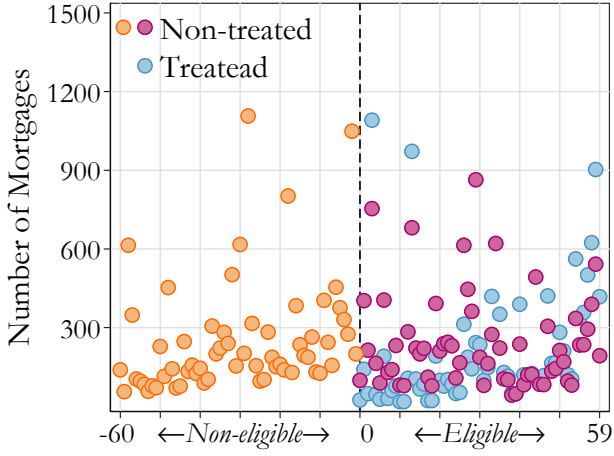
(a) Treatment Distribution



(b) McCrary's Test

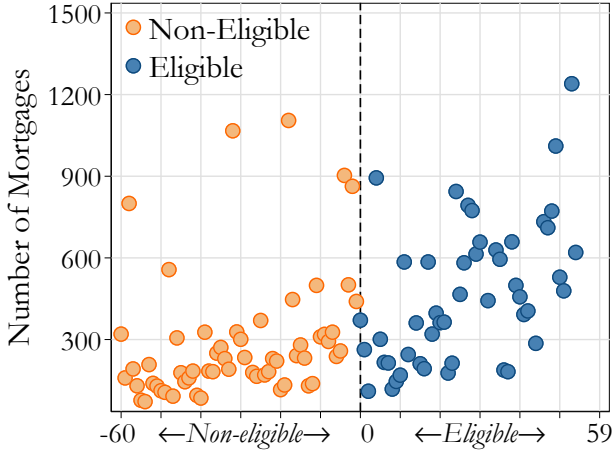
Treated and non-Treated Mortgages

back



Pre-treatment distribution of loans

back



Enforcement of the policy

back

Treatment Biting: Existing Mortgages 2020q2

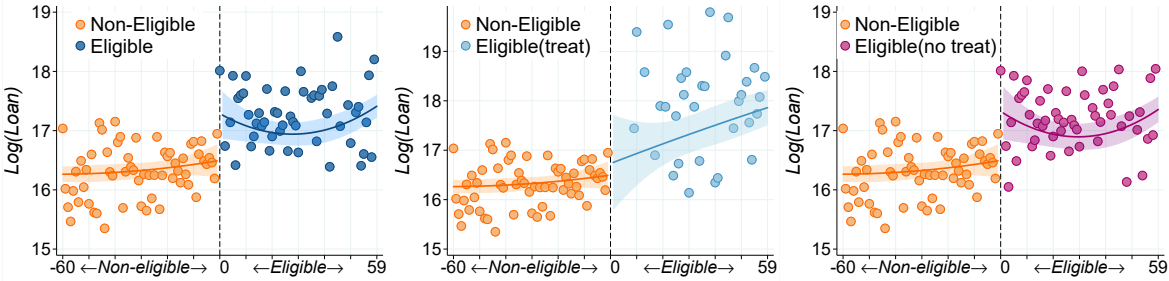
	During quarter of treatment			One quarter after treatment		
	Log(payment)	Delinq. (days)	Maturity (months)	Log(payment)	Delinq. (days)	Maturity (months)
Sharp-RD	-40.20***	-55.50***	0.76	6.69	-17.04***	1.51***
	(2.0)	(3.2)	(0.5)	(8.0)	(5.1)	(0.3)
Observations	138,150	109,445	122,786	108,446	108,446	108,446
BW loc. poly.	9.5	17.0	30.0	21.9	24.2	46.4

Moratoria and New Mortgages

back

- Log(new mortgage$_{ijt}$)

new mortgage$_{ijt}$ = value of loan$_{ij}$ at quarter of origination t_0



(a) Non-Eligible vs Eligible

(b) Non-Eligible vs Eligible-Treated

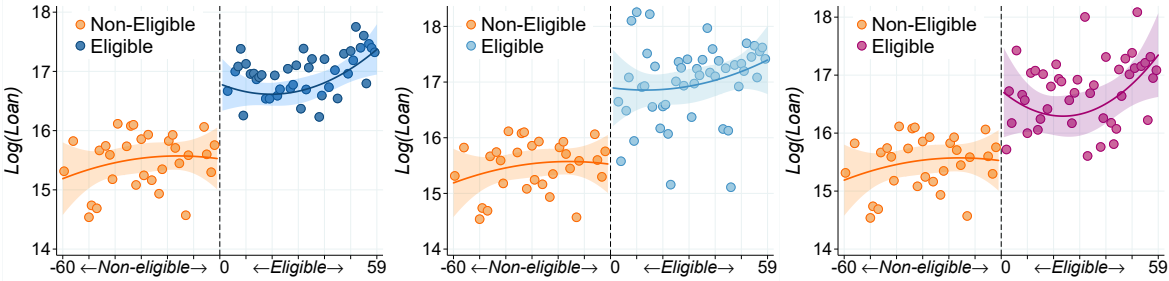
(c) Non-Eligible vs Eligible Non-Treated

Moratoria and New Car Loans

back

- Log(new car loan$_{ijt}$)

new car loan$_{ijt}$ = value of loan$_{ij}$ at quarter of origination t_0



(a) Non-Eligible vs Eligible

(b) Non-Eligible vs Eligible-Treated

(c) Non-Eligible vs Eligible Non-Treated

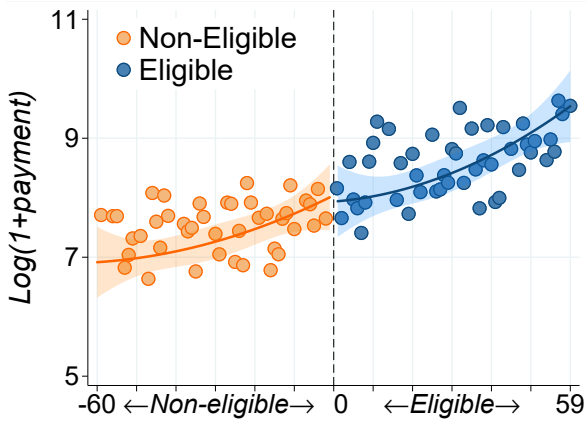
Pre-existing differences in Household Consumption

back

- What if we exploit the discontinuity before the implementation of the policy?

  $\Longrightarrow$ same measures of consumption for 2019Q4

- Observed jump in CC purchases around cutoff disappears



Moratoria and Durable Consumption

back

- Durable Consumption: **Log(new mortgage$_{ijt}$), Log(new car loan$_{ijt}$)**

new mortgage$_{ijt}$ (new car loan$_{ijt}$) = value of loan$_{ij}$ at quarter of origination t_0

	New Cars	New Mortgages
Fuzzy-RD	6.67**	3.78*
	(0.6)	(2.2)
	First Stage	
D_{ij}	0.14**	0.05**
	(0.05)	(0.02)
Observations	4,407	8,846
Bandwidth (in days)	22.8	17.0

Summary Statistics: Treated Households

back

	Mean	SD	P25	P50	P75	N_{obs}
CC Purchases	2.0	4.1	0.2	0.7	2.0	10,379
CC purchases growth	4.8	101.2	-40.2	16.9	67.9	7,534
Existent Mortgages						
Delinquency probability	4.9	21.6	0.0	0.0	0.0	79,228
Outstanding debt	51.7	49.0	20.6	38.2	64.2	76,629
Interest rate	10.5	2.7	9.0	10.7	12.5	77,895
Maturity	10.7	5.9	6.1	10.2	14.7	79,158
LTV	37.2	18.1	22.8	37.1	51.4	79,228
Rating	4.9	0.4	5.0	5.0	5.0	79,183
Short Term Loans						
Delinquency probability	5.0	21.8	0.0	0.0	0.0	17,001
Outstanding debt	5.0	7.4	1.0	2.4	5.4	16,126
Interest rate	22.9	7.9	23.7	27.1	27.2	16,797
Maturity	7.2	8.9	2.9	4.3	5.0	16,853
Rating	4.7	0.9	5.0	5.0	5.0	17,001
Car Loans						
Delinquency probability	17.7	38.2	0.0	0.0	0.0	2,082
Outstanding debt	28.6	26.1	11.1	22.1	37.2	2,048
Repayment	1.6	3.6	0.0	0.8	2.1	2,082
Interest rate	12.3	6.4	10.3	13.0	15.9	1,990
Maturity	3.2	1.8	1.7	3.3	4.5	2,053
Rating	4.3	1.3	5.0	5.0	5.0	2,082

Summary Statistics: Eligible Non-Treated Households

back

	Mean	SD	P25	P50	P75	N_{obs}
CC Purchases	2.3	4.3	0.2	0.8	2.4	4,035
CC purchases growth	-1.4	195.0	-36.1	26.1	77.3	3,043
Existent Mortgages						
Repayment	1.4	1.6	0.5	1.0	1.8	27,597
Delinquency probability	43.9	49.6	0.0	0.0	100.0	32,606
Outstanding debt	50.4	54.8	16.6	33.9	62.6	32,052
Interest rate	10.8	2.7	9.5	10.7	12.7	31,823
Maturity	9.3	5.7	4.8	8.7	13.1	32,334
LTV	32.5	18.5	17.5	31.9	46.5	32,605
Rating	4.4	0.9	4.0	5.0	5.0	32,536
Short Term Loans						
Delinquency probability	8.7	28.2	0.0	0.0	0.0	7,174
Outstanding debt	5.0	7.4	1.1	2.4	5.4	6,414
Interest rate	23.3	7.6	24.3	27.1	27.2	7,040
Maturity	7.1	9.1	2.7	4.2	5.0	7,097
Rating	4.6	1.1	5.0	5.0	5.0	7,174
Car Loans						
Delinquency probability	31.8	46.6	0.0	0.0	100.0	1,484
Outstanding debt	25.6	27.1	5.9	18.3	35.2	1,448
Interest rate	12.7	5.7	10.7	13.2	15.7	1,231
Maturity	2.7	1.8	1.0	2.6	4.2	1,447
Rating	3.6	1.8	2.0	5.0	5.0	1,484

Summary Statistics: Non-Eligible Households

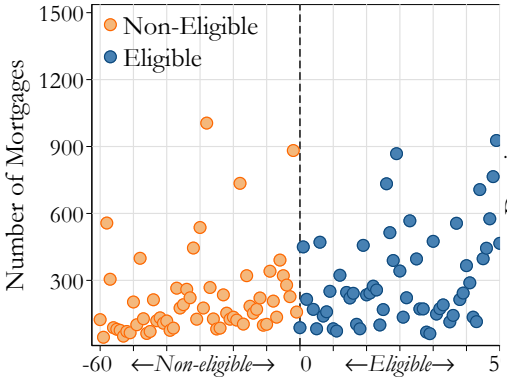
back

	Mean	SD	P25	P50	P75	N_{obs}
CC Purchases	1.3	3.1	0.1	0.4	1.2	1,992
CC purchases growth	-63.7	245.3	-96.3	-25.3	34.1	1,522
Existent Mortgages						
Repayment	1.6	2.4	0.3	0.9	1.9	19,982
Delinquency probability	94.8	22.2	100.0	100.0	100.0	41,045
Outstanding debt	53.1	58.0	18.3	35.2	64.1	40,702
Interest rate	11.1	3.1	9.5	11.1	13.0	40,831
Maturity	9.7	5.8	5.2	8.9	13.8	40,621
LTV	35.3	17.1	21.6	35.8	48.5	41,045
Rating	3.4	1.0	3.0	3.0	4.0	12,150
Short Term Loans						
Delinquency probability	27.9	44.9	0.0	0.0	100.0	3,983
Outstanding debt	4.7	7.0	1.1	2.3	5.0	3,766
Interest rate	24.7	6.4	25.9	27.2	27.2	3,870
Maturity	9.1	11.3	2.1	3.9	5.6	3,903
Rating	3.5	1.8	1.0	5.0	5.0	3,983
Car Loans						
Delinquency probability	81.6	38.7	100.0	100.0	100.0	621
Outstanding debt	22.5	24.2	4.3	16.0	30.4	609
Interest rate	15.1	6.1	11.8	14.6	18.1	459
Maturity	2.4	1.8	0.9	2.0	3.6	594
Rating	1.7	1.1	1.0	1.0	2.0	621

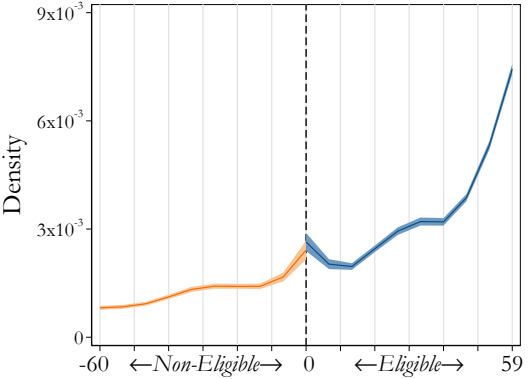
Testing Manipulation

back

- Reject manipulation of the running variable (p-value=0.25)



(a) Treatment Distribution

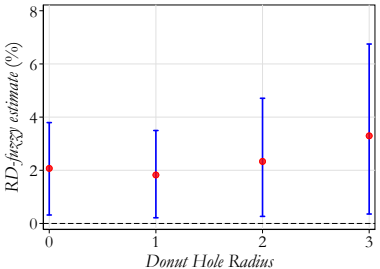


(b) McCrary's Test

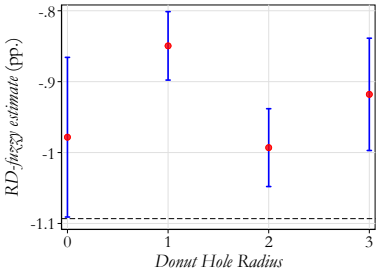
Donut-hole sensitivity test

back

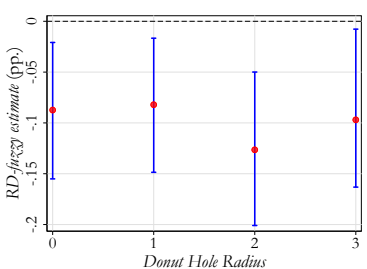
- Test checks for additional "bunching" of observations around the cutoff
- Most estimates are robust to excluding 1, 2, and 3 days before/after the cutoff



(a) CC Expenditure



(b) New Car Loans

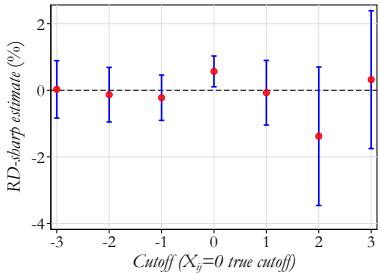


(c) New Mortgages

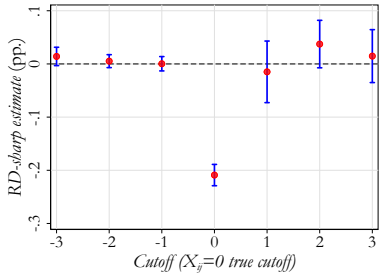
Falsification - different cutoffs

back

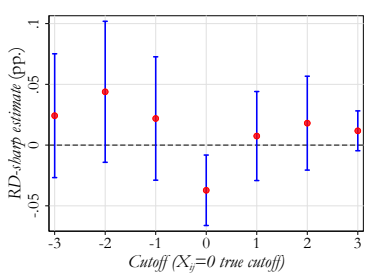
- What if move the cutoff for delinquency days?
- no effects on placebo cutoffs



(a) Log(CC expenditure)



(b) Delinquency Mortgages



(c) Delinquency Short term loans

Testing for pre-policy differences I

back

Variable	RD Estimator	Robust Inference		Bandwidth (in days)	Observations
		p-value	95% Conf. Int.		
Credit Cards					
Log(Expenditure)	-0.68	0.71	[-3.70, 2.35]	49.56	17,252
Delinquency Prob.	-0.05	0.11	[-0.11, 0.00]	20.71	58,303
Log(Outstanding Debt)	-0.14	0.68	[-0.67, 0.40]	32.91	53,469
Interest Rate	0.04	0.85	[-0.29, 0.37]	18.33	66,581
Existing Mortgages					
Repayment	-0.06	0.71	[-0.32, 0.20]	30.84	149,556
Delinquency Prob.	-0.05	0.52	[-0.19, 0.08]	14.81	119,817
Log(Outstanding Debt)	-0.17	0.28	[-0.44, 0.09]	24.57	152,734
Interest Rate	-0.30	0.52	[-1.07, 0.47]	48.99	155,970
Maturity	-0.98	0.29	[-2.49, 0.53]	52.19	155,551
LTV	-1.45	0.64	[-6.52, 3.62]	24.28	155,985
Rating	0.20	0.17	[-0.04, 0.44]	8.83	119,802

Testing for pre-policy differences II

back

Variable	RD Estimator	Robust Inference		Bandwidth (in days)	Observations
		p-value	95% Conf. Int.		
Short Term Loans					
Delinquency Prob.	-0.02	0.50	[-0.08, 0.03]	30.34	27,158
Log(Outstanding Debt)	0.05	0.83	[-0.36, 0.47]	27.87	24,971
Interest Rate	0.08	0.92	[-1.33, 1.49]	19.02	26,830
Maturity	-0.36	0.35	[-0.99, 0.27]	35.76	26,522
Rating	0.24	0.26	[-0.11, 0.59]	40.45	27,158
Car Loans					
Delinquency Prob.	-0.11	0.63	[-0.49, 0.27]	38.28	5,489
Log(Outstanding Debt)	-1.57	0.19	[-3.52,0.38]	27.07	5,362
Interest Rate	0.55	0.65	[-1.44, 2.53]	33.36	4,878
Maturity	-0.22	0.80	[-1.63, 1.20]	35.12	5,379
LTV	5.15	0.58	[-10.19, 20.49]	33.94	5,489
Rating	0.52	0.09	[0.02, 1.02]	30.50	5,489

(Un)-Predictability of Treatment

back

- Check which mortgage characteristics explain treatment status
- Only unning variable explain treatment choice consistently.

	Entire sample	BW=40	BW=30	BW=25	BW=15
Running	0.0021***	0.0090***	0.0087***	0.011***	0.012***
	(0.0001)	(0.00005)	(0.0001)	(0.0001)	(0.0004)
Oustanding Debt	0.41***	0.15***	0.21***	0.19	0.13
	(0.041)	(0.042)	(0.071)	(0.123)	(0.108)
Expected Payment	-1.14e-08***	0.0012***	0.00015	0.00023	0.00072
	(0.000)	(0.0002)	(0.0003)	(0.0003)	(0.0006)
Maturity	-0.0001	-0.00006	0.0004	0.0004	0.0004
	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0005)
LTV	-1.9e-12***	-8.83e-07	1.05e-06	4.2e-06	7.9e-06
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	822,876	28,513	20,289	14,916	10,348
R-squared	0.21	0.38	0.26	0.29	0.34

Dynamic Estimates: CC Expenditure

back

- T $\Longrightarrow$ contemporaneous effect.
- T + τ $\Longrightarrow$ effect τ quarters after receiving debt moratoria.
- T + 2 $\Longrightarrow$ pre-policy differences.

	T-2	T	T+1	T+2	T+3
Fuzzy-RD	-1.07	2.10**	4.24*	0.66	-0.49
	(1.90)	(1.06)	(2.47)	(1.66)	(2.63)
	First Stage				
D_{ij}	0.26***	0.27***	0.29***	0.25***	0.28***
	(0.029)	(0.041)	(0.042)	(0.037)	(0.033)
All Observations	17,344	16,504	17,954	19,696	20,630
Bandwidth (in days)	36.2	19.2	15.9	24.7	27.9

Dynamic Estimates: CC Expenditure

back

- No differences in CC purchases before policy implementation.

	T-2	T	T+1	T+2	T+3
Fuzzy-RD	-1.07	2.10**	4.24*	0.66	-0.49
	(1.90)	(1.06)	(2.47)	(1.66)	(2.63)
	First Stage				
D_{ij}	0.26***	0.27***	0.29***	0.25***	0.28***
	(0.029)	(0.041)	(0.042)	(0.037)	(0.033)
All Observations	17,344	16,504	17,954	19,696	20,630
Bandwidth (in days)	36.2	19.2	15.9	24.7	27.9

Dynamic Estimates: CC Expenditure back

- Effect of moratorium on consumption disappears after two quarters.

  Treated households ↑ CC purchases:

  – 2.10% in quarter moratoria started.

  – 4.24% one quarter after. $\Longrightarrow$ liquidity mitigation + treatment timming and duration.

	T-2	T	T+1	T+2	T+3
Fuzzy-RD	-1.07	2.10**	4.24*	0.66	-0.49
	(1.90)	(1.06)	(2.47)	(1.66)	(2.63)
	First Stage				
D_{ij}	0.26***	0.27***	0.29***	0.25***	0.28***
	(0.029)	(0.041)	(0.042)	(0.037)	(0.033)
All Observations	17,344	16,504	17,954	19,696	20,630
Bandwidth (in days)	36.2	19.2	15.9	24.7	27.9

Moratoria and Mortgage Delinquency Dynamics

back

- ↓ **Delinquency** over next four quarters after treatment.

	T-1	T	T+1	T+2	T+3	T+4
	(1)	(2)	(3)	(4)	(5)	(6)
Fuzzy-RD	-0.05	-0.98***	-0.67***	-0.70***	-0.31***	-0.26***
	(0.08)	(0.07)	(0.1)	(0.04)	(0.05)	(0.06)
	First Stage					
D_{ij}	0.24***	0.21***	0.23***	0.22***	0.24***	0.25***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
Observations	119,981	152,879	147,628	143,105	138,268	102,596
Bandwidth (in days)	14.8	8.2	8.5	20.13	14.6	13.8

Moratoria and Delinquency Dynamics on Other Debt

back

- Only short term ↓ delinquency probability for other household debt.

	T-1	T	T+1	T+2	T+3	T+4
	(1)	(2)	(3)	(4)	(5)	(6)
(A) Short Term Loans						
Fuzzy-RD	-0.02	-0.09**	-0.16***	-0.09	0.03	-0.09
	(0.03)	(0.04)	(0.06)	(0.06)	(0.05)	(0.06)
Observations	27,158	28,158	29,348	31,134	32,823	34,783
(B) Car Loans						
Fuzzy-RD	-0.11	-0.36**	0.13	0.24	0.21	0.27
	(0.23)	(0.18)	(0.26)	(0.18)	(0.19)	(0.51)
Observations	5,489	4,187	4,110	4237	4,335	4,702

Moratoria and Mortgage Debt Dynamics

back

- Existent Mortgage debt $\Longrightarrow$ **Log (Outstanding Balance$_{it}$)**
  - Financial burden doesn't increase in quarter of treatment.
  - $\downarrow$ Mortgage debt four quarters after treatment (due to $\downarrow$ delinquency)

	T-1 (1)	T (2)	T+1 (3)	T+2 (4)	T+3 (5)	T+4 (6)
Fuzzy-RD	-0.17	-0.16	-0.19	-0.17	-0.15	-0.22**
	(0.16)	(0.16)	(0.16)	(0.13)	(0.14)	(0.11)
	First Stage					
$D_{i,j}$	0.21***	0.21***	0.21***	0.21***	0.21***	0.24***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Observations	152,734	149,383	144,872	140,284	135,606	100,420
Bandwidth (in days)	24.6	23.7	22.6	20.8	20.4	18.6

Moratoria and Dynamics on Other Debt

back

- Household debt on short term loans and car loans $\Longrightarrow$ **Log (Outstanding Balance$_{it}$)**

	T-1	T+1	T+1	T+2	T+3	T+4
	(1)	(2)	(3)	(4)	(5)	(6)
(A) Short Term Loans						
Fuzzy-RD	0.06	-0.52*	-0.58**	-0.09	-0.06	-0.35
	(0.25)	(0.29)	(0.27)	(0.34)	(0.39)	(0.31)
Observations	24,971	25,897	26,306	26,964	27,557	28,278
(B) Car Loans						
Fuzzy-RD	-1.60	-2.7**	-2.4***	-0.77	0.94	0.92
	(0.77)	(1.22)	(0.91)	(0.86)	(1.10)	(1.12)
Observations	5,362	4,105	4,006	4,141	4,235	1,837

Moratoria and Dynamics on Other Debt

back

- ↓ **Outstanding debt** on short term loans and car loans:
  - **Quarter of treatment**: 0.52% and 2.7%.
  - **One quarter after treatment**: 0.58% and 2.4%.

	T-1 (1)	T (2)	T+1 (3)	T+2 (4)	T+3 (5)	T+4 (6)
(A) Short Term Loans						
Fuzzy-RD	0.06	-0.52*	-0.58**	-0.09	-0.06	-0.35
	(0.25)	(0.29)	(0.27)	(0.34)	(0.39)	(0.31)
Observations	24,971	25,897	26,306	26,964	27,557	28,278
(B) Car Loans						
Fuzzy-RD	-1.60	-2.7**	-2.4***	-0.77	0.94	0.92
	(0.77)	(1.22)	(0.91)	(0.86)	(1.10)	(1.12)
Observations	5,362	4,105	4,006	4,141	4,235	1,837

Exposure to Debt Moratoria and Bank Response

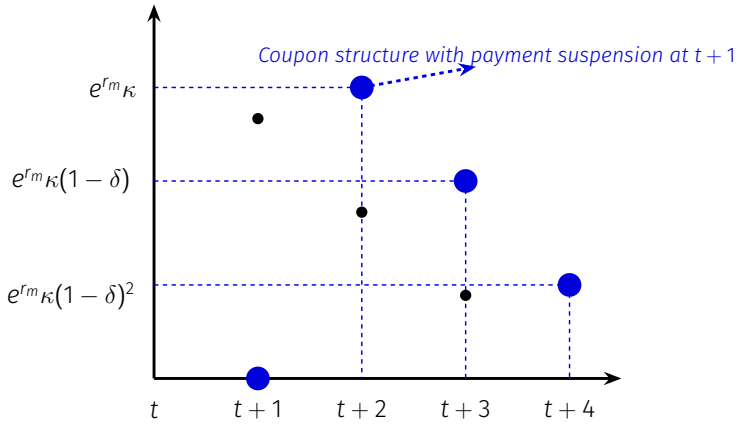
back

	ΔProfit	ΔEquity	Δ Assets	ΔLiab.
Bartik-IV	0.46**	0.21***	0.37***	0.06
	(0.038)	(0.18)	(0.021)	(0.16)
	First Stage			
B_{jt}	0.98***	0.98***	0.98***	0.98***
	(0.192)	(0.192)	(0.192)	(0.192)
F-first stage	26.06	26.06	26.06	26.06
Observations	200	200	200	200
Bank fixed effects	✓	✓	✓	✓
Time-quarter fixed effects	✓	✓	✓	✓

Mortgages with moratoria

back

- Coupon structure of a **non-contingent bond** issued at t:



Homeowner Stayer

back

- If remains homeowner

$$V^{hh}(a,h,d,z,j) = \max_{c,a'\geq 0}\left\{u(c,h) + \beta E V^{h}(a',z',j',h,d)\right\}$$

subject to

$$\begin{aligned} c + \delta_h p_h h + a' + m &= w(1-\tau)\, y(j,z) + a(1+r_k) \\ d' &= (d-m)(1+r_l), \end{aligned}$$

Homeowner Refinancer back

- If decide to refinance $\Longrightarrow$ pay balance and get a new mortgage

$$V^{hf}(a,h,d,z,j) = \max_{c,d',a'} \left\{ u(c,h) + \beta E V^{h}(a',z',j',h,d'') \right\}$$

subject to

$$\begin{aligned} c + d + p_h h + \delta_h p_h h + \varphi_f + a' &= w(1-\tau)\, y(j,z) + a(1+r_k) + d'\left(q^m(a',z,j,d,h) - \varphi_m\right) \\ d' &\leq p_h h (1-\phi) \end{aligned}$$

Homeowner Seller

back

- If sell house (rent or buy new house) $\Longrightarrow$ identical to a renter's problem

$$V^{hr}(a, h, d, z, j) = V^{rr}(a + p_h h(1 - \varphi_s) - d, z, j)$$

Homeowner Defaulter back

- If default

$$V^{he}(a,d,z,j) = \max_{c,s,a'\geq 0} \left\{ u(c,s) + \beta_i E\left[\pi V^r(a',z',j') + (1-\pi) V^i(a',z',j') \right] \right\} \quad (1)$$

subject to

$$c + a' + p_r s = a(1+r_k) + w(1-\tau) y(j,z) + \max\{(1-\varphi_e) p_h h - d, 0\}.$$

Inactive renter

back

$$V^i(a,z,j) = \max_{c,s,a'} \left\{ u(c,s) + \beta \left[\pi EV^r(a',z',j') + (1-\pi) EV^i(a',z',j') \right] \right\}$$

subject to

$$c + a' + p_r s \quad = \quad w\,(1-\tau)\,y(j,z) + a\,(1+r_k)$$

Firms

back

- Perfectly competitive firm produces final output

$$\max_{K_t, N_t, u_t} \mathbb{Z}_t K_t^{\alpha} \left(N_t u_t\right)^{1-\alpha} - \left(r_{k,t} + \delta_k\right) K_t - \left(1 + \zeta r_{l,t+1}\right) w_t N_t$$

- Wage per efficiency of labor (w_t) is defined as:

$$w_t = \underbrace{\bar{w}_t}_{\text{base rate}} + \underbrace{\vartheta \frac{u_t^{1+\psi}}{1+\psi}}_{\text{convex adjustment cost}}$$

Firms

back

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Rental companies back

- Own the rental housing units by buying and selling from households and from each other.

$$(1+r_k)\,V^{rc}(H_r) = \max_{H_r'}\left\{\left(p^r-\kappa-p^h\right)H_r' + (1-\delta_h)H_r + \eta\frac{(H_r-H_r')^2}{2} + V^{rc}(H_r')\right\}$$

- In equilibrium rate of return equal to the rate of return on capital

$$p_r = \kappa + p_h + \eta p_h\left(H_r' - H_r\right) - \frac{\left(1-\delta_h+\eta\left(H_r''-H_r'\right)\right)p_h'}{1+r_k}$$

Rental companies back

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Externally Set Parameters

back

Parameter	Explanation	Value
σ	risk aversion	2
α	capital share	0.4
ρ_ε	annual persistence of income	0.96
σ_ε	annual std of innovation to AR(1)	0.19
φ_h	selling cost for a household	7%
φ_e	selling cost for foreclosures	25%
φ_f	fixed cost of mortgage origination	8%
φ_m	variable cost of mortgage origination	0.75
δ_h	annual housing depreciation rate	2.5%
π	quarterly prob. of being an active renter	3.6%
$\bar{H}$	housing supply	1
ψ	wage curvature	3
ϕ	down payment requirement	0.3
ζ	share of wage bill financed	100%
δ_k	quarterly capital depreciation rate	2.5%
δ_m	quarterly mortgage depreciation rate	2.5%

Internally Calibrated Parameters

back

Parameter	Explanation	Value
β	discount factor	0.96
$\underline{h}$	minimum house size	0.89
r	bank borrowing rate	1.5%
γ	weight of housing services in utility	0.19
κ	rental maintenance cost	0.06
ϑ	wage parameter	2.36
ξ	bank seizure rate	0.2
β_L	bank discount factor	0.95

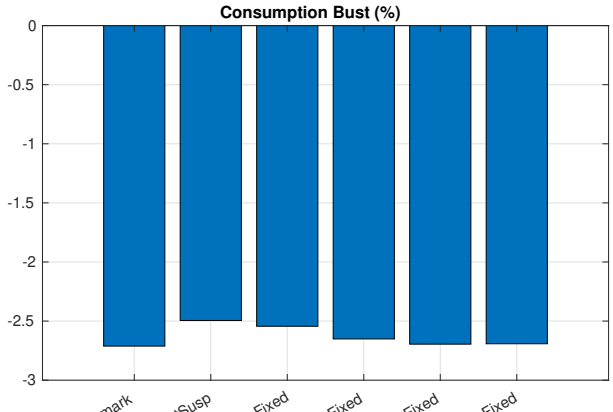
Decomposition of the Debt Suspension Policy

back

- Decompose change in consumption after two quarters into components.

– Indirect effect explains most of the consumption response.

– Direct effect is about 10%



Decomposition of the Debt Suspension Policy

back

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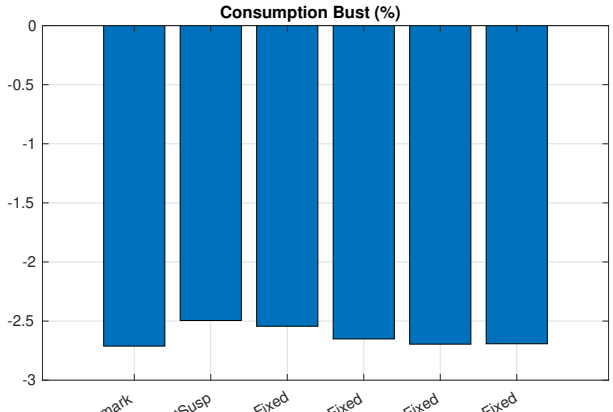
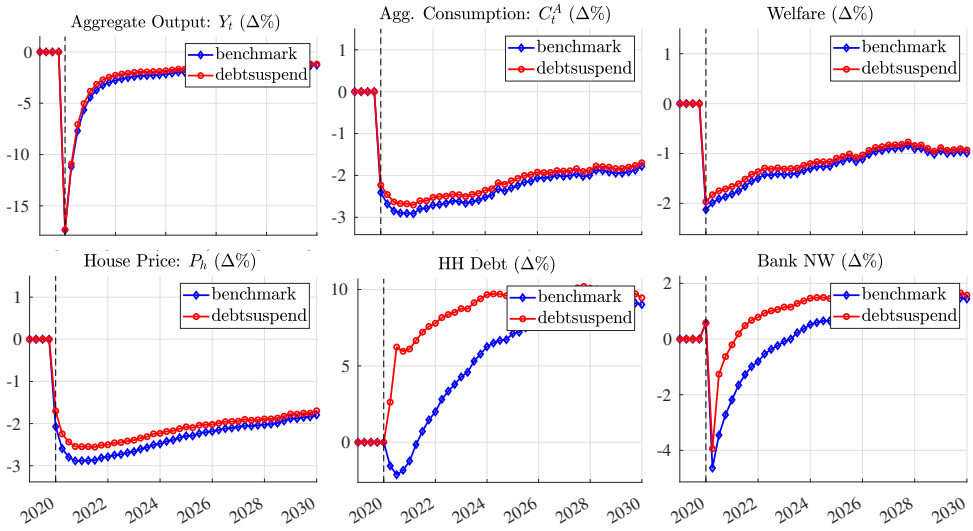


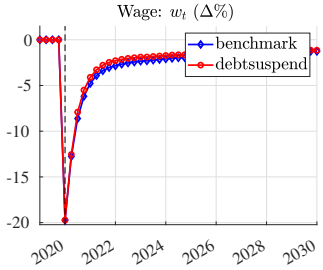
Aggregate Effect: all aggregate variables

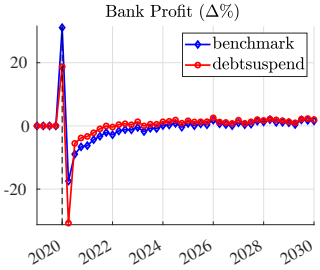
back

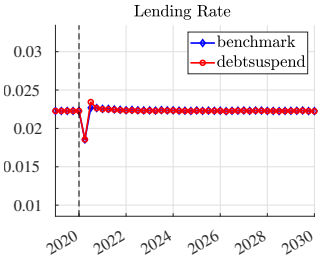


Introducing Moratoria: Other Outcomes

back

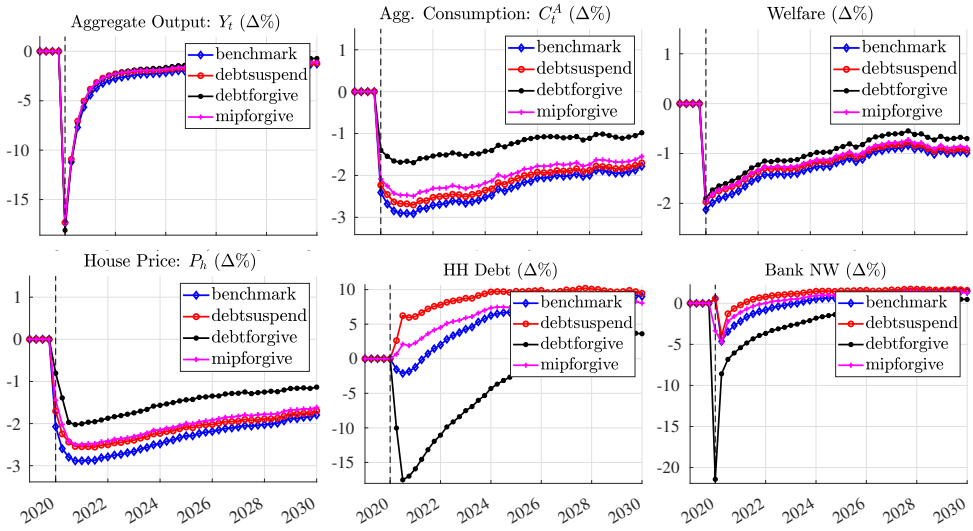






Policy Comparison

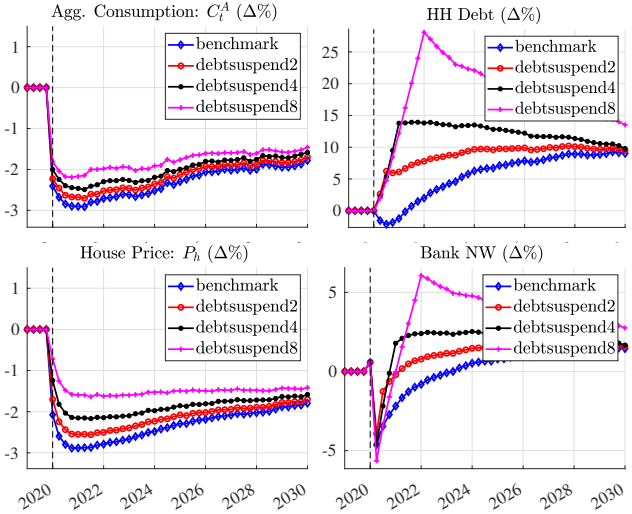
back



Comparing Length of Moratoria

All back

- Gains increase with length of payment suspension to households



Comparing Length of Moratoria

back