Forbearance vs. Interest Rates: Experimental Tests of Liquidity and Strategic Default Triggers

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Motivation

What triggers default on debt obligations, and what debt relief policy best prevents it?

- Policymaking—guides design and targeting of relief policies.
- Finance—distinguishes models that emphasize solvency, liquidity, and strategic behavior.
- Macroeconomics—disciplines channels and sizes of effects of fiscal and monetary policies.

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This paper:

- Large-scale (N=20,944) experiment analyzed using the language and framework of an RCT.
- Unique 2-by-2-by-2 design—3 randomized instruments

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- Use transparent event studies to analyze the effects of policies on defaults.
- Test default models emphasizing liquidity and strategic behavior

$$\text{Decision to Default} = \phi \underbrace{\text{Current Payments}}_{\text{Liquidity}} + \psi \underbrace{\text{PV of } \textit{Future} \text{ Payments}}_{\text{Strategic}} + \underbrace{\text{Other Factors}}_{\text{solvency, risk, costs}}$$

Preview of Results

1. Solvency—face value *FV* too high
    - No! Modifications orthogonal to face value (and income, risk, costs) *do* affect whether/when to default.
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Liquidity Triggers—Payments (First-stage) vs. Defaults (Intent-to-treat)

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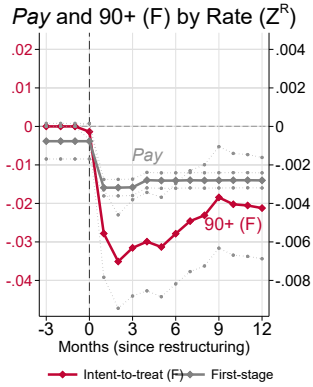
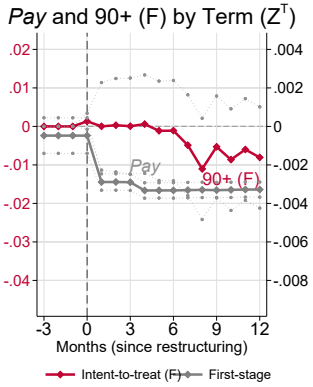
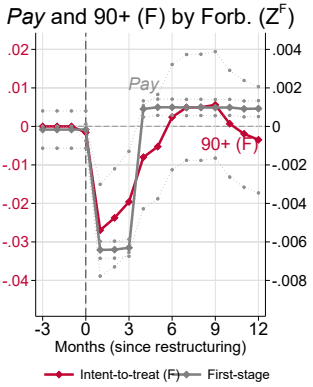


by Term ($\mathbb{Z}_i^T$)



by Forbearance ($\mathbb{Z}_i^F$)



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- Characterize a strategic trigger whose location is influenced by distress, precaution, and assets.
- Rate reductions have effects beyond liquidity; more powerful for unconstrained.

Conceptual Framework

Effect on Payments

$$\begin{aligned} \text{Payment} &= FV\left(\frac{1}{T}+\frac{R}{2}+\frac{R}{2T}+\frac{R^2T}{12}-\frac{R^2}{12T}+O(R^3)\right) \\ Pay &\simeq \left(\frac{1}{T}+\frac{R}{2}\right) \end{aligned} \tag{1}$$

Pay very sensitive to forbearance, much less on the interest rate.

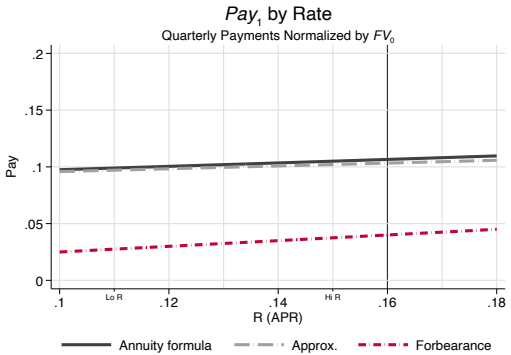
- Typical R 16% APR. The typical T 3 years. Quarterly *Pay* of $\frac{1}{12}+\frac{4\%}{2}\simeq 0.1$.
- Forbearance, postponing amortizing principal, reduces *Pay* 60%, to quarterly R of 4%.
- 4*pp* APR reduction (25% reduction) reduces *Pay* 5%.
- 10% increase in T' (off a base of 3 years) reduces *Pay* 8%.

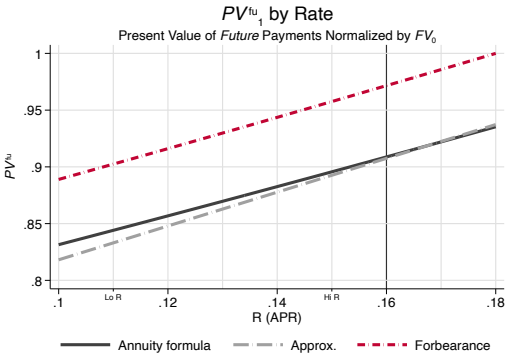
Effect on Present Value of *Future* Payments

$$\begin{aligned} \text{Present Value}_0 &= \text{Payment}\left(T - \frac{R^*\ T}{2} - \frac{R^*\ T^2}{2} + O(R^{*2})\right) \\ PV_0 &\simeq \left(1 + (R - R^*)\,\frac{T+1}{2}\right) \end{aligned} \tag{2}$$

- Rate reductions *revalue*—alter *PV* despite keeping *FV* constant.
  - ΔR of 4*pp* APR equivalent in *PV* to a write down of $\frac{1}{2} \cdot T \cdot \Delta R$= 6% of *FV*
  - To a first-order approximation, the change in *PV* is independent of R^*.
  - Effects on future *Pay* account for more or less the entire impact.
  - Reduction in *Pay* stream could exactly be replicated in *PV* terms via a *FV* write down.
  - Unlike a write-down, borrowers cannot capitalize by prepaying or calling at *FV*.
  - Revaluation proportional for *Pay* and *PV*, hence larger if debt has a high duration, i.e., *T* is large.
- Term extensions spread out payments further over time.
  - Change in *PV* proportional to $\frac{1}{2} \cdot T \cdot (R - R^*)$.

Current Payments and Present Value of *Future* Payments





Competing Models

- Solvency: default if the face value too high.
  - No credit constraints and $R^*=R$.
- Liquidity: default if current payments are too high.
  - Affordability constraint, extreme myopia/short-effective planning horizons, or rule-of-thumb behavior.
- Strategic: default by solvent and liquid: if future payments are too high.
- Endogenous: whether defaults are strategic is linked to borrower balance sheets

Model	What triggers default?			What reduces default?			Policy
	FV	*Pay*	PV^{fu}	$R\downarrow$	$T\uparrow$	*F*	
Solvency	✓						Write-down
Liquidity		✓		✓	✓	✓	Forbearance
Strategic			✓	✓			Rate reduction
Endogenous	✓	✓	✓	✓	✓	✓	Heterogeneous

Institutional Details

Macroeconomic and Institutional Details

- Macroeconomic conditions neither depression nor the transitory type.
  - Banks or the government are not immediately culpable.
  - Defaults best characterized as idiosyncratic.
- Unsecured loans with fixed rates, terms up to 72 months, fixed nominal payments.
  - 40% total, two-thirds of non-mortgage *FV* outstanding to households.
- No bankruptcy protection.
  - 30+ followed up via phone. 90+ forwarded to collections and reported to the credit bureau.
  - Wage garnishment up to 25% of income. Seizure of cash, durables, real estate.
  - At the onset, 5% of aggregate *FV* in non-performing status.
  - Lenders have the capability to facilitate modifications.

Summary Statistics

	Unit	*N*	mean	s.d.	*p*10	*p*50	*p*90
Demographics							
Age	Years	20,944	38.0	9.8	26	37	52
Metro area (1m+)		20,944	0.23	0.42	0	0	1
Delinquent loan							
Loans (Consolidated)	Count	20,944	1.25	0.53	1	1	2
FV (Original)	TRY	20,944	15,281	11,172	4,546	12,298	29,081
FV (Remaining)	TRY	20,944	10,403	8,980	2,480	7,728	21,639
R	APR, %	20,944	16.3	1.1	14.8	16.4	17.4
T (Original)	Months	20,944	36.8	7.7	24	36	48
T (Remaining)	Months	20,944	23.9	11.9	10	21	43
Payment	TRY	20,944	531	375	176	434	959
Pay	% of FV	20,944	6.4	3.4	3.0	5.6	11.2
New loan							
FV_0	TRY	20,944	10,403	8,980	2,480	7,728	21,640
R'	APR, %	20,944	13.0	2.6	9.6	13.2	16.5
T'	Months	20,944	41.3	14.9	18	48	61
Forbearance (Take-up)	%	7,308	32.8	46.9	0	0	100
Payment	TRY	20,944	306	255	77	238	617
Pay	% of FV	20,944	3.3	1.6	1.5	3.0	5.6
Balance sheet							
30+		20,944	0.89	0.31	0	1	1
90+		20,944	0.30	0.46	0	0	1
Assets (Checking)	TRY	18,715	-1,022	1,778	-2,400	-792	0
Limit (Credit Line)	TRY	18,112	5,163	8,169	650	2,750	10,800
Debt (Credit Line)	TRY	18,112	4,173	8,252	0	1,653	9,890

Experimental Design

Experimental Timeline

Old Contract in Arrears $(R,\ T)$ $\rightarrow$ Randomization $\mathbb{Z}^R \times \mathbb{Z}^T \times \mathbb{Z}^F$ (2×2×2=8 groups) $\rightarrow$ Refinancing Call $R' | \mathbb{Z}^R$ displayed; $T^{\text{Offer}} | T, \mathbb{Z}^T$ offered; T' decided; $F | \mathbb{Z}^F$ offered; F decided $\rightarrow$ New Contract $(R',\ T',\ F)$

Selection and Randomization

- Participants are preexisting borrowers who hold an unsecured loan in arrears.
- 8 treatment legs in a 2-by-2-by-2 design.
  - Draw three random numbers—to determine rate (R), term (T), forbearance (F).
  - $\mathbb{Z}_i^k = 1$—*High* relief designation if number is above a specific threshold.
    - Threshold equals 0.5 for rate and term and 0.65 for forbearance.
- Three randomized instruments for econometric evaluation:

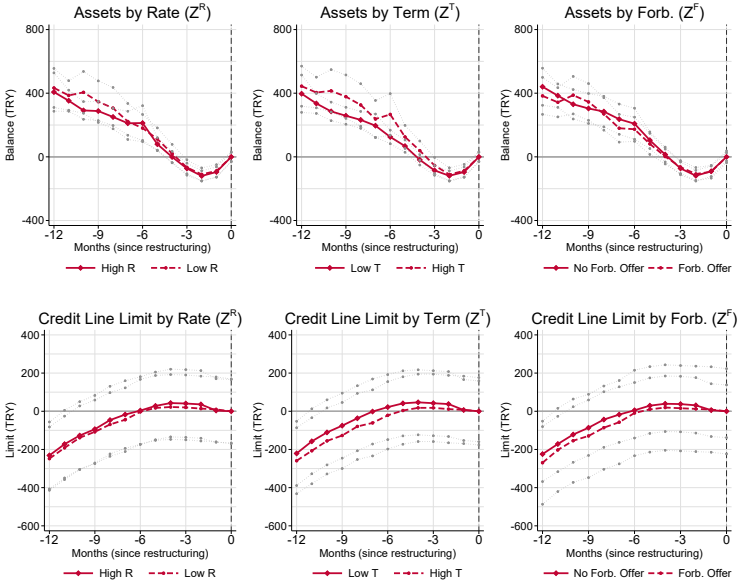
$$\mathbb{Z}_i^R \quad \mathbb{Z}_i^T \quad \mathbb{Z}_i^F$$

Covariate Balance

$$Y_i = \sum^{k \in R,T,F} \theta^k \mathbb{Z}_i^k + \varepsilon_i$$

		Age Years	Loans Consol. Count	*FV* Org. TRY	FV_0 Rem. TRY	*R* Org. APR, %	*T* Org. Months	Payment Org. TRY	*Pay* Org. Nm	30+ %	90+ %
	$\mathbb{Z}^R$	- 0.22 (0.13)	- 0.0002 (0.007)	- 22 (155)	34 (124)	0.003 (0.02)	0.08 (0.11)	- 1.2 (5.2)	- 0.08 (0.05)	-0.82 (0.43)	-0.31 (0.64)
	$\mathbb{Z}^T$	- 0.07 (0.13)	- 0.01 (0.007)	-3 (154)	105 (124)	0.01 (0.02)	-0.11 (0.11)	0.4 (5.2)	- 0.05 (0.05)	-0.10 (0.43)	0.67 (0.64)
	$\mathbb{Z}^F$	- 0.02 (0.14)	- 0.009 (0.008)	172 (162)	170 (130)	- 0.02 (0.02)	0.06 (0.11)	5.5 (5.4)	- 0.02 (0.05)	0.45 (0.45)	-0.03 (0.67)
	α	38.1 (0.13)	1.26 (0.007)	15,234 (147)	10,274 (118)	16.3 (0.02)	36.8 (0.10)	530 (4.9)	6.5 (0.05)	89.6 (0.41)	30.3 (0.60)
	N	20,944	20,944	20,944	20,944	20,944	20,944	20,944	20,944	20,944	20,944
F	*p*	0.40	0.33	0.77	0.48	0.60	0.58	0.78	0.28	0.19	0.72
K-S	$\mathbb{Z}^R$	0.41	1	0.59	0.46	0.92	0.91	0.74	0.18	0.88	1
	$\mathbb{Z}^T$	1	0.98	0.27	0.56	0.65	0.33	0.67	0.22	1	0.97
	$\mathbb{Z}^F$	0.77	1	0.20	0.11	0.94	1	0.12	0.41	1	1

Covariate Balance: Dynamic Pre-trends



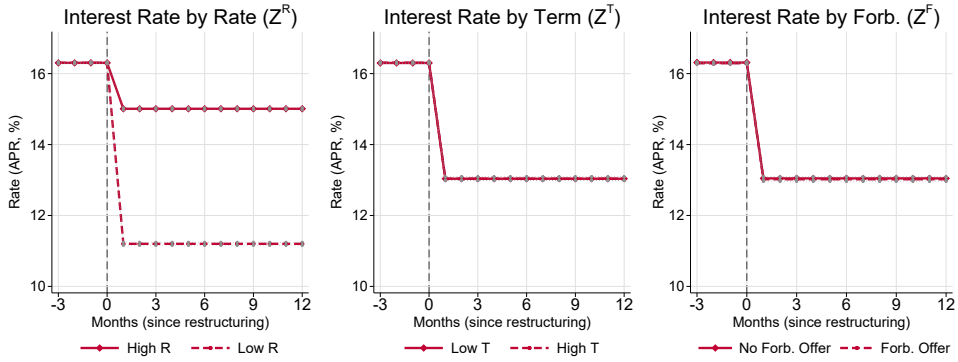
Assignment of Forbearance, Interest Rates, and Term

Randomized $\mathbb{Z}_i^R$, $\mathbb{Z}_i^T$, and $\mathbb{Z}_i^F$ determine rate R', term offer T^{offer}, and forbearance offer.

- Rate $R' < R$, off a market rate lower than R.
  - $\mathbb{Z}_i^R = 0$ assigned $60bps$, $\mathbb{Z}_i^R = 1$ $540bps$ APR reduction.
  - Bounded below by $\underline{R}$.
- Term extension *offer*, $T^{\text{offer}} > T$.
  - Not the final term, but a recommendation—an *encouragement*. Imperfect compliance.
  - Group into grids of 12. Offer T^{offer} is $\bar{T}_k$ times 150% to $\mathbb{Z}_i^T = 0$, and $\bar{T}_k$ times 200% to $\mathbb{Z}_i^T = 1$.
- $\mathbb{Z}_i^F$=1 *offered* forbearance.
  - Postponing the payment of the principal for three months.
  - Purely transitory, keeping term constant, backloading.
  - In contrast to *deferment*, borrower responsible for interest that accrues.

First Stage: Interest Rate

by Rate ($\mathbb{Z}_i^R$) by Term ($\mathbb{Z}_i^T$) by Forbearance ($\mathbb{Z}_i^F$)



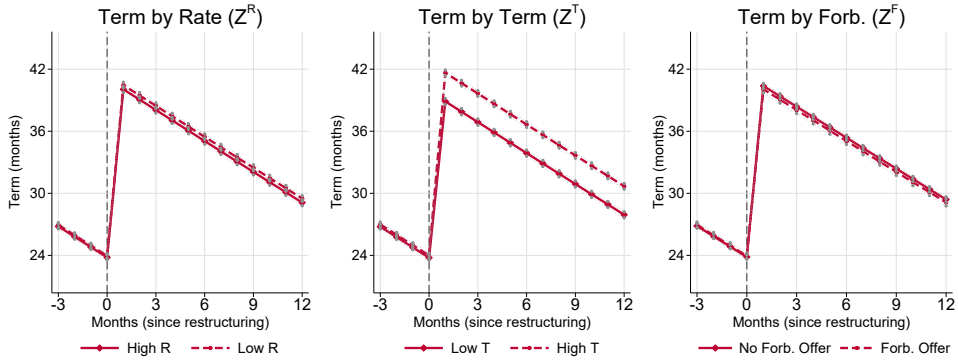
$\mathbb{Z}_i^R = 0$ are assigned to 60 bps, and $\mathbb{Z}_i^R = 1$ to 540 bps APR rate reduction.

Unannounced. F=7,551.

Not negotiable and cannot be changed. Bounded below by a minimum $\underline{R}$.

First Stage: Term

by Rate ($\mathbb{Z}_i^R$) by Term ($\mathbb{Z}_i^T$) by Forbearance ($\mathbb{Z}_i^F$)



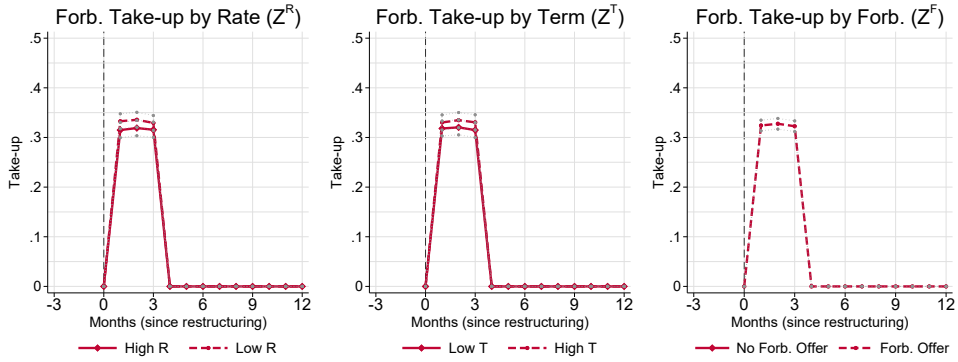
Randomized term extension *offer*, $T^{\text{offer}} > T$.

Expected. F=63.

As in the wild, the borrower is not constrained in choosing T'.

First Stage: Forbearance

by Rate ($\mathbb{Z}_i^R$) by Term ($\mathbb{Z}_i^T$) by Forbearance ($\mathbb{Z}_i^F$)



$\mathbb{Z}_i^F$=1 are *offered* forbearance. One-in-three take-up.

Unannounced. F=2,216.

Suspends and postpones the payment of the principal for 3 months, backloads. Not free.

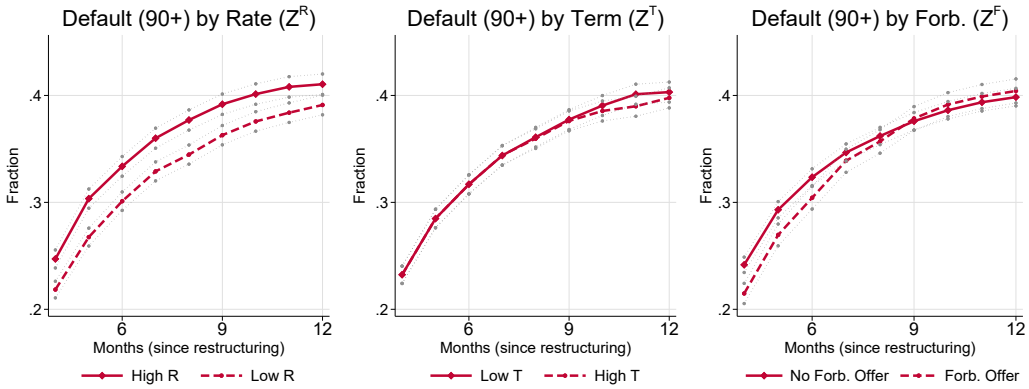
First Stage: Contract Terms

	R' APR, %	T' Months	F' Take-up, %	F' ($\mathbb{Z}^F$=1) Take-up, %
$\mathbb{Z}^R$	- 3.81	0.43	0.59	1.66
	(0.03)	(0.21)	(0.38)	(1.10)
$\mathbb{Z}^T$	- 0.03	2.77	0.51	1.45
	(0.03)	(0.20)	(0.38)	(1.10)
$\mathbb{Z}^F$	- 0.02	- 0.32	32.8	
	(0.03)	(0.22)	(0.40)	
Cons.	15.0	39.8	-0.56	31.2
	(0.02)	(0.19)	(0.36)	(0.96)
N	20,944	20,944	20,944	7,308
F	7,551	63	2,216	2

Results

Solvency Triggers—Event Study

by Rate ($\mathbb{Z}_i^R$) by Term ($\mathbb{Z}_i^T$) by Forbearance ($\mathbb{Z}_i^F$)



Modifications orthogonal to the face value and other determinants of default (e.g., income, wealth, risk, costs of default) effect whether and when to default.

Solvency Triggers—Intent-to-treat Effects

$$Y_i = \sum^{k \in R,T,F} \theta^k \mathbb{Z}_i^k + f_t + \varepsilon_i$$

	Short-run			Long-run		
	$4m$	$5m$	$6m$	$9m$	$12m$	$15m$
Base	23%	28%	32%	38%	40%	40%
$\mathbb{Z}^R$	- 2.78 (0.58)	- 3.51 (0.62)	-3.15 (0.64)	-2.79 (0.66)	-1.85 (0.67)	-2.13 (0.67)
$\mathbb{Z}^T$	- 0.02 (0.58)	0.01 (0.62)	-0.02 (0.64)	-0.13 (0.66)	-0.54 (0.67)	-0.82 (0.67)
$\mathbb{Z}^F$	-2.69 (0.61)	-2.37 (0.65)	-1.96 (0.67)	0.24 (0.70)	0.56 (0.71)	-0.35 (0.70)
$\mathbb{P}(\theta^R = 0)$	$<$0.001	$<$0.001	$<$0.001	$<$0.001	0.006	0.002
$\mathbb{P}(\theta^T = 0)$	0.98	0.99	0.98	0.85	0.42	0.22
$\mathbb{P}(\theta^F = 0)$	$<$0.001	$<$0.001	0.004	0.73	0.43	0.62

First Stage Effects on Current and Future Payments

	Pay_1 Current	Pay_2 Current	PV_1^{fu} Future	PV_2^{fu} Future
$\mathbb{Z}^R$	- 0.96	- 0.85	- 6.28	- 5.74
	(0.07)	(0.06)	(0.08)	(0.12)
$\mathbb{Z}^T$	- 0.88	- 1.01	0.49	1.59
	(0.07)	(0.06)	(0.08)	(0.12)
$\mathbb{Z}^F$	- 1.92	0.29	1.66	1.63
	(0.07)	(0.06)	(0.09)	(0.13)
Cons.	11.6	11.8	92.9	85.2
	(0.06)	(0.06)	(0.08)	(0.12)
N	20,944	20,944	20,944	20,944
F	401	160	2,128	816

All modifications reduce current payments—equivalent to 96 cents, 88 cents, and $1.92 for each $100 of face value, respectively.

Liquidity Triggers—Payments (First-stage) vs. Defaults (Intent-to-treat)

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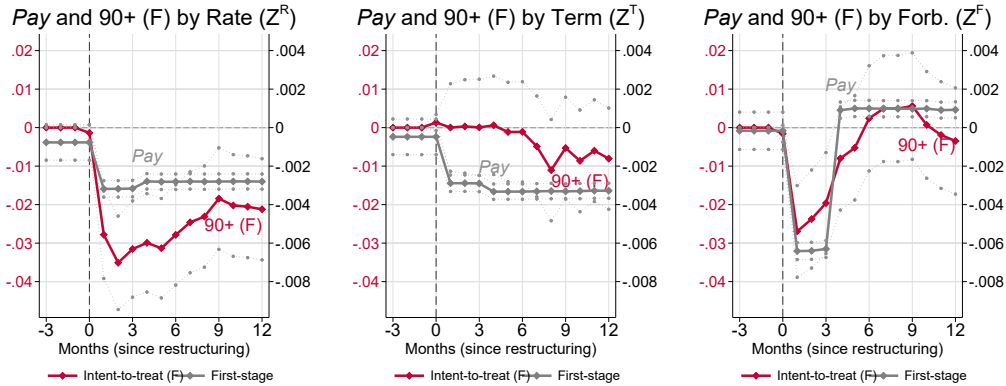


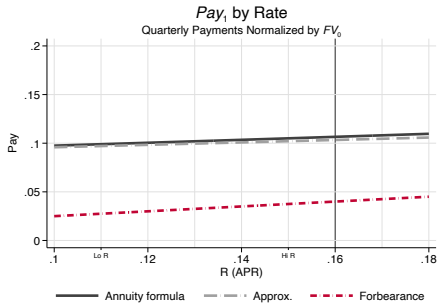
Forbearance has no effects beyond expiration. Rate reductions have immediate effects that persist.

Liquidity not the sole driver—Rate cuts reduce payments the least but reduce delinquencies most.

$$\text{Decision to Default} = \phi \underbrace{\text{Current Payments}}_{\text{Liquidity}} + \psi \underbrace{\text{PV of } \textit{Future} \text{ Payments}}_{\text{Strategic}} + \underbrace{\text{Other Factors}}_{\text{wealth, risk, costs}}$$

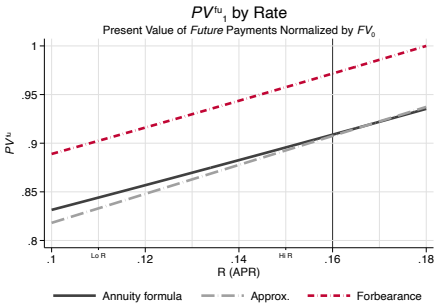
Effect of Interest Rates on Current and *Future* Payments

Pay—Current Payments



$$Pay \simeq \left(\frac{1}{T} + \frac{R}{2} + \frac{R}{2T} + \frac{R^2 T}{12} - \frac{R^2}{12T} + O(R^3)\right)$$

PV^{fu}—Present Value of *Future* Payments



$$PV^{fu} \simeq \left(1 + (R - R^*)\,\frac{T}{2} + O(R^{*2})\right)$$

Effects on PV^{fu} account for more or less the *entire* impact of interest rate changes.

A *Naive* and Non-parametric Decomposition

Let ϕ and ψ denote the sensitivity of defaults to current and future payments.

To obtain an estimate, compare the intent-to-treat and first stage effects of $\mathbb{Z}^R$ and $\mathbb{Z}^F$:

$$\underbrace{-3.15}_{\textit{ITT}} = \underbrace{-0.96}_{\text{FS on } \textit{Pay}} \underbrace{\phi}_{\textbf{1.28}} - \underbrace{6.28}_{\text{FS on } \textit{PV}^{\textit{fu}}} \underbrace{\psi}_{\textbf{0.31}}$$

Bivariate Wald yields 1.28 and 0.31 for ϕ and ψ.

Defaults triggered by both current and future payments; more sensitive to current payments.

$$\frac{\psi}{\phi} = 0.24$$

News about a dollar in future equal a 24-cent increase in current payments—a strategic effect.

Strategic Triggers

Panel A: Sensitivity $Y_i = \phi \text{Pay}_i + f_t + \varepsilon_i$				*Panel B: Decomposition* $Y_i = \phi \text{Pay}_i + \psi PV_i^{fu} + f_t + \varepsilon_i$				
Pay	3.31	-0.007	1.03	*Pay*	1.11	1.29	1.21	3.11
Current	(0.72)	(0.74)	(0.35)	Current	(0.29)	(0.32)	(0.29)	(0.80)
				PV^{fu}	0.33	0.31	0.36	0.92
				Future	(0.10)	(0.10)	(0.10)	(0.29)
Instrument				Instrument				
$\mathbb{Z}^R$	✓			$\mathbb{Z}^R$	✓	✓	✓	✓
$\mathbb{Z}^T$		✓		$\mathbb{Z}^T$	✓		✓	✓
$\mathbb{Z}^F$			✓	$\mathbb{Z}^F$	✓	✓	✓	✓
							Controls	IV Probit
$\mathbb{P}(\phi = 0)$	<0.001	0.99	0.004	$\mathbb{P}(\phi = \psi = 0)$	<0.001	<0.001	<0.001	<0.001
				$\mathbb{P}(\phi = 0)$	<0.001	<0.001	<0.001	<0.001
				$\mathbb{P}(\psi = 0)$	0.001	0.003	<0.001	0.001
				$\mathbb{P}(\phi = \psi)$	0.017	0.007	0.008	0.015
				ψ/ϕ	0.30	0.24	0.30	0.29

Forbearance needs to reduce payments by three times to obtain the impact of rate reductions.

Identified moment ψ/ϕ—dollar change in PV^{fu} similar to a 30-cent increase in quarterly *Pay*.

Liquidity vs. Strategic Effects of Interest Rates

Total revaluation effect of interest rates—approximately $\frac{1}{2}\ T\ \Delta R$

Under perfect intertemporal substitution, more or less the *entire* impact through future payments.

Nevertheless, refinancing a mortgage is often interpreted as a liquidity shock.

$$\frac{\Delta Y}{\Delta R} = \underbrace{\underbrace{\frac{\Delta Y}{\Delta Pay}}_{\hat{\phi}=1.11}\ \underbrace{\frac{\Delta Pay}{\Delta R}}_{0.96\%\ FV_0}}_{\text{Liquidity} \approx \frac{1}{3}} + \underbrace{\underbrace{\frac{\Delta Y}{\Delta PV^{fu}}}_{\hat{\psi}=0.33}\ \underbrace{\frac{\Delta PV^{fu}}{\Delta R}}_{6.28\%\ FV_0}}_{\text{Strategic} \approx \frac{2}{3}}$$

Strategic effects equivalent to a deferral program that reduces monthly payments by 5% of average monthly household disposable income.—$0.30 \times 6.28\% \times \frac{10{,}403}{3{,}844}$.

Balance Sheet Effects—Late Payments and Other Accounts

	Panel A: Late Payments				*Panel B: Other*	
	0+	30+	120+	150+	30+	90+
Base	58%	38%	30%	30%	4%	1%
$\mathbb{Z}^R$	-3.58 (0.68)	-3.53 (0.67)	-3.00 (0.63)	-3.17 (0.63)	-0.11 (0.25)	-0.01 (0.14)
$\mathbb{Z}^F$	-3.80 (0.71)	-3.08 (0.70)	-1.87 (0.66)	-1.62 (0.66)	0.84 (0.27)	0.28 (0.14)
Pay Current	1.81 (0.31)	1.69 (0.31)	1.07 (0.29)	1.00 (0.29)	-0.26 (0.12)	-0.09 (0.06)
PV^{fu} Future	0.29 (0.11)	0.30 (0.11)	0.31 (0.10)	0.35 (0.10)	0.06 (0.04)	0.02 (0.02)
$\mathbb{P}(\psi = 0)$	0.008	0.004	0.002	$<$0.001	0.13	0.43
$\mathbb{P}(\phi = \psi)$	$<$0.001	$<$0.001	0.02	0.04	0.014	0.11
ϕ/ψ	0.16	0.18	0.29	0.35	$<$0	$<$0

Early-cycle more sensitive to forbearance and current payments—i.e., driven by liquidity.

Late-cycle is more sensitive to rate reductions and future payments—i.e., strategic.

Robustness—Discounting

	Constant			Hyperbolic		Hetero.	Expected
R^*	0%	24%	48%	β=0.9	β=0.8	Old R_i	$\mathbb{E}[PV]$
Pay Current	1.15 (0.29)	1.10 (0.30)	1.07 (0.30)	1.11 (0.29)	1.11 (0.29)	1.12 (0.29)	1.79 (0.33)
PV^{fu} Future	0.25 (0.07)	0.35 (0.11)	0.38 (0.15)	0.37 (0.11)	0.41 (0.13)	0.32 (0.10)	0.71 (0.22)
$\mathbb{P}(\psi = 0)$	<0.001	0.002	0.017	0.001	0.001	<0.001	0.001
$\mathbb{P}(\phi = \psi)$	0.003	0.026	0.078	0.025	0.040	0.015	<0.001
ψ/ϕ	0.22	0.32	0.36	0.33	0.37	0.29	0.40

Endogenous Triggers

Determinants of the shape of default region in models macroeconomists routinely use:

- Distress
- Precaution
- Assets

Endogenous Triggers—Heterogeneity in Intent-to-treat Effects

	Panel A: Distress Days Late			*Panel B:* Precaution Times Binding			*Panel C:* Assets Checking Balances		
	(A1)	(A2)	(A3)	(B1)	(B2)	(B3)	(C1)	(C2)	(C3)
	90+	31 - 90	< 30	$\emptyset$	High	Low	$\emptyset$	Low	High
Frac.	0.30	0.59	0.11	0.14	0.43	0.43	0.10	0.45	0.45
Base	32%	36%	11%	28%	35%	29%	30%	32%	32%
$\mathbb{Z}^R$	- 4.72 (1.16)	- 2.41 (0.86)	- 1.50 (1.29)	- 5.43 (1.68)	- 2.04 (1.00)	- 3.38 (0.95)	- 3.27 (1.93)	- 2.47 (0.96)	- 3.72 (0.95)
$\mathbb{Z}^F$	- 4.55 (1.21)	- 1.29 (0.90)	0.53 (1.36)	- 3.52 (1.75)	- 1.74 (1.05)	- 1.63 (1.00)	- 3.58 (2.04)	- 1.89 (1.00)	- 1.67 (1.00)
$\mathbb{P}(\theta^R = 0)$	<0.001	0.005	0.25	0.001	0.04	<0.001	0.09	0.01	<0.001
$\mathbb{P}(\theta^F = 0)$	<0.001	0.15	0.70	0.045	0.10	0.10	0.08	0.06	0.10

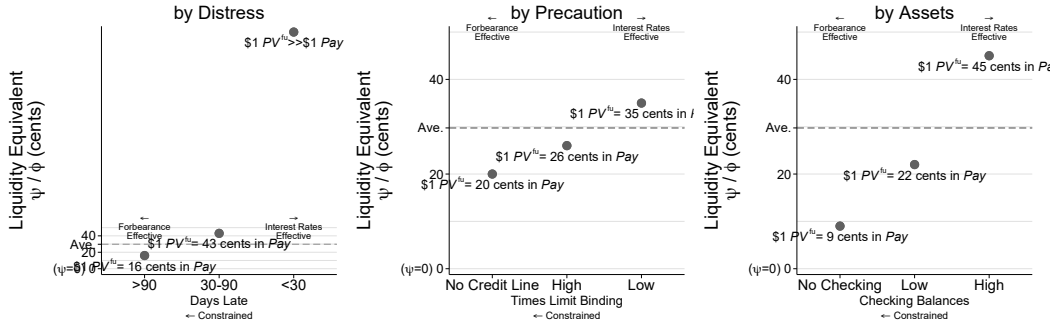
Borrowers not in default do not find forbearance attractive as it only alters the timing of repayment.

Rate reductions are more effective for participants who can intertemporally substitute.

Endogenous Triggers—Heterogeneity in Treatment Effects

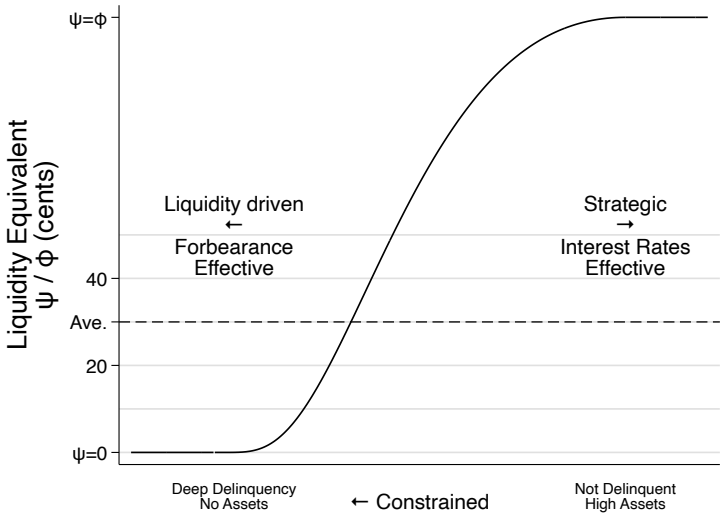
	Panel A: Distress Days Late			*Panel B:* Precaution Times Binding			*Panel C:* Assets Checking Balances		
	(A1)	(A2)	(A3)	(B1)	(B2)	(B3)	(C1)	(C2)	(C3)
	90+	31 - 90	<30	$\emptyset$	High	Low	$\emptyset$	Low	High
Frac. in Bin	0.30	0.59	0.11	0.14	0.43	0.43	0.10	0.45	0.45
Pay Current	2.40 (0.55)	0.66 (0.38)	0.08 (0.70)	2.19 (0.87)	0.79 (0.46)	1.09 (0.42)	2.08 (0.91)	1.04 (0.45)	0.97 (0.43)
PV^{fu} Future	0.39 (0.18)	0.28 (0.14)	0.23 (0.22)	0.43 (0.25)	0.20 (0.17)	0.39 (0.15)	0.19 (0.30)	0.23 (0.16)	0.44 (0.15)
$\mathbb{P}(\psi = 0)$	<0.001	0.08	0.91	0.012	0.08	0.009	0.02	0.02	0.02
$\mathbb{P}(\psi = 0)$	0.03	0.04	0.29	0.078	0.22	0.01	0.53	0.15	0.003
$\mathbb{P}(\phi = \psi)$	<0.001	0.38	0.85	0.071	0.26	0.13	0.06	0.12	0.26
ψ/ϕ	0.16	0.43	2.88	0.20	0.26	0.35	0.09	0.22	0.45
Strategic	0.55	0.73	0.98	0.58	0.63	0.73	0.47	0.57	0.77

Endogenous Triggers—Heterogeneity in Treatment Effects

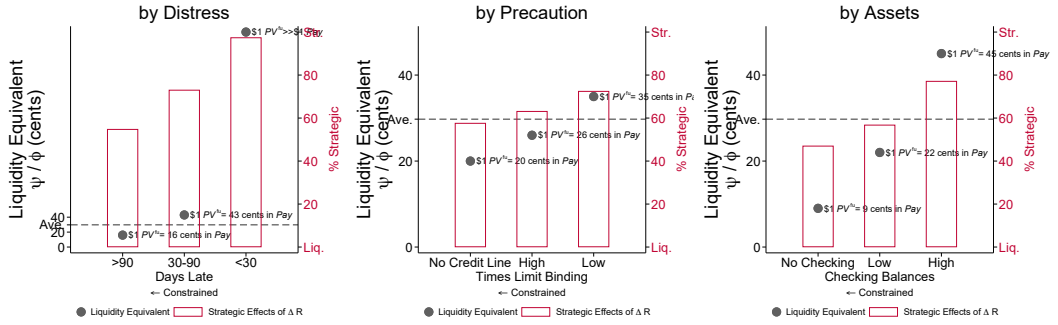


Distress, precaution, and assets all determine the location of the liquidity trigger.

Shape of the Default Trigger



Endogenous Triggers—Heterogeneity in Strategic Effects of Interest Rates



For early-cycle delinquencies, 98% of the effects of interest rates is through strategic channels.

Concluding Remarks

Debt relief experiment to study default triggers and policy to prevent it.

- Liquidity is not the sole trigger
- Strategic borrowers default in response to changes orthogonal to solvency and liquidity.
- Endogeneity of triggers—whether defaults are strategic is tightly linked to balance sheets.

Characterize single strategic trigger whose location is influenced by distress, precaution, and assets.

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In future work, it would be valuable to ask:

- Are commonly used calibrations compatible with the shape of the default region?
- Studying liquidity and strategic effects for nondelinquent refinancing.

Thank you!