Discount Window Lending and Bank Liquidity:
Evidence from the Paycheck Protection Program

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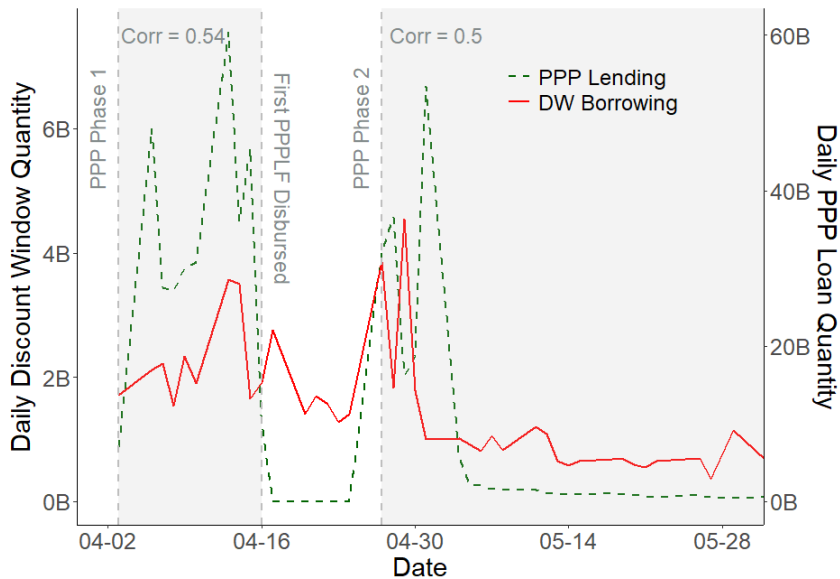
Motivation

COVID-19 impacted at the United States late March of 2020.

US Government introduced the **Paycheck Protection Program** in April 3rd to help small firms.
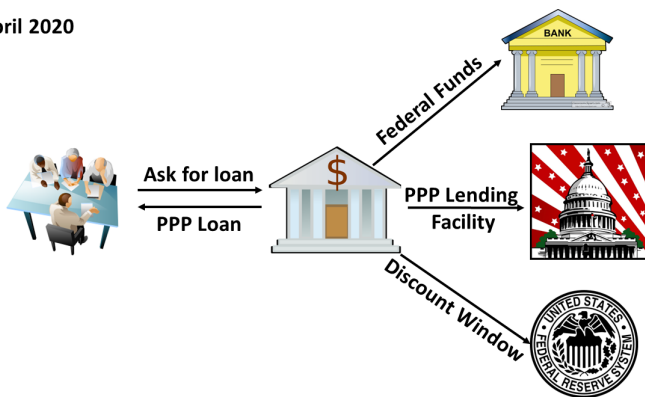
The **PPP** distributed $800B in small business lending.

How important was monetary systems *(discount window)* in the implementation of the PPP?

Evidence

Graphical

April 2020

No relationship between aggregate fed funds and PPP lending.

Contribution

1. Document relationship between PPP lending and DW borrowing.
   - DW usage has a heterogeneous effect for small and large banks.

2. **When** and **why** did banks use the discount window? Event Study
   - was used as a measure of temporary liquidity before 3PLF funding.

3. **How** much did DW borrowing impact PPP lending?
   /textcolorredCross-Section IV
   - For large banks, DW usage increased PPP lending by 91% during early stages.
   - 69% after 3PLF funding, suggesting substitution away from DW.

Literature

- Effect of liquidity facility on PPP Program
  - Lopez and Spiegel (2021), Anbil, Carlson, and Styczynski (2021).
    Contribution: Explores alternate CB liquidity facility.

- Effect of PPP program on employment
  - Barraza et al. (2020), Chetty et al. (2020), Autor et al. (2022), Faulkender et al. (2020), Granja et al. (2020), Li and Strahan (2020).
    Contribution: DW borrowing amplifies fiscal policy.

- DW use during financial crises
  - Berger et al. (2014), Armentier et al. (2015), Glancy et al. (2020).
    Contribution: affect of DW on large vs small banks.

Balance Sheet

When bank create loan, deposits increase by same amount.
When money is withdrawn, reserves fall.

Paycheck Protection Program (PPP)

Administered by Small Business Administration, distributed by banks.

2 phases:

1. Phase 1: 4/3 to 4/16, amount: \$350B.
2. Phase 2: 4/27 to 8/8, amount: \$320B.

97% were distributed in April and May of 2020.

Loans:

- Riskless and did not count for most regulatory ratios.
- Paid lenders origination fee of 1-5%.
- Maturity of 2-5 years.

PPP Lending Facility (3PLF)

All PPP lenders eligible for 3PLF funding.

Details:

- Began 4/9, first loan to bank on 4/16.

- Cost 35 bp, used PPP as collateral.

- Matched the maturity of PPP loans.

Drawbacks:

- Processing delay of up to 3 months for funds. (median: 18 days).
- Funds came after Phase 1 ended.

Discount Window (DW)

Lender-of-last-resort in the financial system.

Details:

- Provide loans up to 90 days at 25 bp.
- Collateralized by approved loans and securities.

Drawbacks:

- Needs to file forms (OC10) ex-ante.
- Borrowing is a negative signal of stability - 'stigma'.

Data

Focus on April and May 2020, where 97% of loans were given.

Primary (Loan-Level):

- PPP Loan Database (SBA) - Erel and Liebersohn (2020)
- 3PLF Database (Fed)
- Discount Window Borrowing (Fed)

Secondary:

- Call Reports (FFIEC) - quarterly bank characteristics
- Summary of Deposit (FDIC) - Bank deposit shares pre-COVID
- COVID Rates (CDC) - Daily, County-Level
- Economic Impact (Baumeister et al. (2021)) - Weekly, State-Level

Share of banks borrowing from each lending facility

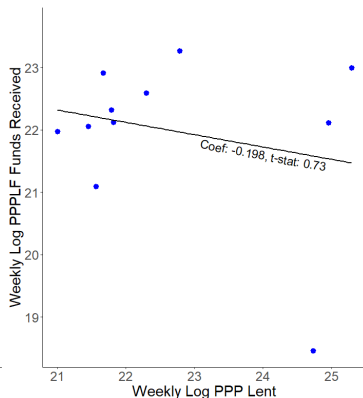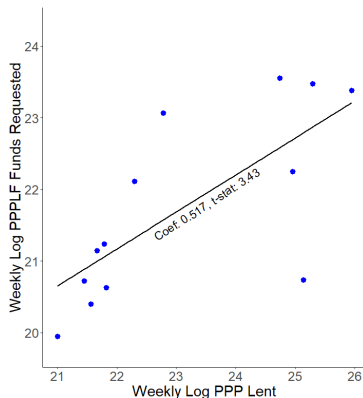5200 banks total, 3600 made PPP loans during April and May 2020.

	No Borrowing	From DW	From 3PLF	From both	Total
Small Banks	88.6%	1.2%	9.4%	0.7%	2579
Large Banks	74.8%	6.2%	16.1%	2.9%	1048
Pooled	84.6%	2.7%	11.3%	1.4%	3627

Borrowing from DW only counted if amount $\geq$ \$100,000.
75th percentile cutoff for small vs large ($\sim$\$600M).

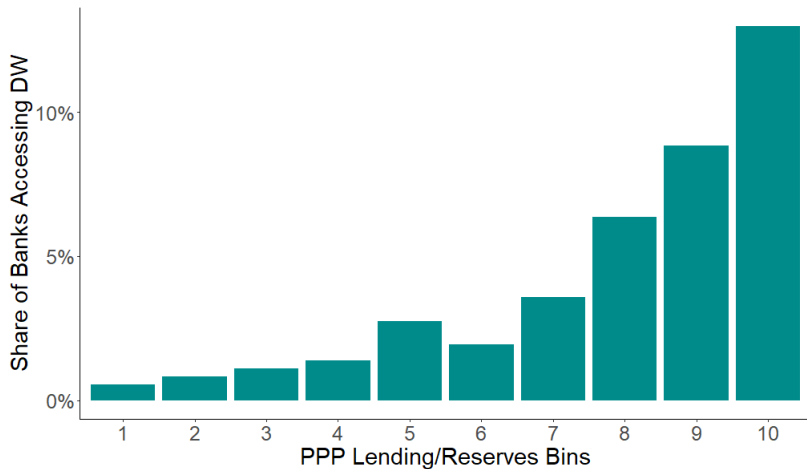- Large banks prefer DW, small banks prefer 3PLF.

Why not the 3PLF?

(a) Weekly 3PLF funds **requested**. (b) Weekly 3PLF funds **received**.

More PPP lending correlates with more 3PLF funds requested, but not received.

Binned relationship

Banks that lend more PPP loans access the DW more.
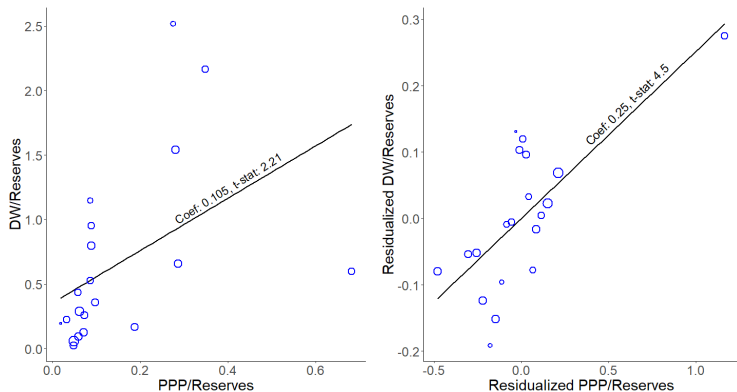
Correlation between DW borrowing and PPP lending

Table: (↦ Individual FE)

DW borrowing quantity also correlated with PPP lending quantity.

When are banks using the discount window?

Hypothesis: while they're waiting for long-term funding from the 3PLF.

Benchmark TWFE model:

$$\mathbb{1}[DW_{it}] = \beta \mathbf{T}_{it} + \delta_i + \delta_t + e_{it} \tag{1}$$

DiD - estimates average treatment effect for treated
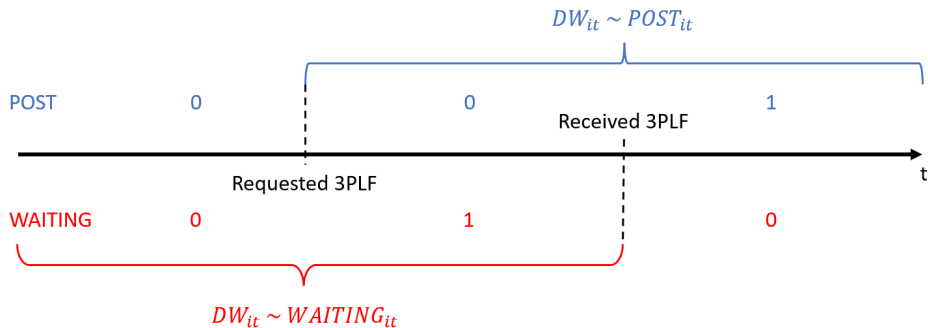
$\mathbf{T}_{it}$ is 2 sets of treatment variable:

1. WAITING - Indicator when they're **waiting** for 3PLF funds.
2. POST   - Indicator once they've **received** 3PLF funds.

Sun and Abraham (2020) estimator for staggered treatment. ⟫ More

Timeline of regression

DiD Result ∥ Clustered (Bank) SE, N = 296,593

Dependent Variable:	DW Indicator	
Model:	Pooled	Interacted
1 - After 3PLF Requested		
WAITING	0.019***	
	(0.005)	
WAITING × Small Banks		0.011**
		(0.005)
WAITING × Large Banks		0.030***
		(0.010)
Bank FE	✓	✓
Date FE	✓	✓

Dependent Variable:	DW Indicator	
Model:	Pooled	Interacted
2 - After 3PLF Received		
POST	-0.019***	
	(0.007)	
POST × Small Banks		-0.013*
		(0.007)
POST × Large Banks		-0.028**
		(0.014)
Bank FE	✓	✓
Date FE	✓	✓

Dependent var. mean: 1.5%.

200% increase for large banks, 73% increase for small banks.

Event study results ⇥ Baseline
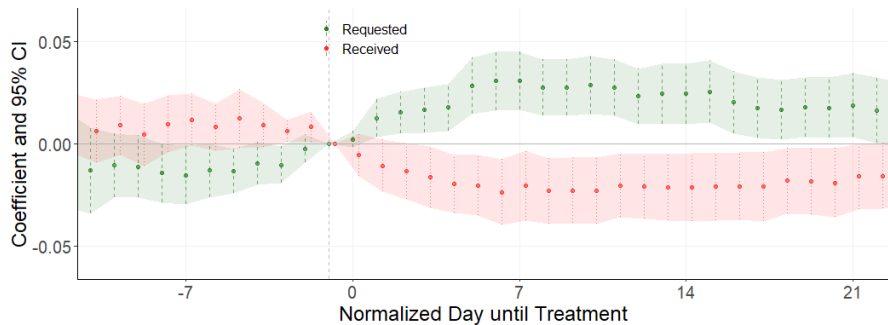
Pooled sample

How much did DW use expand PPP lending?

Hypothesis: Significant during first stage, weaker after 3PLF funding.

Convert panel data into cross-section. Look at:

- Phase 1.

- Phase 2.

- Phase 1 and 2.

How much did DW use expand PPP lending?

OLS regression:

$$\log(\# \text{ of PPP loans}) = textcolorred\beta\mathbb{1}[\text{DW}_i] + \gamma\mathbf{X}_i + \delta_{S(i)} + \delta_{F(i)} + e_i \quad (2)$$

β estimates correlation between use of DW and quantity of PPP loans lent.

Control for bank-level characteristics and alternate sources of funding.

Size decile and Fed district fixed effects.

OLS Result

Dependent Variable:	Log Number of PPP Loans			
Model:	Pooled	Pooled	Large	Small
Variables				
DW Indicator	0.250***	0.171**	0.177*	0.218***
	(0.084)	(0.076)	(0.107)	(0.084)
Bank Characteristic Controls	✓	✓	✓	✓
Alternate Funding Sources		✓	✓	✓
Fed District & Size Decile FE	✓	✓	✓	✓
Observations	3,558	3,558	997	2,561
R^2	0.70215	0.72113	0.55994	0.58623

White standard-errors in parentheses
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Endogeneity

Possible types of endogeneity:

- Simultaneity - choice to use DW and lend PPP loans jointly made.

- Omitted variable - unobserved bank characteristics.

- Daily fluctuation in balance sheet cost and liquidity constraints.

Solution: Instrumental Variables

IV Specification

Exploit the propensity of banks to use the DW again if they've used it previously.

Channels - Informational/Logistical - F-stat $\sim$ 80-400:

1. Fixed cost of filing OC10.
2. Setting up and maintaining eligible collateral.

Banks that previously use DW have a 9pp greater chance of using it during 2020 Q2.

- 10.2% for large banks.
- 5.7% for small banks.

Assumption: Previous DW usage does not affect PPP lending directly.

Extensive Margin - did using DW increase PPP lending?

Dependent Variable:	Log Number of PPP Loans		
	Pooled	Large Banks	Small Banks
Phase 1 Only			
DW Indicator	0.908***	0.928***	1.26
	(0.291)	(0.309)	(0.855)
Phase 2 Only			
DW Indicator	0.440*	0.691**	0.069
	(0.261)	(0.343)	(0.489)
3PLF/Reserves	0.297***	0.520***	0.221***
	(0.036)	(0.061)	(0.032)
Phase 1 and 2			
DW Indicator	0.548**	0.688**	0.380
	(0.249)	(0.282)	(0.598)
3PLF/Reserves	0.258***	0.475***	0.181***
	(0.034)	(0.059)	(0.032)
Observations	3,558	997	2,561
All Controls	✓	✓	✓
Fed District & Size Decile FE	✓	✓	✓

White standard-errors in parentheses
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Intensive Margin - does borrowing more increase lending?

Dependent Variable:	Log Number of PPP Loans		
	Pooled	Large Banks	Small Banks
Phase 1 Only			
DW Borr/Res	0.057**	0.078***	-0.003
	(0.026)	(0.026)	(0.036)
Phase 2 Only			
DW Borr/Res	0.057	0.570	-0.037
	(0.057)	(4.63)	(0.056)
Phase 1 and 2			
DW Borr/Res	0.021*	0.037**	0.002
	(0.011)	(0.017)	(0.006)
Observations	145	89	56
All Controls	✓	✓	✓
Fed District & Size Decile FE	✓	✓	✓

White standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Summary of contribution

- Explores usage of central bank liquidity facilities in most recent crisis.
- Event Study:
  - Both sets of banks used DW before 3PLF funding arrived.
- Instrumental Variables:
  - Usage of DW expanded PPP lending for large banks by 93% in Phase 1, no effect on small banks.
  - Effect drops to 69% after substitution towards 3PLF.
  - One SD increase in DW borrowing increases PPP lending by 44%.

What does this mean for policy?

- Granja et al (2021) shows:
  1. Firms that received funds earlier retained more employees.
  2. Cost per job year from $106,000 to $168,000.
- Fiscal policy implemented through the financial sector requires liquidity.
- Processing time for the 3PLF was a large reason why banks used the DW.
- Differential effects of monetary facilities for large versus small banks.

Robustness - Individual Fixed Effects ⟲ Back

Dependent Variable:		DW Indicator		
	Pooled		Large Banks	Small Banks
LPM - Without Dropping				
PPP Lending/Reserves	0.009	0.008	0.023	-0.004
	(0.007)	(0.007)	(0.015)	(0.004)
Observations	250,782	242,648	58,016	184,632
LPM - Dropping Banks				
PPP Lending/Reserves	0.101*	0.097*	0.191***	-0.011
	(0.053)	(0.055)	(0.063)	(0.041)
Observations	8,771	8,428	4,998	3,430
Poisson				
PPP Lending/Reserves	0.219*	0.208*	0.336***	-0.007
	(0.118)	(0.120)	(0.125)	(0.130)
Observations	8,771	8,428	4,998	3,430
Logistic				
PPP Lending/Reserves	1.09***	1.10***	1.67***	-0.241
	(0.416)	(0.427)	(0.485)	(0.439)
Observations	8,428	8,085	4,851	3,234
Bank Controls:		✓	✓	✓
Bank FE	✓	✓	✓	✓
Date FE	✓	✓	✓	✓

Clustered (Bank) standard-errors in parentheses
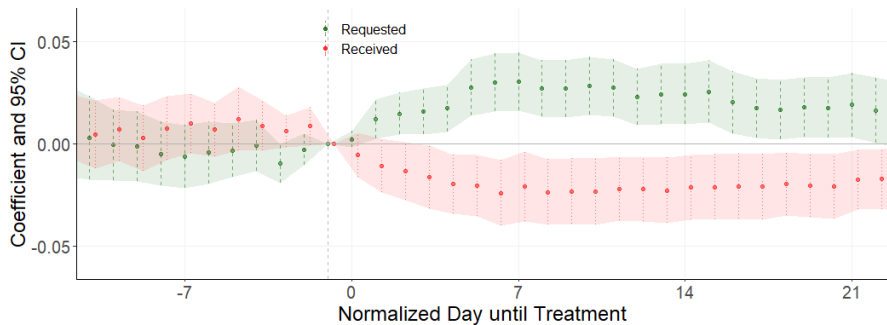*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Staggered treatment correction ⟶ Back

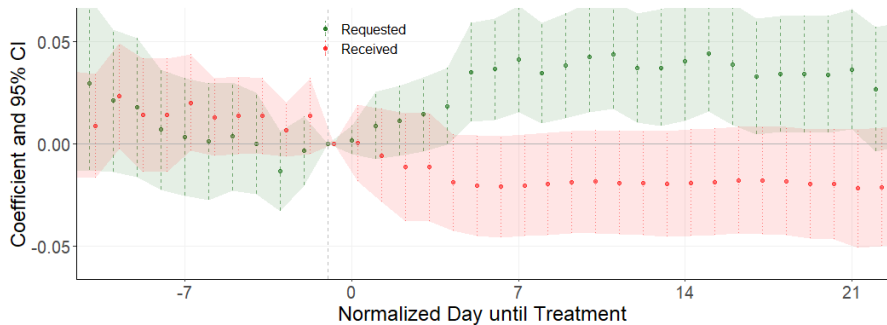Since treatment is staggered, Goodman-Bacon (2018) bias exists.
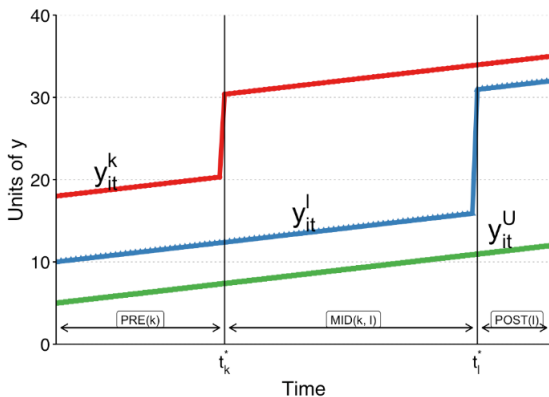
Solution: apply Sun and Abraham (2020) correction.

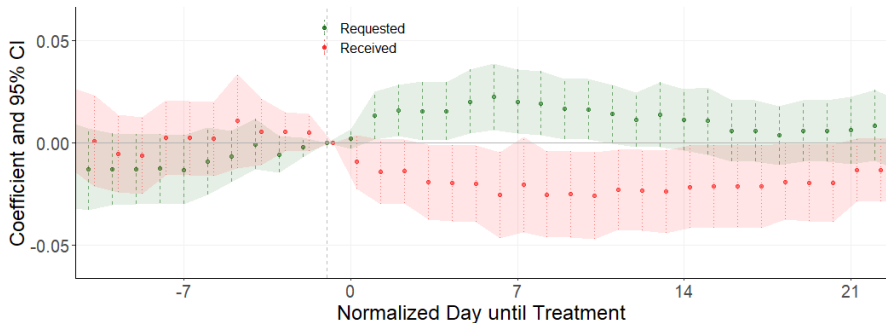# Robustness - Baseline Event Study ↳ Back

Pooled sample

Robustness - Baseline Event Study ⤳ Back

Large banks

Robustness - Baseline Event Study ⟲ Back

Small banks