Bank Relationships and the Geography of PPP lending

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Paycheck Protection Program

- The Paycheck Protection Program (PPP) extended over $500 billion in conditionally forgivable loans at onset of the pandemic.
  - Initial $349 billion exhausted within 13 days
  - Banks reportedly prioritized existing customers
- Possible trade-off between fast disbursement of funds and ability to reach those with limited bank relationships.
  - "[S]mall businesses that were truly in need of financial support during the economic crisis often faced longer waits and more obstacles to receiving PPP funding than larger, wealthier companies" (2020 House Coronavirus Subcommittee report)

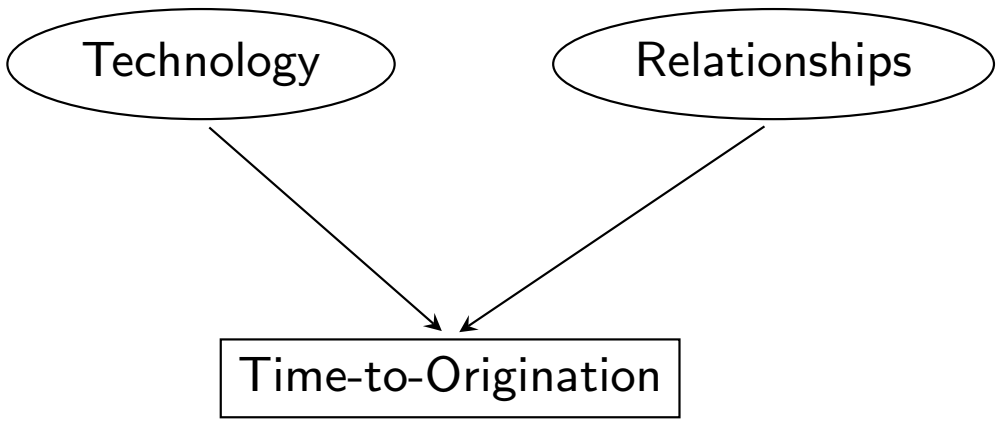
Distance and Relationship Lending

Small business banking relationships generally unobservable, but location is informative as to relationship-status.

- Normal loans: Banks lend to nearby borrowers due to information advantage (Agarwal & Hauswald, 2010) or monitoring advantage (Degryse & Ongena, 2005)
- PPP loans: Guarantee removes credit risk considerations, and many branches shut down due to pandemic $\implies$ less benefit from proximity

Implication: relationship and non-relationship lending likely to have different geographic distribution.

Framework



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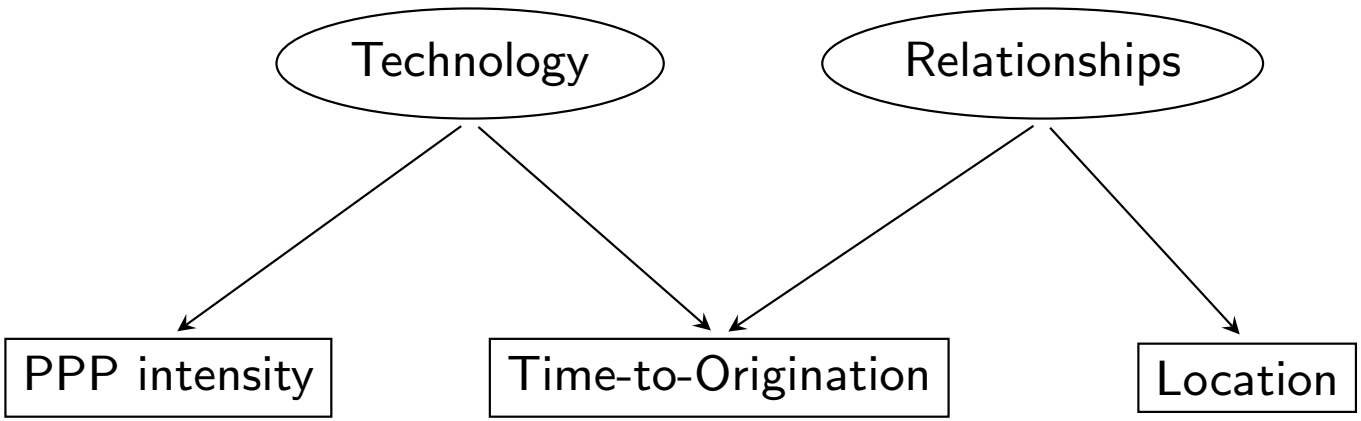


This paper:

- Documents relationship between location, PPP intensity, and timing.
- Constructs a model that replicates the empirical facts.
- Estimates the benefit from relationships that matches the empirical facts.

Preview

Empirical Results

- Half of banks' PPP loans went to borrowers within 2 miles of a branch, nearly 90% of which are estimated to be relationship loans.
- U-shaped relationship between PPP intensity and time-to-origination
- Local borrowers receive credit earlier, especially if borrowing from high-intensity bank

Model of PPP loan allocation

- Replicates empirical findings.
  - Distance mechanism: Local borrowers more likely to be relationship borrowers (who avoid switching costs)
  - U-shaped mechanism: High PPP intensity $\implies$ (1) superior processing technology and (2) lower relationship probability. (2) dominates at higher PPP intensity.
- Estimate that banks served relationship clients 5-9 days earlier than non-relationship clients.

Contribution

Related literature:

1. Estimates of effects of PPP credit availability based on ZIP code, county or state lender characteristics: Erel & Liebersohn, 2020; Li & Strahan, 2021; Granja et al., 2022
   - This paper: Relationships matter at finer spatial scale than typically studied.
2. Studies of relationships and PPP lending with data from surveys, UCC filings or public firms: Bartik et al., 2020; Amiram & Rabetti, 2020; Balyuk et al., 2020; Duchin et al., 2022
   - This paper: Analyzes full sample of bank PPP loans by using location to infer relationship likelihood.
3. Studies of PPP receipt delays: Denes et al., 2021; Doniger & Kay, 2021; Gorbachev et al., 2023
   - This paper: Estimates role of bank technology and borrower relationships in determining delays.

Data

Primary data sources

- Loan level PPP data: SBA, address lat/lon from geocod.io
- Branch locations: Summary of Deposits
- Pre-COVID business loan balances: Call Report
- Tract controls: LODES (employment/wages) & CRA (pre-COVID small business lending)

Data processing

- Lenders in PPP data fuzzy-matched to id_rssd based on name and location
- Geocoded borrower and branch information used to find the distance between the borrower and the nearest branch of the lending bank

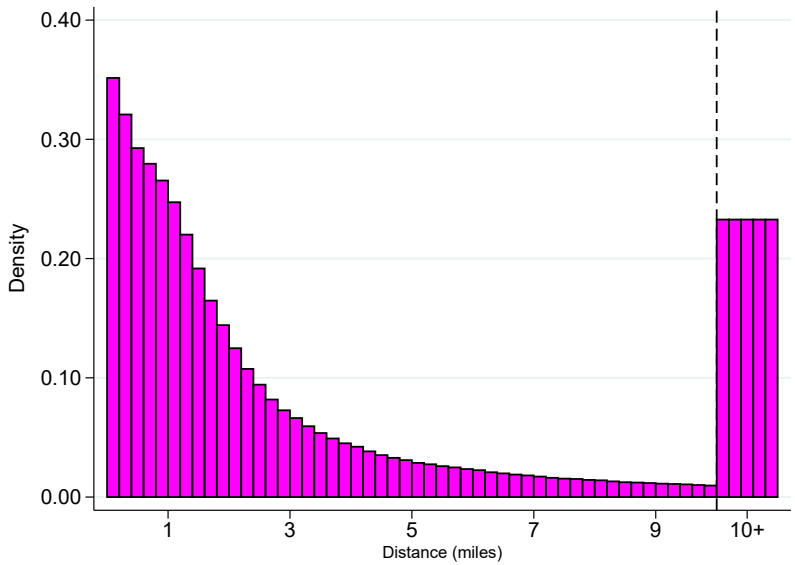
Key Variables

- Time-to-Origination$_{i,b}$: Days between origination date and April 3, 2020
- Distance$_{i,b}$: Miles btwn borrower i and nearest branch of lending bank b
- PPP Intensity$_b$: $\text{PPP}_b / (.9 \times \text{SB Loans}_{b,19Q} + .1 \times \text{C\&I Loans}_{b,19Q})$

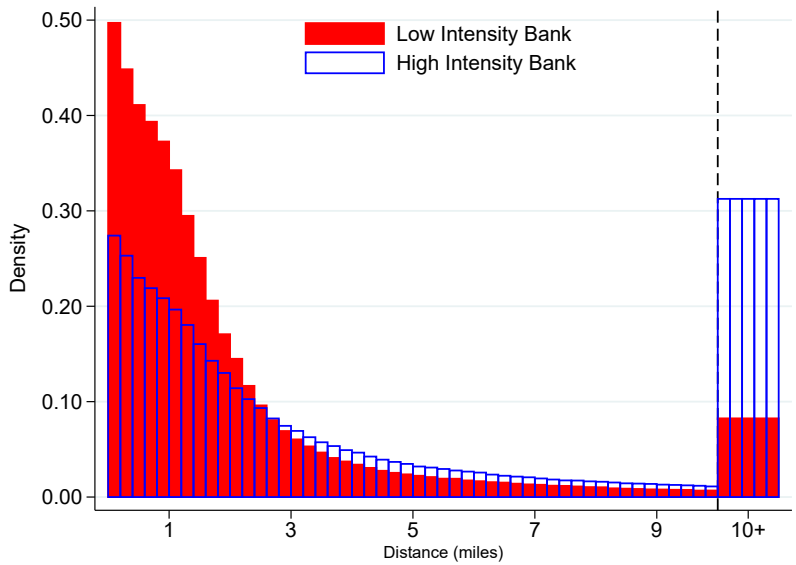
PPP lending was highly local

Half of bank PPP loans went to borrowers within 2 miles of a branch. 68% for banks with a PPP intensity < 1.

Distribution of Lender Distance



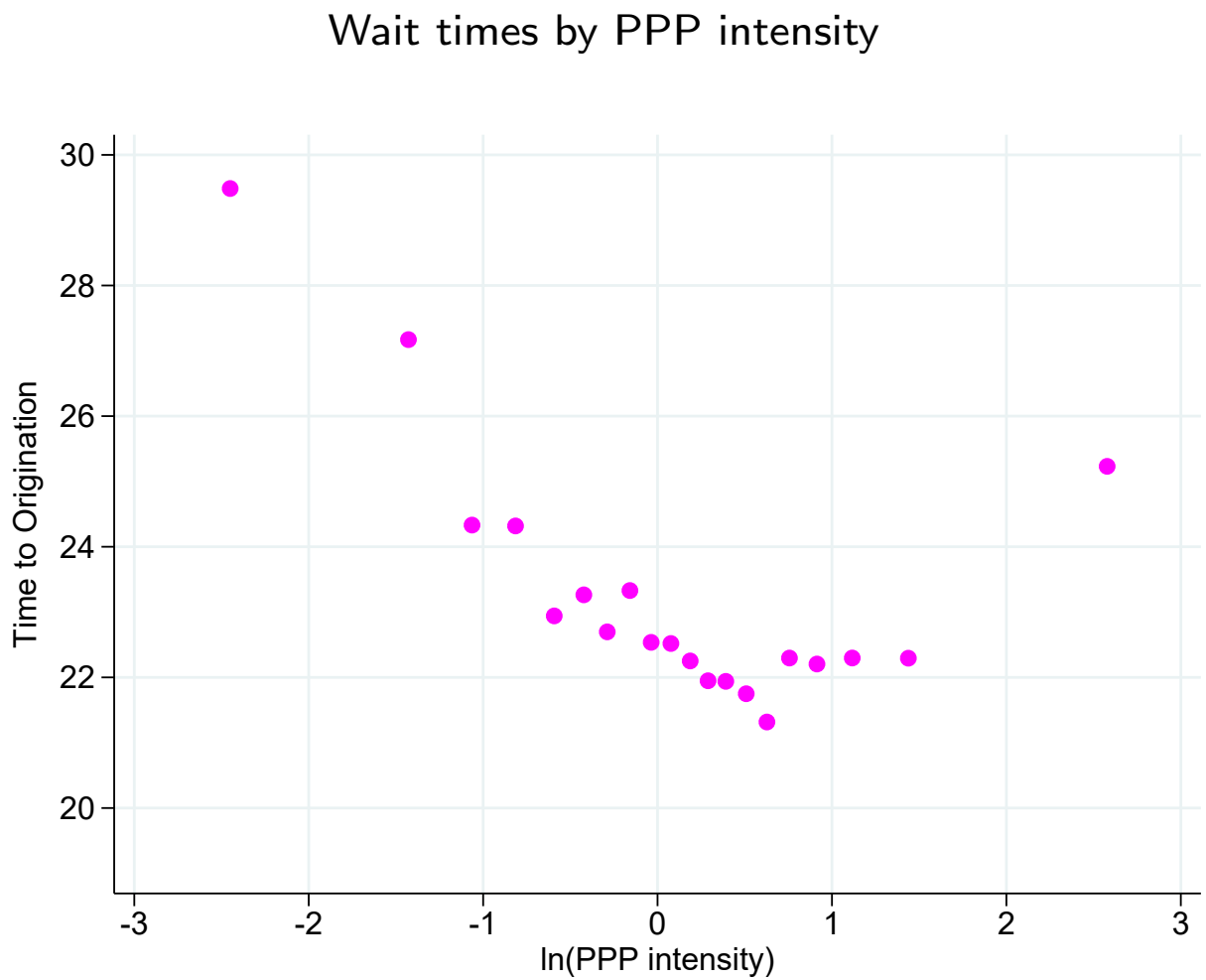
(a) Overall Distribution



(b) Distribution by Bank PPP Intensity

Notes: Figure plots histograms of the distance between a PPP borrower and the address of the nearest branch of the lending bank. The area to the right of the dotted line gives the mass of loans made by lenders more than 10 miles away. The left panel pools all bank PPP loans, while the right separates banks with a high and low PPP intensity (the blue and red bars, respectively).

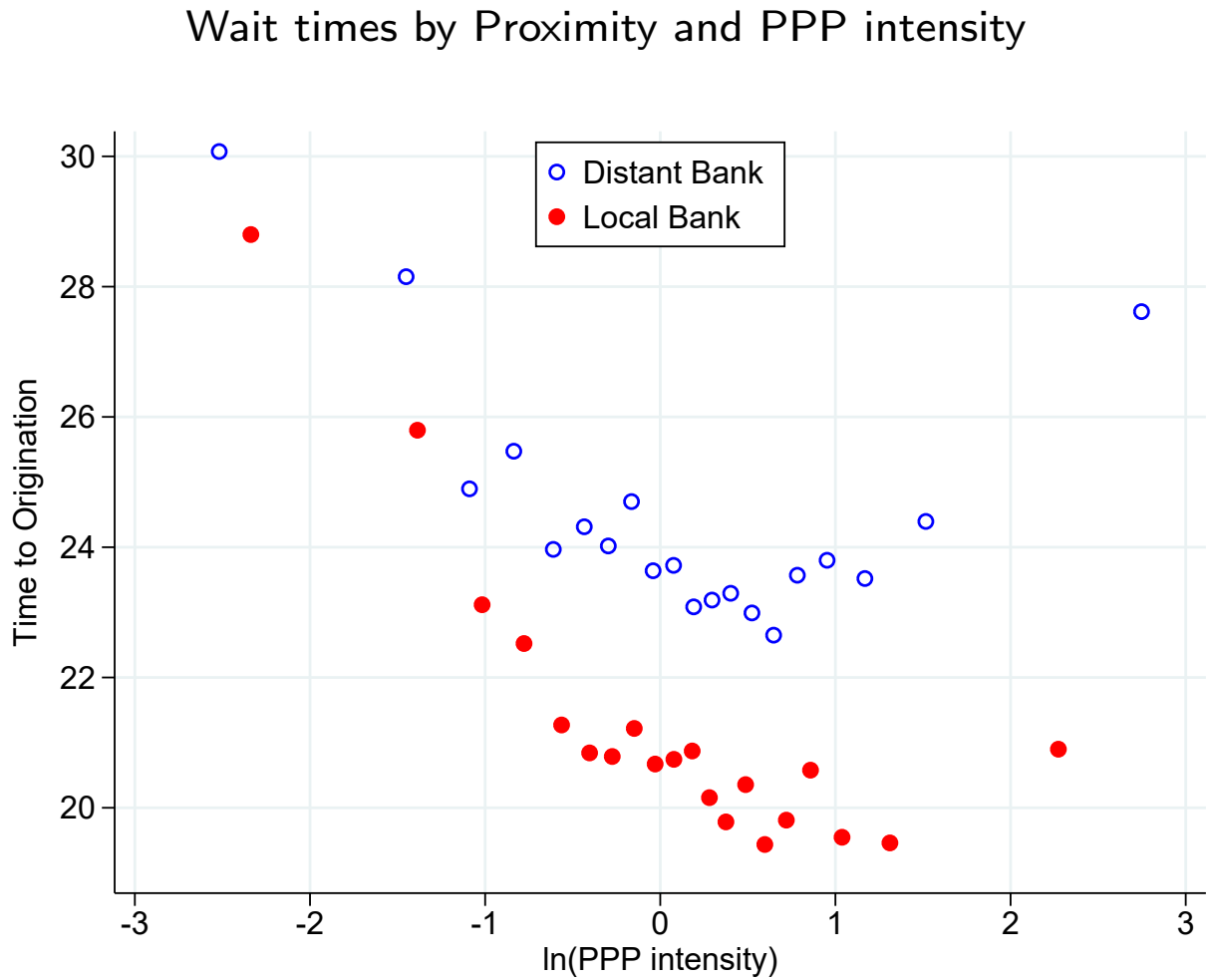
U-shaped relationship between PPP intensity and origination timing



Notes: Figure plots binscatter regressions of time-to-origination on the log PPP intensity of the lending bank for 2020 bank PPP loan originations. Controls include the size of the loan, an indicator for whether the firm has fewer than 5 employees, census tract characteristics (an urban indicator, the share of employees that are nonwhite, and the logarithms of prepandemic small business employment and small business lending), and county fixed effects. Weighted by the inverse of the number of PPP loans from the lending bank.

▸ Unweighted

U-shape driven by non-local lending



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▸ Unweighted Figure ▸ Regressions

Model overview

Key model ingredients:

- Lenders compete on time (since PPP terms are uniform)
  $\Longrightarrow$ higher PPP intensity for banks that underwrite faster
- Lenders prioritize existing clients and borrowers face time cost to switching to non-relationship lender
  $\Longrightarrow$ benefit of relationship with high intensity lender
- Relationship/non-relationship loans have different geographic distribution
  $\Longrightarrow$ benefit of *proximity* to high intensity lender

Goal:

- Solve/Estimate Time-to-Origination$= F(\text{distance}, \text{PPP intensity})$
- Back out function w.r.t. Relationships and Technology.

Supply of PPP loans

Banks take $\tau_b(\frac{L}{R_b})^\gamma$ days on average to process first L loans

- τ_b: time to process R_b relationship loans
- γ: congestion effects

Relationship clients served first $\implies$ Expected times for relationship and non-relationship loans, T_b^R & T_b^N, differ.

- $T_b^R = \tau_b(\frac{\min\{L_b, R_b\}}{R_b})^\gamma$
- T_b^N s.t. $\tau_b \rho_b^\gamma = \rho_b^{-1}\tau_b + (1 - \rho_b^{-1})\, T_b^N$ if $\rho_b > 1$

where

- L_b is total PPP lending
- $\rho_b \equiv \frac{L_b}{R_b}$ is PPP intensity (so ρ_b^{-1} is relationship share)

Demand for PPP Loans

Borrowers go to lender offering the fastest processing time.

- Non-relationship loans have same processing time, T, in equilibrium.
- Time to receive non-relationship loan is $\mu_i T$, where μ_i is a pareto distributed proportional switching cost.

For low technology banks ($\tau_b > T$), demand determined by share of borrowers whose switching costs are high enough to prevent exit:

$$L_b = R_b \times Pr(T_b^R < \mu_i T) = R_b(\frac{T}{T_b^R})^{\alpha}$$

Equilibrium Wait Time

τ_b determines ρ_b, so wait times can be expressed as function of PPP intensity rather than technology:

$$\mathbb{E}(T_{i,b}|R_{i,b},\rho_b) = T \times \begin{cases} \rho_b^{\frac{-1}{\alpha}} & \text{if } \rho_b < 1 \text{ and } R_{i,b} = 1 \\ \frac{\rho_b - 1}{\rho_b^{1+\gamma} - 1} & \text{if } \rho_b > 1 \text{ and } R_{i,b} = 1 \\ \bar{\mu} T & \text{if } \rho_b > 1 \text{ and } R_{i,b} = 0 \end{cases}$$

Mechanisms:

- Low-intensity lenders: τ_b s.t. lenders retain share ρ_b of relationship clients.
- High-intensity lender: τ_b s.t. lenders can make L_b loans and offer a non-relationship processing time T.

Distance

Relationship and non-relationship lending have different geographic distributions, $f^R(d)$ and $f^N(d)$. Expected wait times can now be expressed as a function of distance and PPP intensity. Defining $\lambda(d) \equiv \frac{f^N(d)}{f^R(d)}$:

$$\mathbb{E}(T_{i,b}|d_{i,b},\rho_b) = T \times \begin{cases} \rho_b^{\frac{-1}{\alpha}} & \text{if } \rho_b < 1 \\ \bar{\mu} - \underbrace{\Big(1+(\rho_b-1)\lambda(d_{i,b})\Big)^{-1}}_{P(R_{i,b}=1|d_{i,b},\rho_b)} \underbrace{\Big(\bar{\mu} - \frac{\rho_b - 1}{\rho_b^{1+\gamma}-1}\Big)}_{\text{Benefit of Relationship}} & \text{if } \rho_b > 1 \end{cases}$$

Function matches empirical findings:

- $\mathbb{E}(T_{i,b}|d_{i,b},\rho_b)$ is U-shaped in ρ_b
- Benefit of proximity to active lenders (if $\lambda'(d) > 0$):
  $\frac{\partial\, \mathbb{E}(T_{i,b}|d_{i,b},\rho_b)}{\partial d_{i,b}} > 0$ for $\rho_b > 1$, $= 0$ for $\rho_b < 1$

Estimation strategy

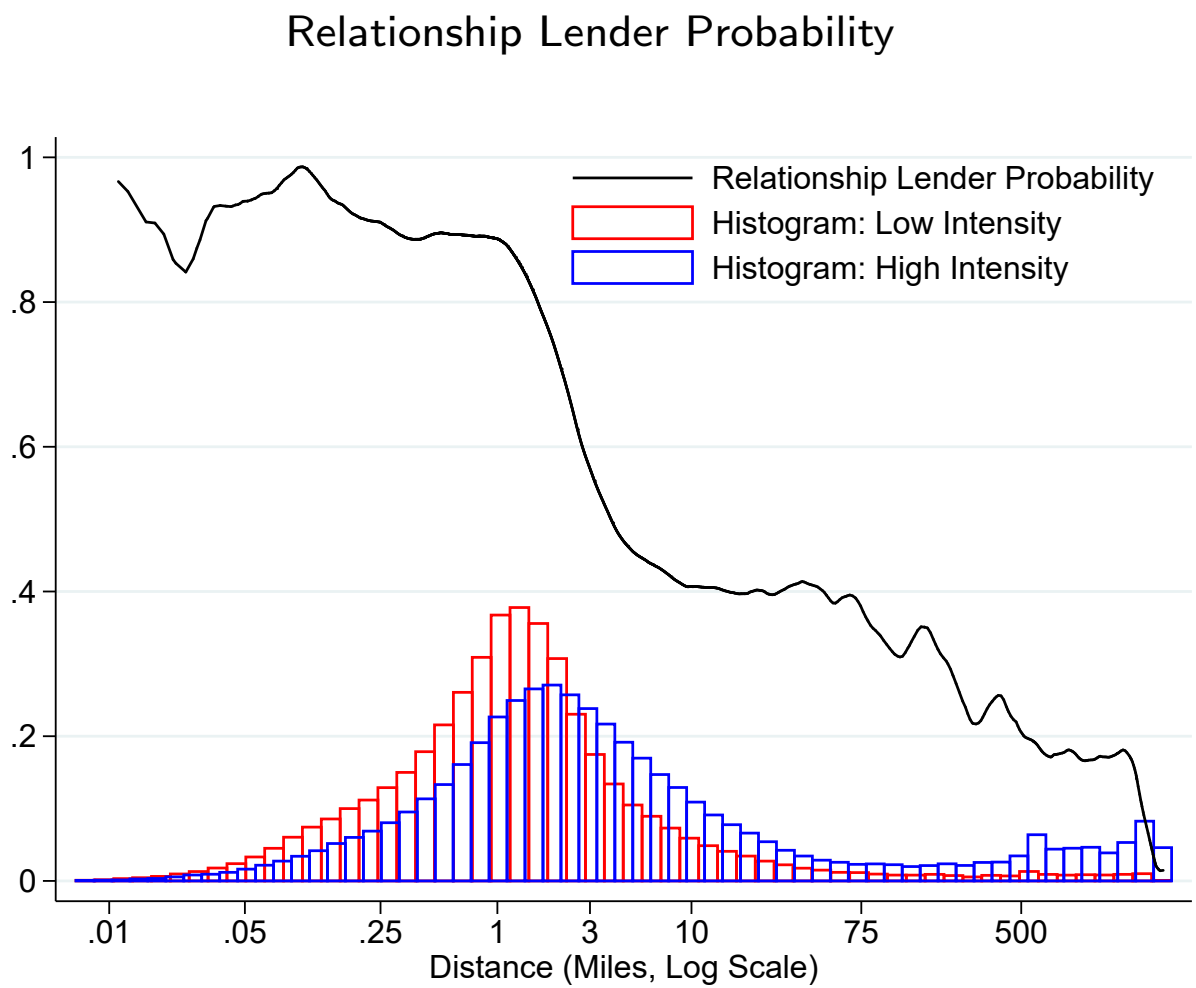
Estimation of of $P(R_{i,b} = 1|d_{i,b}, \rho_b) = \Big(1 + (\rho_b - 1)\lambda(d_{i,b})\Big)^{-1}$

- ρ_b from Call Reports
- $\lambda(d) = \frac{f^N(d)}{f^R(d)}$ estimated from distance distribution of high/low PPP intensity lenders.
  - $\hat{f}^R(d) = f(d|\rho_b < 1)$
  - $\hat{f}^N(d)$ s.t. $f(d|\rho_b > 1) = 0.502\hat{f}^R(d) + 0.498\hat{f}^N(d)$, where $0.502 = \mathbb{E}_i(\rho_b^{-1}|\rho_b > 1)$ is estimated relationship loan share of high intensity banks.

(μ, T, γ, and α) estimated by nonlinear least squares

- Time-to-Origination$_{i,b} = \mathbb{E}(T_{i,b}|d_{i,b}, \rho_b) + (X_i'\beta)^+ + \varepsilon_{i,b}$
- $(X_i'\beta)^+$ controls to capture application time

Distance and Relationship Lending



Notes: Figure plots the estimated probability that a loan is from a relationship lender by distance. Blue and red bars provide distance histogram for high and low intensity banks, respectively.

Banks serve relationship borrowers 5–9 days earlier

T	9.768	13.625	13.930	15.078
$\bar{\mu}$	1.426	1.317	1.311	1.048
γ	0.088	0.046	0.045	0.694
α	3.778	4.287	4.765	4.691
Weighted	X	X	X	
Application Time	$(X_i'\beta)^+$	0	$(X_i'\beta)$	$(X_i'\beta)^+$
Relationship Benefit (days)	5.0 - 9.1	4.9 - 8.5	4.9 - 8.6	6.9 - 15.7

Notes: Table presents estimates from the equation:

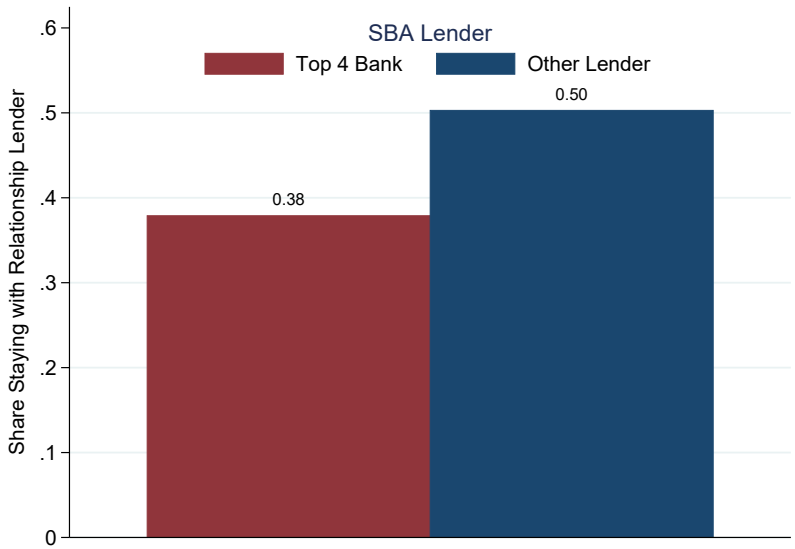
$$\text{Time-to-Origination}_{i,b} = \mathbb{E}(T_{i,b}|d_{i,b}, \rho_j) + (X_i'\beta)^+ + \varepsilon_{i,b}$$

where $\text{Time-to-Origination}_{i,b}$ is the number of days until origination for loan i, $\mathbb{E}(T_{i,b}|d_{i,b}, \rho_b)$ is the expected processing time given the bank-borrower distance and bank PPP intensity, and $(X_i'\beta)^+$ is a control for application time, which is restricted to be weakly positive in the baseline specification. The X vector includes the log loan amount, and the following tract level controls: the nonwhite employment share, the logarithm of prepandemic tract small business employment, the logarithm of prepandemic small business lending, and an urban indicator. The specification is weighted by the inverse of the number of PPP originations at bank b. Columns 2-4 make the following alterations to this baseline specification: Column 2 omits the controls, Column 3 removes the restriction that time to application is positive, Column 4 is unweighted.

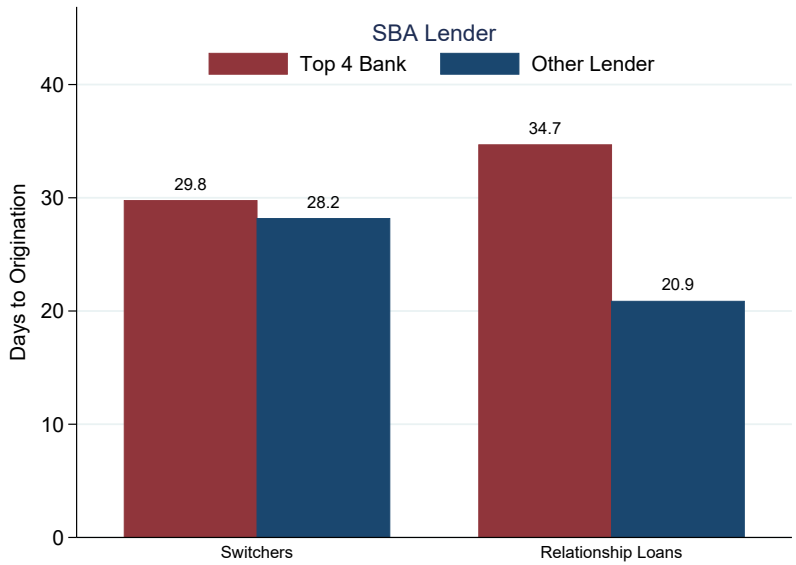
Extension 1: Validation from SBA data

Consistent with model, lower intensity lenders retain fewer clients (left) and are slower to extend non-relationship loans (right)

PPP Outcomes by Previous SBA Lender Type



(a) Share of Relationships Retained



(b) Origination Time

Notes: Charts plot the share of borrowers who take out a PPP loan from their previous SBA lender (left) and the average time-to-origination by whether or not borrowers use their previous SBA lender (right). Red bars show results for PPP borrowers that took out an SBA loan from a top 4 bank, while blue bars show results for borrowers from other SBA lenders.

SBA Relationships and Origination Speed

	Days to Origination			
	(1)	(2)	(3)	(4)
Relationship$_{i,b}$	-4.75**	-4.07**	-5.78**	-4.76**
	(0.41)	(0.44)	(0.44)	(0.48)
x ln(PPP Intensity$_b$)	-1.46**	-1.17**	-1.32**	-1.10*
	(0.46)	(0.44)	(0.46)	(0.44)
Local Branch$_{i,b}$			-1.40*	-1.13*
			(0.63)	(0.52)
x ln(PPP Intensity$_b$)			-1.17	-0.60
			(0.72)	(0.42)
x Relationship$_{i,b}$			2.67**	1.63**
			(0.60)	(0.54)
ln(PPP Intensity$_b$)	-0.18		0.06	
	(0.38)		(0.34)	
R^2	0.328	0.430	0.330	0.431
Obs.	117,506	116,969	117,487	116,950
Controls?	X	X	X	X
County FE	X	X	X	X
Lending Bank FE?		X		X
Weighted	X	X	X	X
Relationship Benefit (days)	4.7 - 7.7	4.1 - 6.4	5.8 - 8.4	4.8 - 6.9

Notes: Table presents estimates from regressing days until origination on log PPP intensity of the lending bank, an indicator for whether the lending bank has a branch within 2 miles of the borrower, an indicator for whether the lending bank previously provided an SBA loan to the borrower, and pairwise interactions of these variables. Sample covers bank PPP loans to borrowers with previous SBA loans. Columns 2 and 4 additionally include lending bank fixed effects. Regressions weight by the inverse of the number of loans in the sample by the lending bank. All specifications control for the size of the loan, whether the business has fewer than 5 employees and tract characteristics (an urban indicator, the share of employees that are nonwhite, and the logarithms of prepandemic small business lending and employment). Standards errors, in parentheses, are clustered by bank. $^{+},^{*},^{**}$ indicate significance at 10%, 5% and 1%, respectively. The bottom row reports the range of the benefits of borrowing from a relationship bank for banks with an ln(PPP Intensity) between 0 and 2 (assuming a nonlocal bank).

Extension 2: Effects of PPP Intensity of Banks within 2 miles of a tract

	Days to Origination		Local Bank Share (pp)		Fintech Share (pp)		ln(PPP Lending)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln(\text{PPP Intensity})_j$	-1.17**	-1.02**	4.03**	4.71**	-0.70**	-0.56**	0.02*	0.01
	(0.20)	(0.16)	(0.34)	(0.36)	(0.18)	(0.10)	(0.01)	(0.01)
R^2	0.645	0.678	0.407	0.519	0.397	0.344	0.822	0.909
Obs.	48,897	48,897	48,301	48,301	46,226	46,226	48,897	48,897
Tract Controls?	X	X	X	X	X	X	X	X
County FE?	X	X	X	X	X	X	X	X
Employment Weighted?		X		X		X		X

Notes: This table presents estimates from the equation:

$$y_j = \alpha_{c(j)} + \beta \ln(\text{PPP Intensity})_j + \gamma' X_j + \varepsilon_j$$

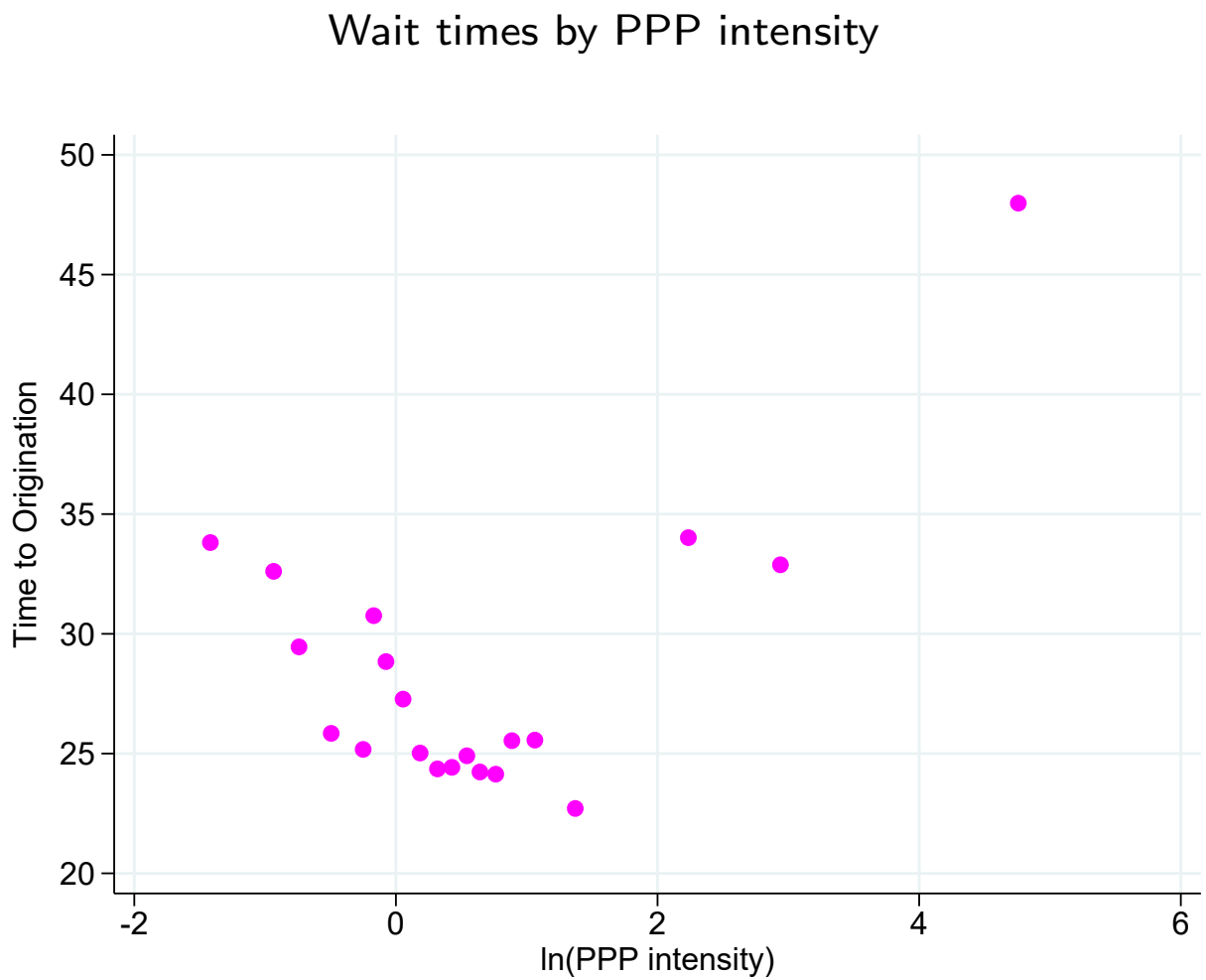
where y_j is a PPP outcome for a tract j. $\ln(\text{PPP Intensity})_j$ is the average of the logarithm of the ratio of PPP lending in other tracts to prepandemic small business lending for banks with branches within 2 miles of the tract centroid, weighted by the deposits in those branches. X_j is a vector of tract-level controls, including the the logarithms of 2017 small business employment ($\leq$500 employees) and 2019 small business lending in the tract; the logarithm of the number of branches within 2 miles of the tract; and the shares of jobs in the tract that earn over $3333 per month, earn under $1250 per month, are held by a worker with a college degree, or are held by nonwhite employees. $\alpha_{c(j)}$ is a county fixed effect. y_j is the average number of days until origination for the loans in the tract in columns 1 & 2, the percent of credit provided by banks within two miles in columns 3 & 4, the percent of credit provided by fintech lenders in columns 5 & 6 and the logarithm of 2020 total PPP lending in the tract in columns 7 & 8. Even-numbered specifications weight by tract small business employment. Standards errors, in parentheses, are clustered by county. $^+,^*,^{**}$ indicate significance at 10%, 5% and 1%, respectively.

Conclusion

- Borrowers near more-active lenders received PPP loans earlier than other borrowers
- Cross sectional differences in origination timing can be explained by a model where banks prioritize existing clients, and borrowers face switching costs
- Estimated model indicates that banks served relationship borrowers 5–9 days before nonrelationship borrowers.
  - Delay consistent with findings analyzing benefits of prior SBA relationships
- Suggests intermediating aid through the banking sector can disadvantage the underbanked

Appendix

U-shaped relationship, unweighted results



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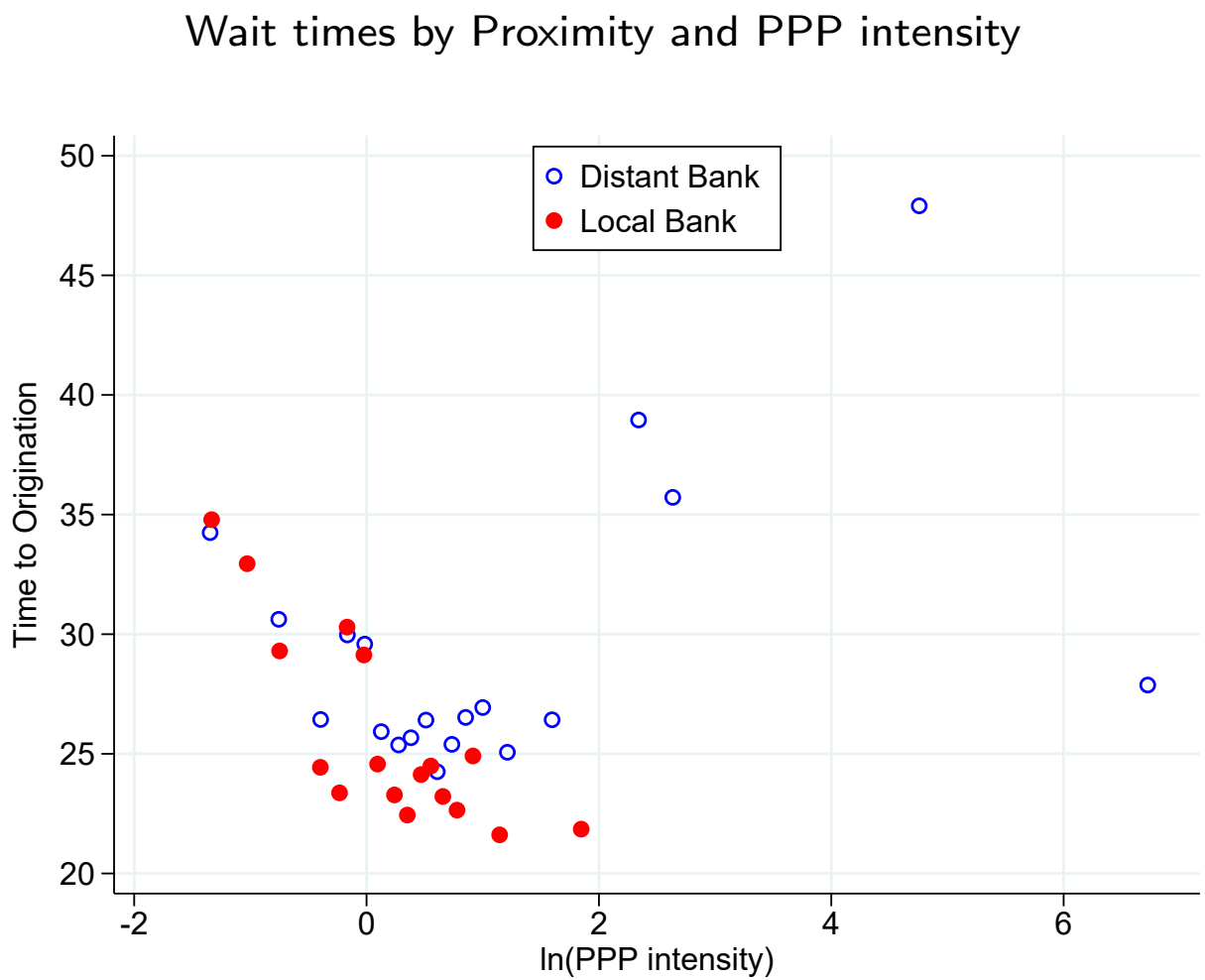
Back

U-shape driven by non-local lending, unweighted



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Back

U-shape driven by non-local lending, regressions

	Days to Origination					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(PPP Intensity$_b$)	-2.41**	-1.62	-0.65	-1.17**	-1.19**	-1.00**
	(0.75)	(1.10)	(1.19)	(0.18)	(0.18)	(0.20)
ln(PPP Intensity$_b$)^2	1.30**	1.12**	1.01**	0.61**	0.60**	0.59**
	(0.14)	(0.13)	(0.13)	(0.09)	(0.09)	(0.09)
Local Branch$_{i,b}$	-0.87$^+$	-1.11*	-0.39	-1.35**	-1.35**	-1.29**
	(0.47)	(0.52)	(0.45)	(0.11)	(0.11)	(0.11)
x ln(PPP Intensity$_b$)			-2.49**			-0.63**
			(0.89)			(0.18)
ln(Loan Amount)$_{i,b}$	-4.19**	-4.07**	-4.04**	-4.64**	-4.63**	-4.63**
	(0.34)	(0.36)	(0.35)	(0.05)	(0.05)	(0.05)
Small Firm$_{i,b}$	4.43**	4.46**	4.47**	4.09**	4.09**	4.10**
	(0.78)	(0.78)	(0.78)	(0.12)	(0.12)	(0.12)
Internet Bank$_b$		2.69	1.14		12.24**	11.60**
		(4.11)	(4.33)		(3.64)	(3.56)
Top 4$_b$		4.24*	3.47$^+$		4.58*	4.28*
		(1.90)	(1.91)		(1.94)	(1.97)
R^2	0.265	0.267	0.268	0.182	0.182	0.182
Obs.	4,077,112	4,077,112	4,077,112	4,077,112	4,077,112	4,077,112
Tract Controls?	X	X	X	X	X	X
County FE?	X	X	X	X	X	X
3-Digit NAICS FE?	X	X	X	X	X	X
Weighted?				X	X	X

Notes: This table presents estimates from regressing the number of days until origination on log PPP intensity of the lending bank, log PPP intensity squared and an indicator for whether the bank has a branch within 2 miles of the borrower. Specifications in columns 2 & 5 add controls for whether the bank is one of the four largest lenders or an internet bank, and the specifications in columns 3 & 6 add an interaction of log PPP intensity with the local lender dummy. All specifications control for the size of the loan, whether the business has fewer than 5 employees and tract characteristics (nonwhite employment share, log small business employment, log prepandemic small business lending, and an urban indicator), and include county and 3-digit NAICS fixed effects. Estimates for tract controls are not displayed. Standards errors, in parentheses, are clustered by county. $^+$,*,** indicate significance at 10%, 5% and 1%, respectively.

Back