Covid restrictions, federal assistance and small businesses

What can we learn from electricity data?

Jack Gregory,[1] Katrina Jessoe[1] & Gabriel E. Lade[2]

COVID-19 and Energy Session
Energy Policy Conference
14 October 2021

[1] Department of Agricultural & Resource Economics, University of California, Davis
[2] Department of Economics, Macalester University

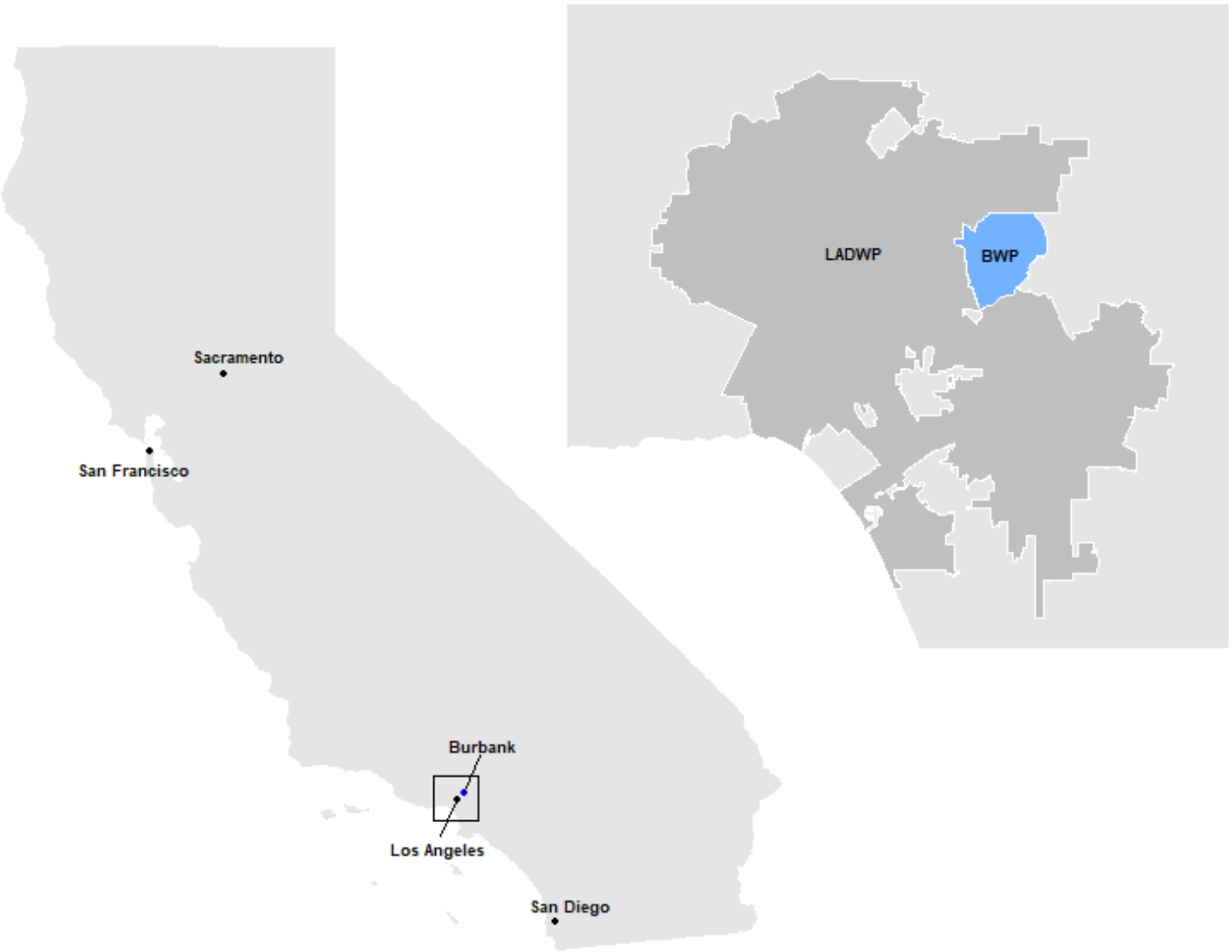
Motivation

- **Aim**
  - Investigate the effect of the pandemic and subsequent relief packages on small businesses
  - Use high-resolution electricity data and an event study approach.
- **Questions**
  1. How have public health orders impacted business activity and exits?
  2. How have federal loan programs mitigated these impacts?
- **Main assumptions**
  - Electricity use is a proxy for business activity; and,
  - Electricity accounts are a proxy for exit.

Preview of results

1. Restrictions caused lower business activity and more business exits.
2. Loan receipt correlated with smaller decreases in business activity and smaller increases in business exits.

Burbank Water & Power I

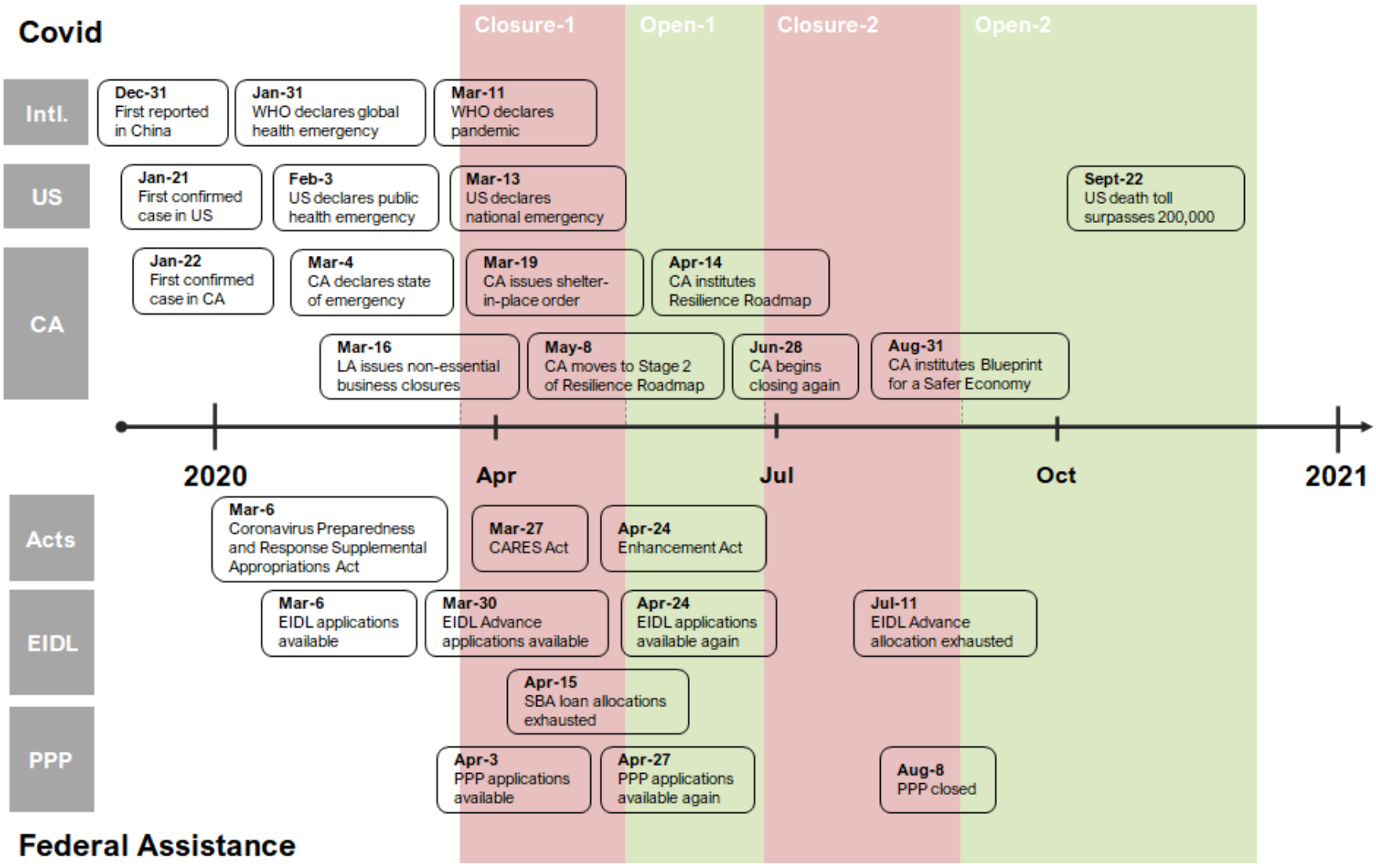


Burbank Water & Power II

- **Utility**
  - Municipal utility in Southern California
  - Accounts = 53,272
  - Sales = 1,092 GWh
- **Electricity data**
  - Proprietary dataset containing universe of commercial customers
  - Use: hourly panel with variation in business and time dimensions
  - Bills: monthly panel of use and amounts

NAICS count

Covid



COVID cases

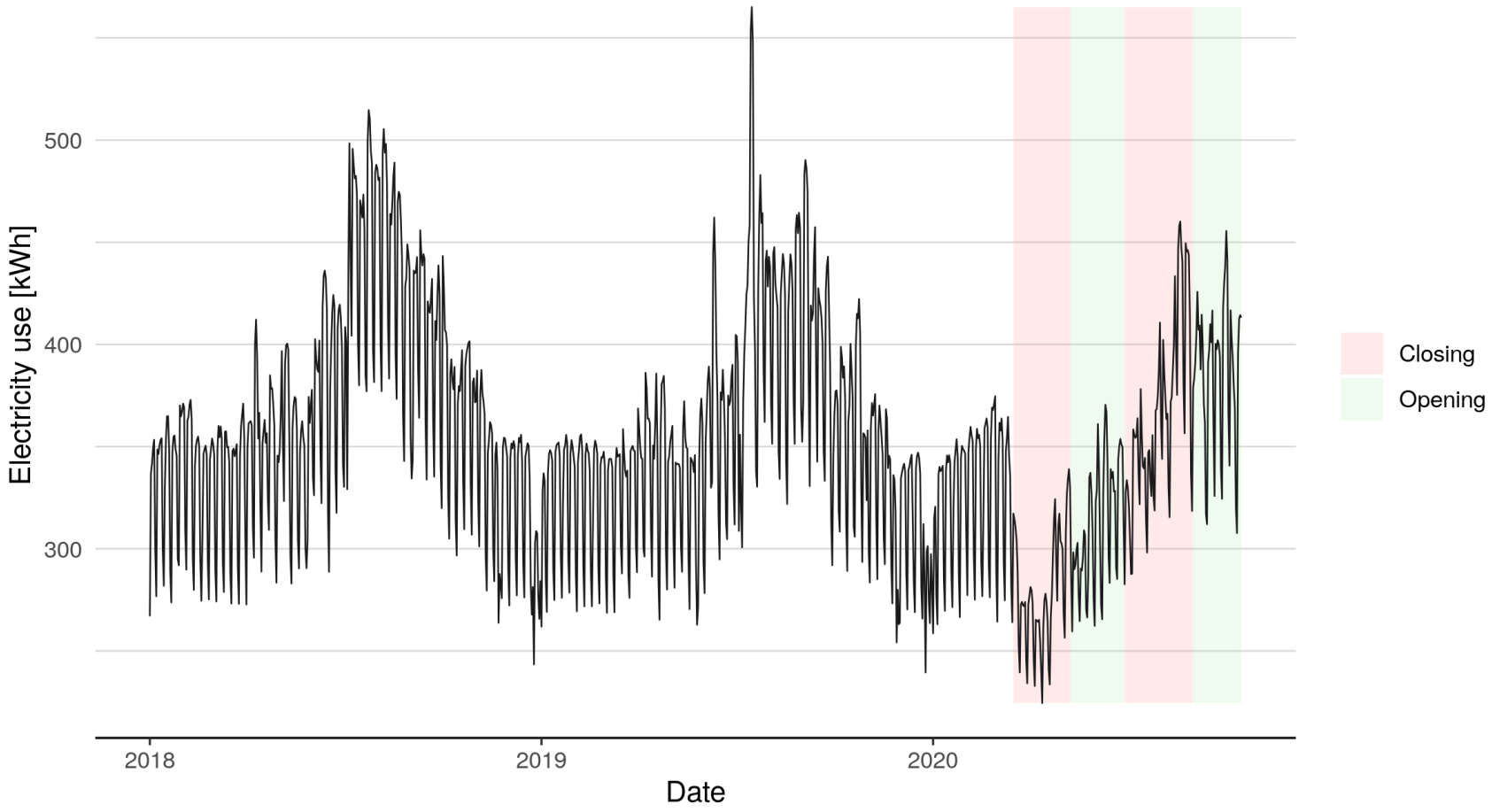
Federal assistance

- **Loan programs**
  - Economic Injury Disaster Loans (EIDL) & Paycheck Protection Program (PPP)
  - Primarily enacted through the CARES Act 2020
  - Administered through the Small Business Administration (SBA)
  - For our analysis, we ignore differences between the programs
- **Data**
  - Public dataset containing universe of federal loans

U.S. Small Business Administration

Loan programs Loan count Loan stats

Average electricity use



Empirical strategy

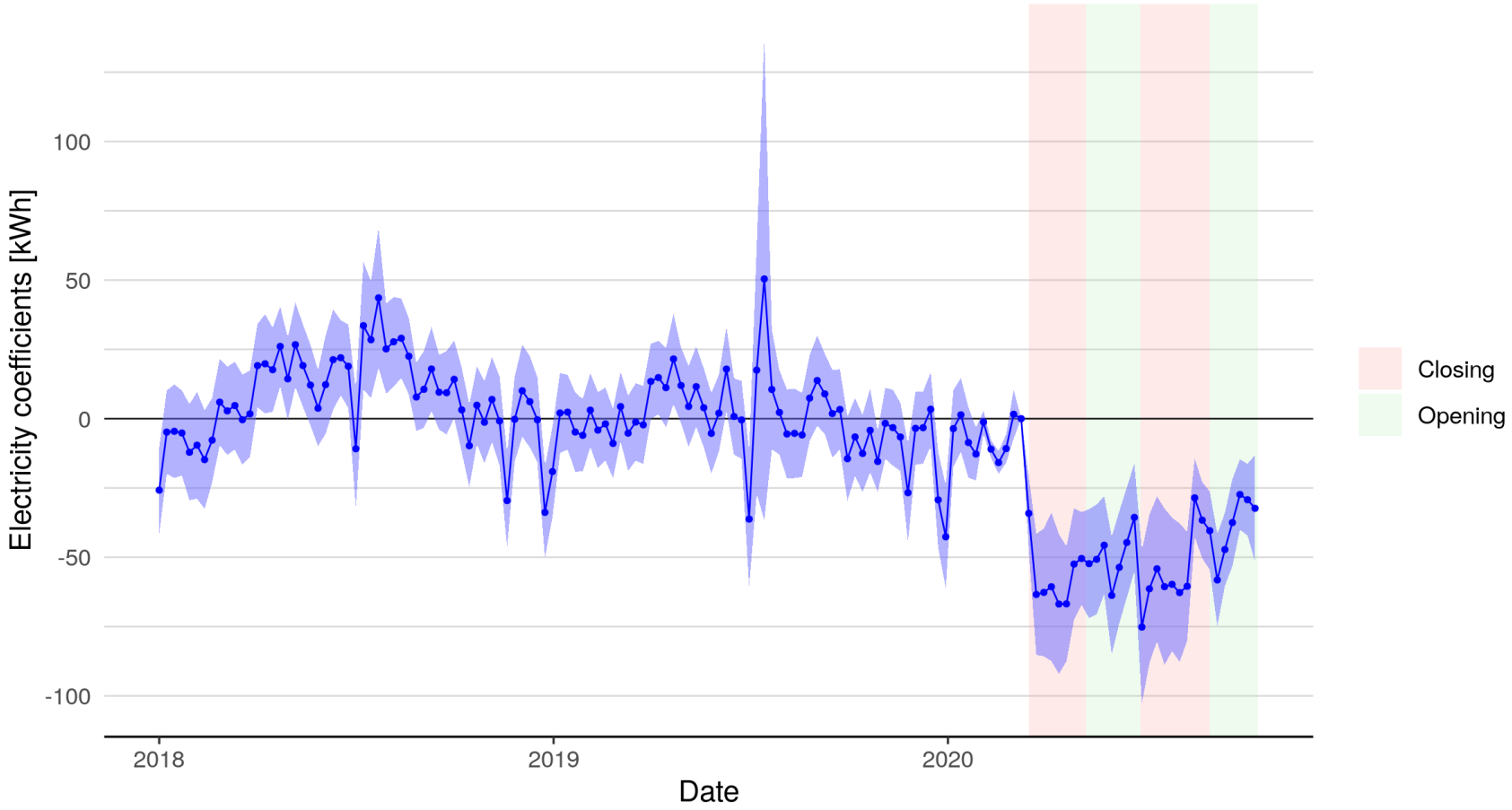
- **Event study**
  - All businesses in the panel receive treatment simultaneously
  - Allow for heterogeneous effects across restriction periods
  - Causal interpretation assuming no systematic changes over time except for treatment

- **Two-way fixed effects** estimation using OLS:

$$y_{it} = \sum_j \beta_j 1[r = j] + \mathrm{X}_{it}\gamma + \alpha_{idm} + \varepsilon_{it} \tag{1}$$

  - y_{it} is the outcome of interest for business i in period t.
  - $1[r = j] \; \forall \; j$ are the event indicators for a specific close or open period.
  - X_{it} are controls related to local weather and COVID case numbers.
  - α_{idm} represents unit and time fixed effects combinations.
  - ε_{it} is an error term clustered at the business level.

Average electricity use residuals



Reg table With cases By hour

Average electricity use residuals by loans

Balance table Reg table

Survival analysis by loans

	All Data	No Loan	Loan
	(1)	(2)	(3)
Close-1 (2020-03-16)	0.00013***	0.00016***	0.00002
52 days	(4.59)	(4.44)	(1.18)
	0.68%	0.83%	0.10%
Open-1 (2020-05-08)	0.00032***	0.00032***	0.00031***
50 days	(7.80)	(6.74)	(3.94)
	1.60%	1.60%	1.55%
Close-2 (2020-06-28)	0.00055***	0.00055***	0.00055***
63 days	(12.05)	(10.35)	(6.16)
	3.47%	3.47%	3.47%
Open-2 (2020-08-31)	0.00052***	0.00052***	0.00051***
45 days	(11.85)	(10.24)	(5.98)
	2.34%	2.34%	2.30%
ID FE	X	X	X
Businesses	4,602	3,387	1,215
Observations	1,234,032	898,582	335,450
R^2	0.02849	0.03278	0.01278
Adjusted R^2	0.02485	0.02912	0.00918

Notes: Significance is represented as *** for p<0.001, ** for p<0.01, and * for p<0.05; while, *t*-statistics are in parentheses.

Acct exits Acct changes

Contribution & extensions

- **Contribution**
  - Deepening understanding of how the pandemic affected business activity
  - First to assess the combined effect of both the PPP and EIDL programs
  - First to study the high-resolution effects of federal loan receipt
- **Extensions**
  - High spatial resolution of our data means we can recover matches at the business level
  - Improved matches may allow us to overcome the inherent loan receipt selection bias
  - Allow the identification of heterogeneous effects at the industry and even the unit level

Main takeaways

- **COVID**
  - Average commercial electricity use decreased due to COVID restrictions
  - Closure periods experienced lower activity than re-opening periods
  - Exits increased over the duration of the pandemic and accelerated during closure periods
- **Federal loans**
  - Loan receipt correlated with smaller decreases in electricity use
  - Loan receipt also correlated with increased survival probability during the initial closure period, though the effect dissipates rapidly

jack@ucdavis.edu

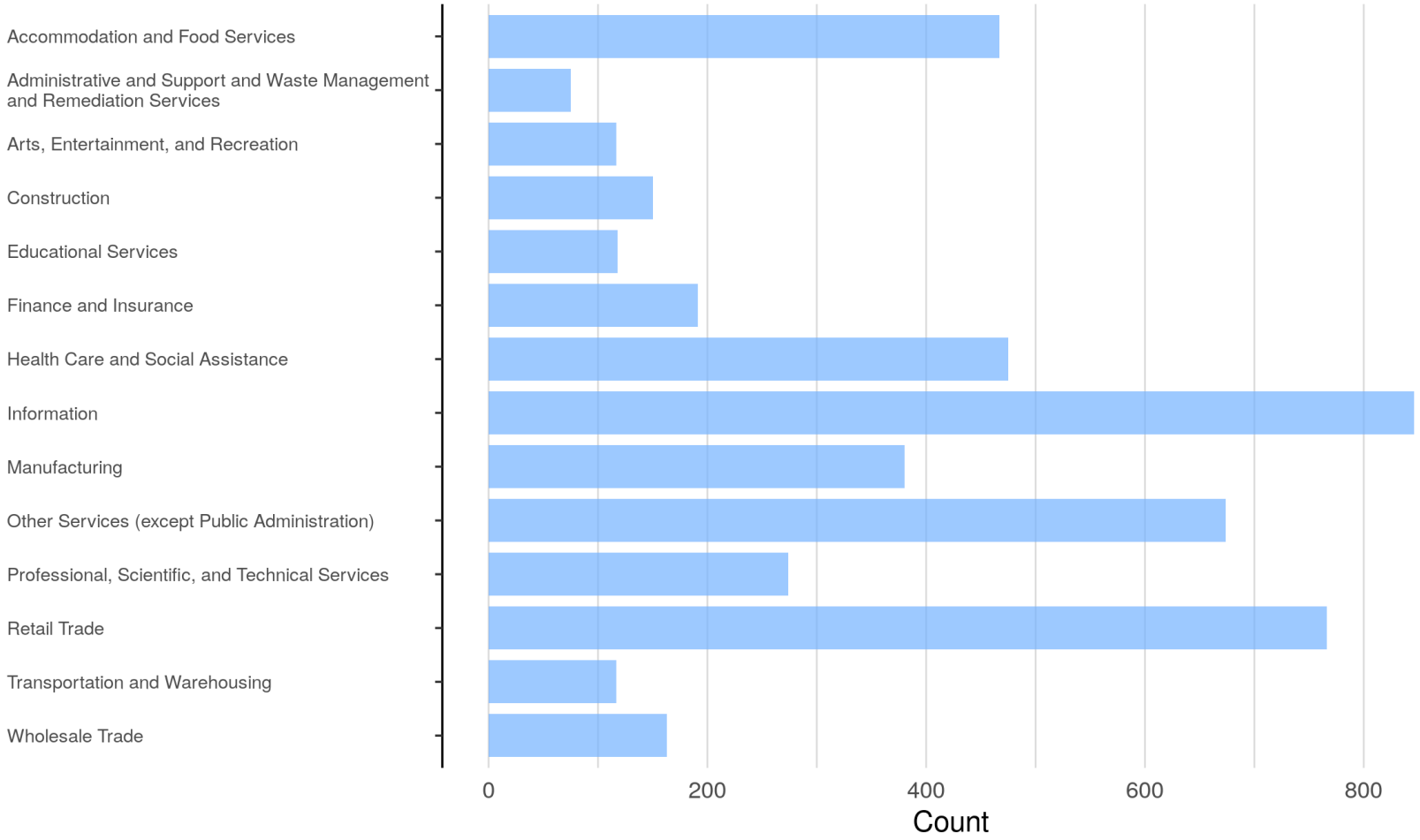
Supplementary Material

References

Bover, O., Fabra, N., García-Uribe, S., Lacuesta, A., and Ramos, R. (2020). Firms and households during the pandemic: What do we learn from their electricity consumption? Documentos ocasionales, Banco de España.

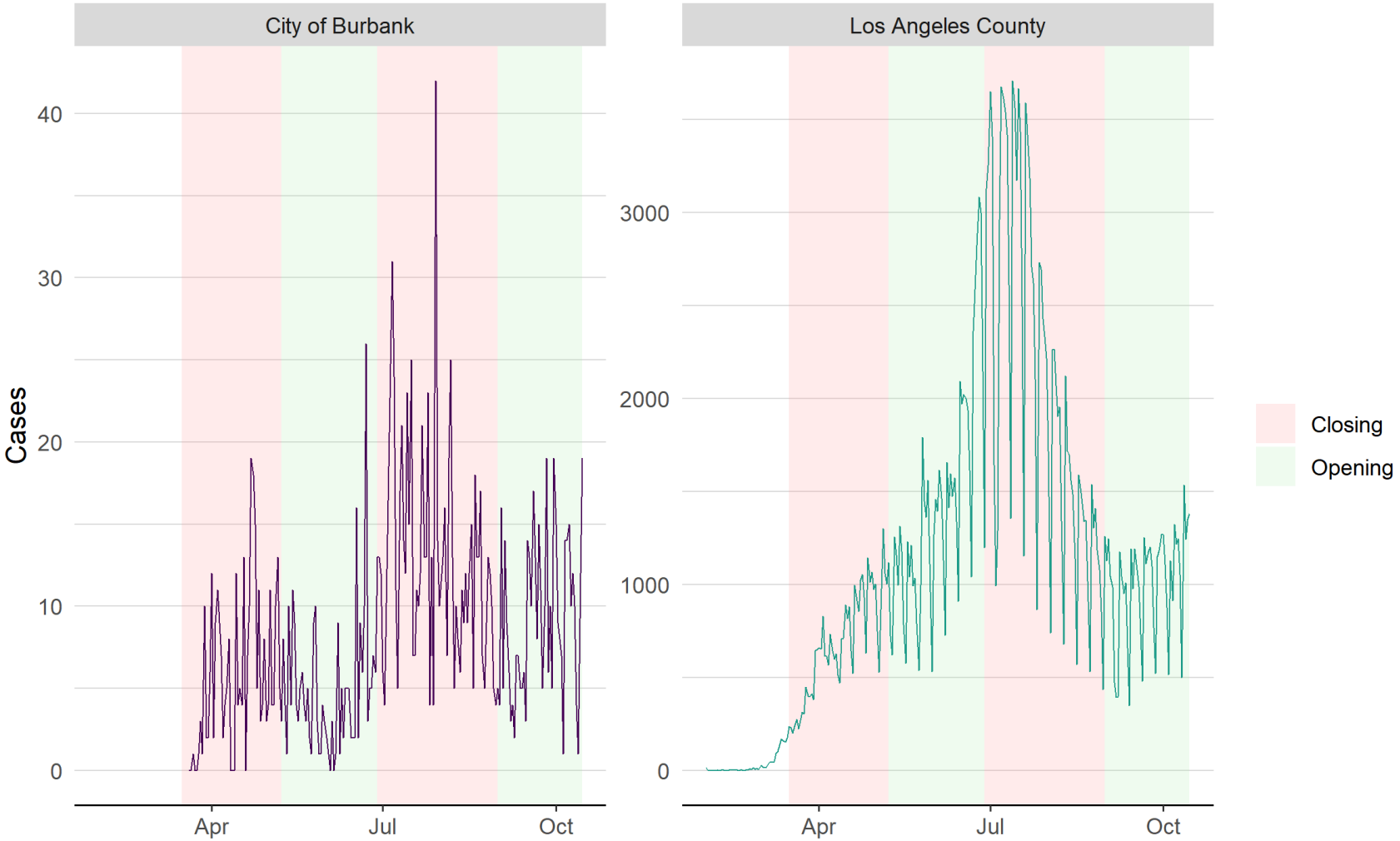
Cicala, S. (2020). Powering work from home. Working Paper 27937, National Bureau of Economic Research.

NAICS industry codes



Return

COVID cases



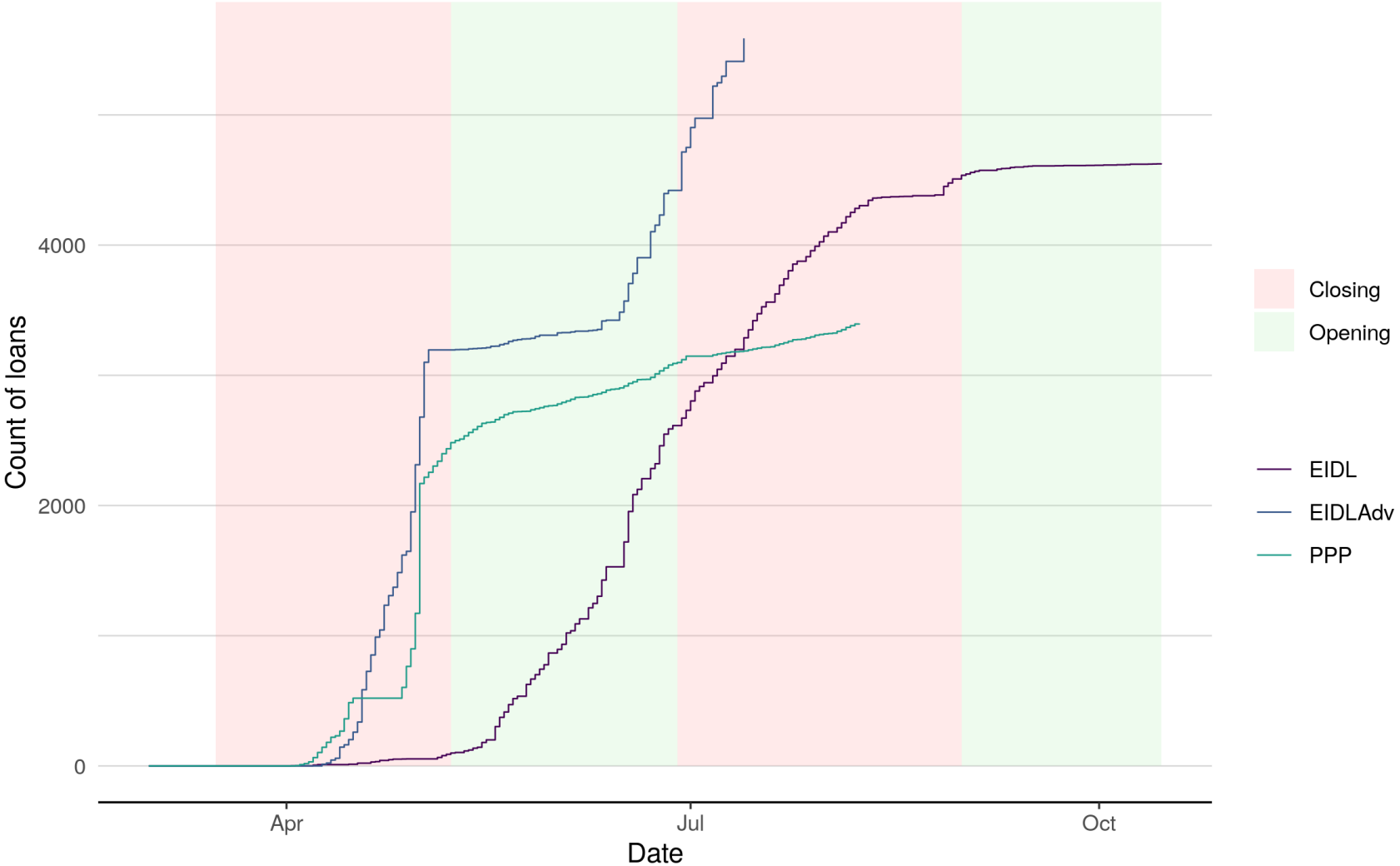
Return

SBA loan programs

	PPP	EIDL
Description	Low-interest, medium-term loan program where applications are processed through a network of private lenders across the US.	Competitive-interest, long-term loan program where applications are processed by the SBA; includes the EIDL Advance where up to $10,000 may be requested separately or in conjunction with a full EIDL loan.
Purpose	To meet operating expenses, primarily payroll.	To meet various financial obligations and operating expenses.
Availability	Apr to Aug 2020; Dec 2020 to present	EIDL Advance Mar to Jul 2020; EIDL Mar 2020 to present
Max	$10 million	Six months of working capital
Terms	Interest of 1% repaid over 2 to 5 years and deferred for 1 year with no collateral and no personal guarantee required.	Interest of 3.75% repaid over up to 30 years where collateral is required for loans over $25,000 and a personal guarantees for loans exceeding $200,000.
Forgivable	Yes, if all employee retention criteria are met and funds used for eligible expenses.	No, loan may be repaid at any time with no prepayment penalties.

Return

Loan count by date & program



Return

Loan summary stats

Characteristic	No loan	Loan
Number of businesses	3,587	1,226
Daily electricity use pre-pandemic (kWh)	444.5	119.4
Daily electricity use post-pandemic (kWh)	419.4	110.8
Number of business exits post-pandemic	181	61
Share of business exits post-pandemic (%)	5.7	5.2
Mean loans per business		2.0
Mean date of first loan		2020-05-06
Mean date of all loans		2020-05-17
Mean amount of first loan		121,172
Mean amount of total loan		197,504

Return

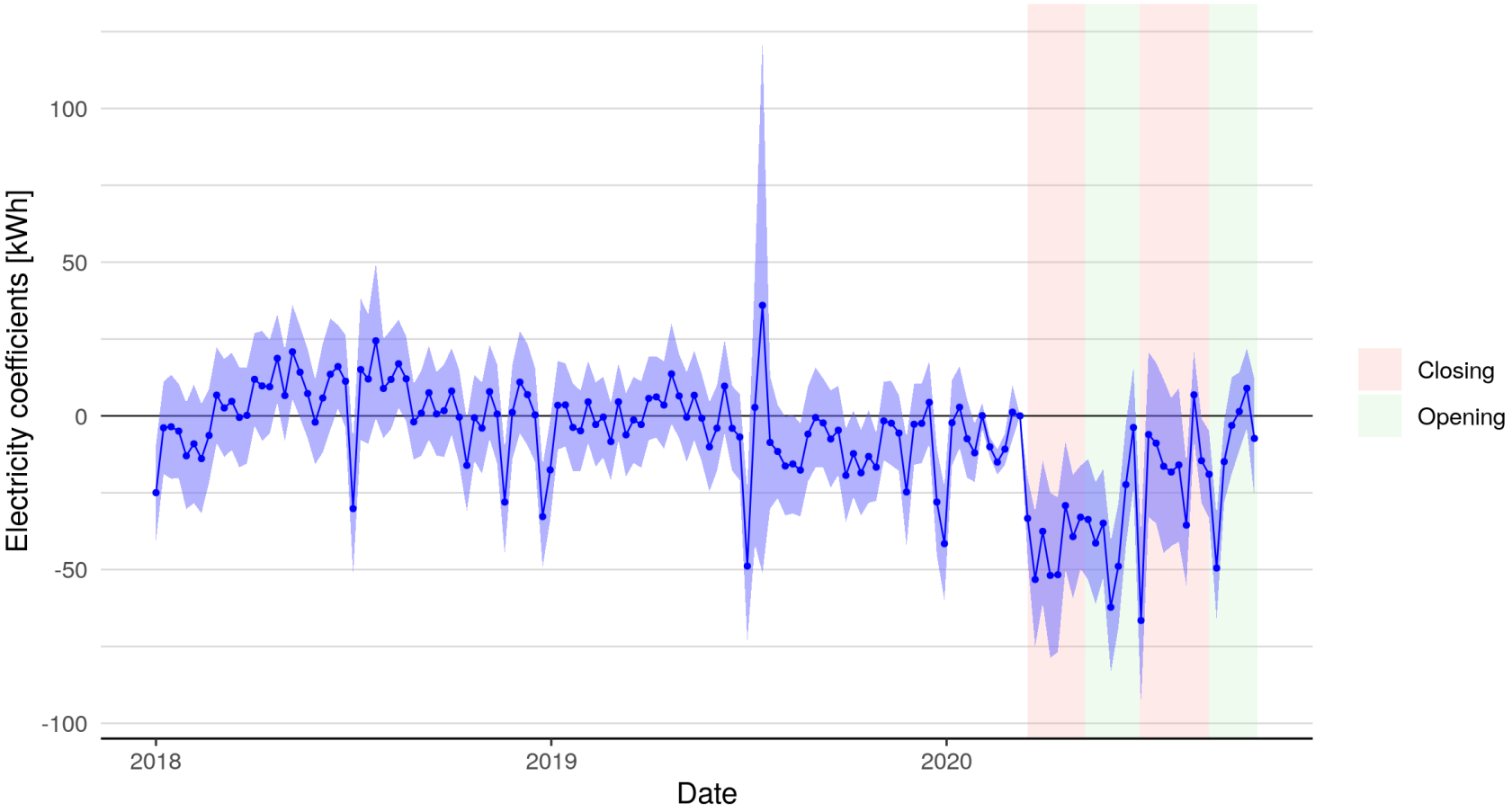
Change in electricity use

	(1)	(2)	(3)	(4)
Close-1 (2020-03-16)	−64.70***	−66.94***	−71.40***	−71.49***
	(−5.12)	(−5.11)	(−5.33)	(−5.33)
Open-1 (2020-05-08)	−51.14***	−61.89***	−61.87***	−61.87***
	(−3.99)	(−4.48)	(−4.48)	(−4.48)
Close-2 (2020-06-28)	−63.50***	−64.68***	−64.00***	−63.87***
	(−4.48)	(−4.39)	(−4.36)	(−4.36)
Open-2 (2020-08-31)	−26.04*	−43.26***	−48.37***	−48.50***
	(−2.27)	(−3.55)	(−3.88)	(−3.88)
Temperature		2.97***	1.55***	1.55***
		(9.13)	(5.68)	(5.67)
HDD			2.57***	2.57***
			(8.46)	(8.46)
ID FE	X	X	X	X
Day-of-Week FE	X	X	X	
Month-of-Year FE	X	X	X	
ID:Day-of-Week FE				X
ID:Month-of-Year FE				X
Businesses	4,813	4,546	4,546	4,544
Observations	4,402,221	4,327,915	4,327,915	4,327,896
R^2	0.957	0.966	0.966	0.977

Notes: Significance is represented as *** for p<0.001, ** for p<0.01, and * for p<0.05; while, *t*-statistics are in parentheses.

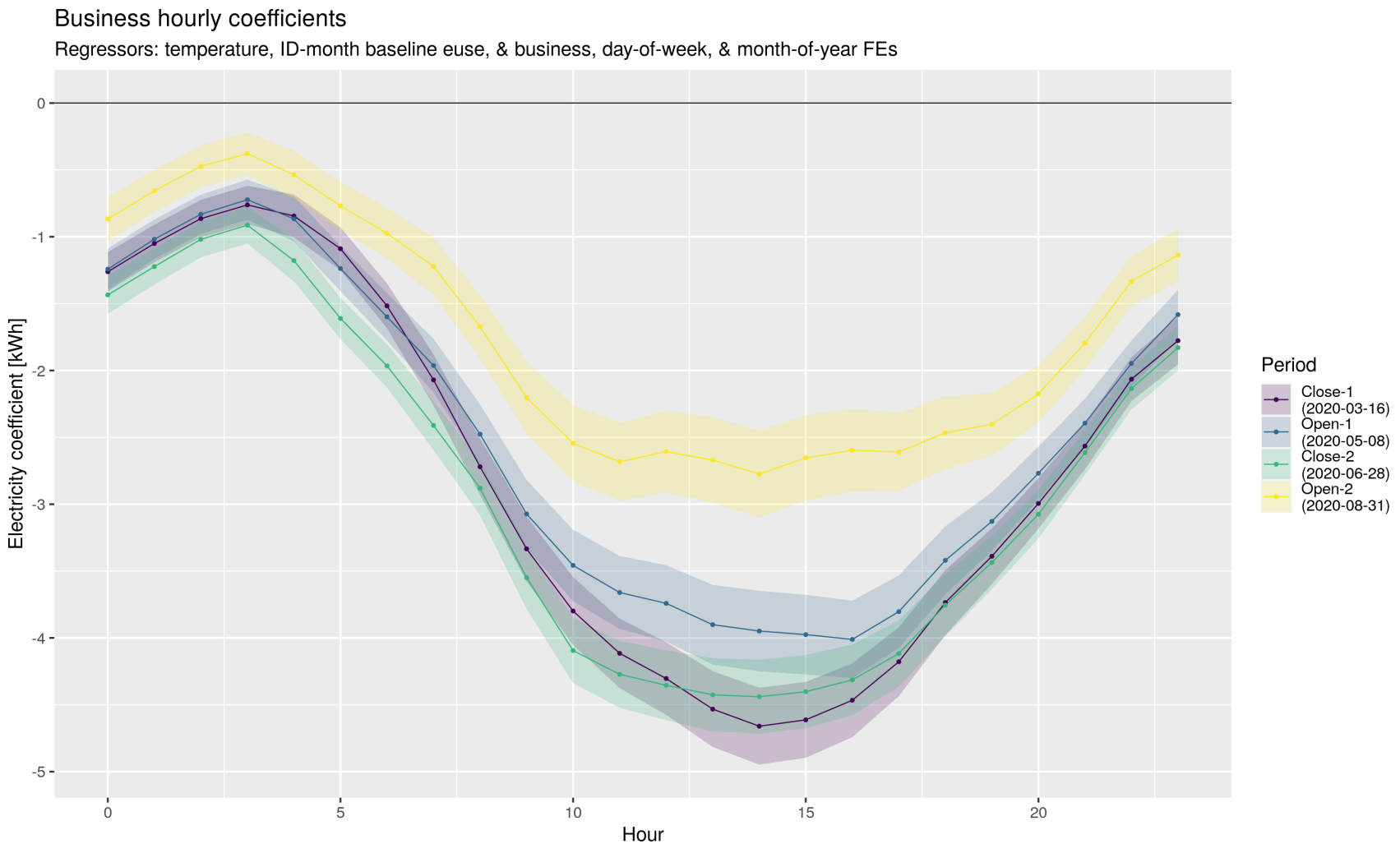
Return

Change in electricity with Burbank cases



Return

Change in electricity use by hour



Businesses defined as name-account-address tuples.
Shaded areas represent 99% confidence intervals.

Return

Loan balance table

Characteristic	No loan	Loan	Difference
Daily Electricity Use (kWh)	448.0 (3, 312.3)	120.6 (277.7)	327.4^{***} [149.21]
Finance and Insurance (%)	4.4 (20.6)	2.8 (16.5)	1.6^{**} [2.77]
Health Care and Social Assistance (%)	8.3 (27.6)	14.2 (34.9)	-5.8^{***} [−5.22]
Information (%)	19.9 (39.9)	10.1 (30.2)	9.7^{***} [8.75]
Transportation and Warehousing (%)	2.9 (16.7)	1.4 (11.5)	1.5^{***} [3.47]
Number of Observations	2,322,551	845,643	
Number of Businesses	3,361	1,185	

Notes: Standard deviations are in parentheses, with t statistics of the difference between 'no loan' and 'loan' businesses in brackets where *** $p<0.001$; ** $p<0.01$; * $p<0.05$.

Return

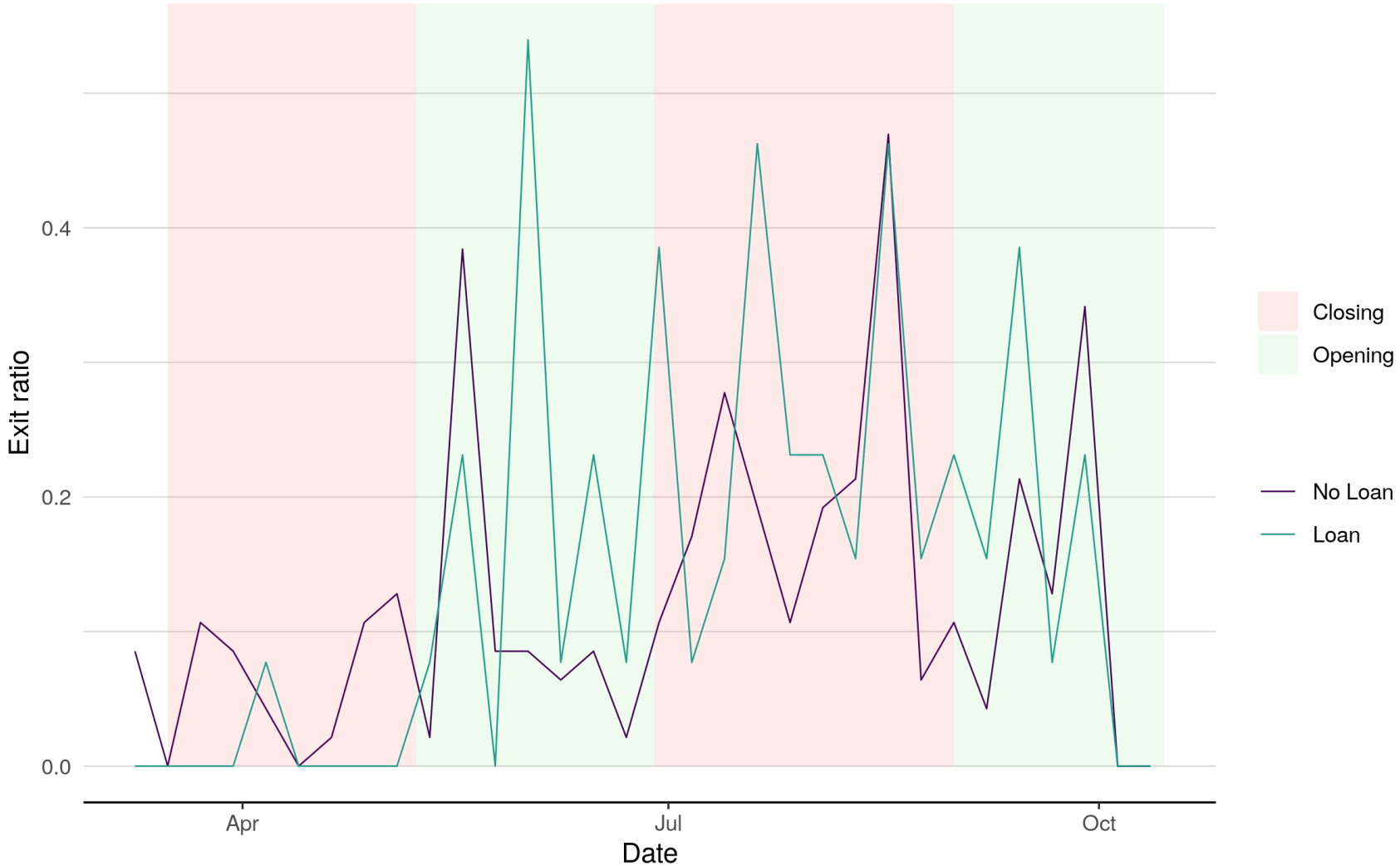
Change in electricity use by loans

	All Data		No Loan		Loan	
	(1)	(2)	(3)	(4)	(5)	(6)
Close-1 (2020-03-16)	−64.76***	−70.05***	−80.38***	−86.54***	−24.12***	−27.05***
	(−5.13)	(−5.38)	(−4.61)	(−4.82)	(−9.69)	(−10.69)
Open-1 (2020-05-08)	−51.29***	−60.78***	−64.99***	−76.47***	−15.49***	−19.59***
	(−4.01)	(−4.53)	(−3.68)	(−4.13)	(−6.63)	(−8.04)
Close-2 (2020-06-28)	−67.84***	−65.79***	−84.03***	−81.60***	−24.03***	−23.03***
	(−4.58)	(−4.48)	(−4.13)	(−4.04)	(−9.10)	(−8.80)
Open-2 (2020-08-31)	−26.16*	−45.60***	−32.26*	−55.48***	−9.86***	−19.02***
	(−2.28)	(−3.75)	(−2.04)	(−3.32)	(−4.25)	(−7.71)
Temperature		1.52***		1.91***		0.46***
		(5.69)		(5.24)		(7.23)
HDD		2.51***		2.90***		1.45***
		(8.49)		(7.20)		(17.30)
ID FE	X	X	X	X	X	X
Day-of-Week FE	X	X	X	X	X	X
Month-of-Year FE	X	X	X	X	X	X
Businesses	4,813	4,813	3,587	3,587	1,226	1,226
Observations	4,402,221	4,402,221	3,221,128	3,221,128	1,181,093	1,181,093
R^2	0.96	0.96	0.96	0.96	0.90	0.90
Adjusted R^2	0.96	0.96	0.96	0.96	0.90	0.90

Notes: Significance is represented as *** for p<0.001, ** for p<0.01, and * for p<0.05; while, *t*-statistics are in parentheses.

Return

Exit count by date & program



Return

Change in account numbers

	(1)	(2)	(3)	(4)	(5)
Close-1 (2020-03-16)	−0.62***	−0.47***	−0.45***	−0.47***	−0.46
	(0.09)	(0.10)	(0.10)	(0.10)	(0.33)
Open-1 (2020-05-08)	−1.00***	−1.05**	−0.96***	−1.00***	−1.00**
	(0.09)	(0.11)	(0.11)	(0.11)	(0.37)
Close-2 (2020-06-28)	−1.54***	−1.83***	−1.82***	−1.83***	−1.83***
	(0.08)	(0.09)	(0.09)	(0.09)	(0.36)
Open-2 (2020-08-31)	−2.18***	−2.43***	−2.28***	−2.26***	−2.28***
	(0.09)	(0.10)	(0.11)	(0.11)	(0.36)
Temp			−0.03***	−0.04***	−0.04***
			(0.01)	(0.01)	(0.01)
HDD				0.03	0.03***
				(0.02)	(0.01)
Industry-Zip FE	X	X	X	X	X
Month-of-Year FE		X	X	X	
IZ:Month-of-Year FE					X
Industry-Zips	68	68	68	68	68
Observations	9,820	9,820	9,820	9,820	9,820
R^2	0.09	0.10	0.10	0.10	1.00
Adjusted R^2	0.08	0.09	0.09	0.09	1.00

Notes: Significance is represented as *** for p<0.001, ** for p<0.01, and * for p<0.05; while, standard errors are in parentheses.

Return