

Covid restrictions, federal assistance and small businesses

What can we learn from electricity data?

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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?

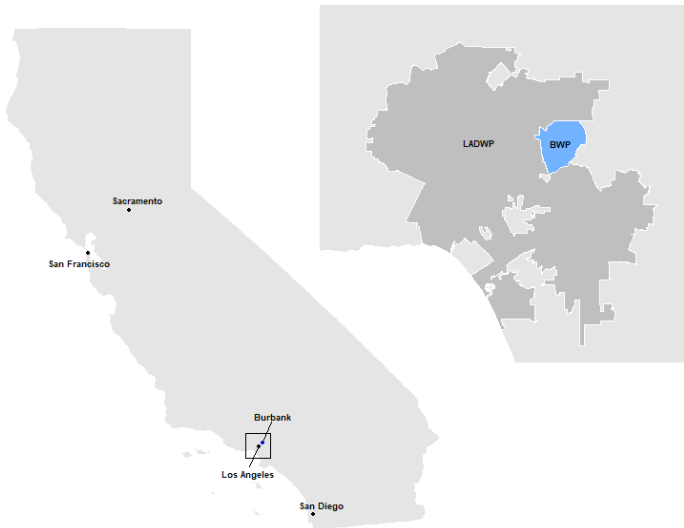
● Main assumptions

- 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**

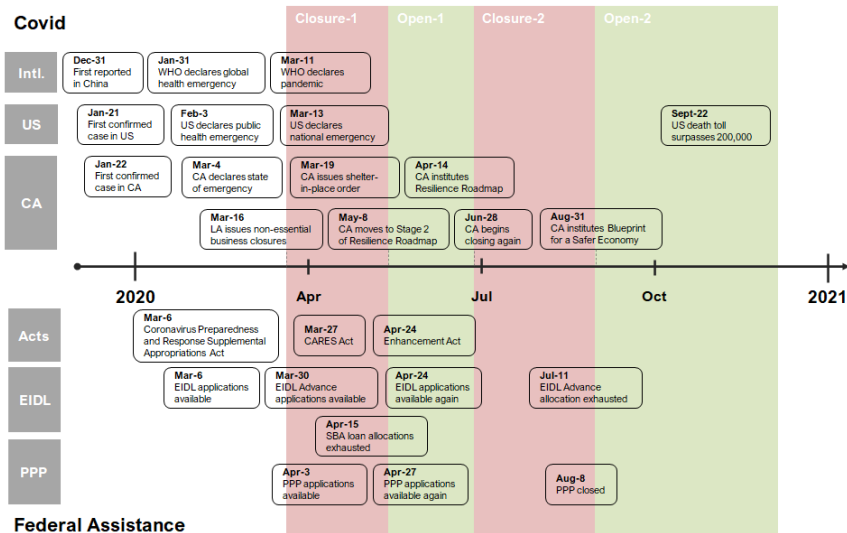
- Municipal utility in Southern California
- Accounts = 53,272
- Sales = 1,092 GWh

- **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



Covid



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

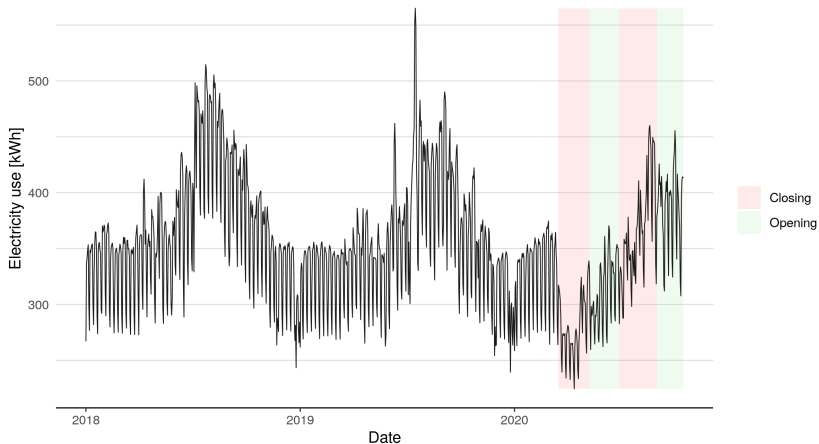
- **Data**

- Public dataset containing universe of federal loans



U.S. Small Business
Administration

Average electricity use



Empirical strategy

- **Event study**

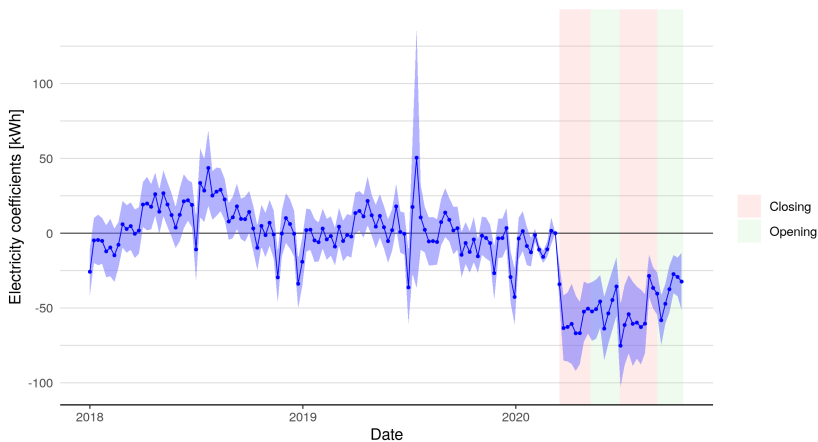
- All businesses in the panel receive treatment simultaneously
- Allow for heterogeneous effects across restriction periods
- Causal interpretation assuming no systematic changes over time except for treatment

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

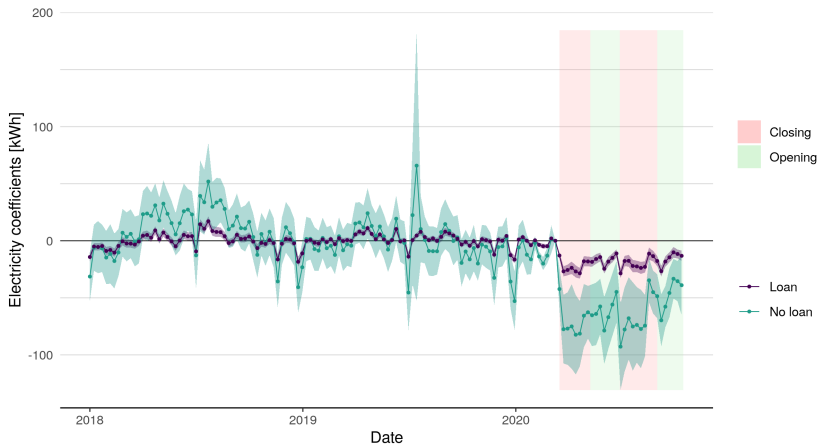
$$y_{it} = \sum_j \beta_j 1[r = j] + \mathbf{X}_{it}\boldsymbol{\gamma} + \alpha_{idm} + \varepsilon_{it} \quad (1)$$

- 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.
- \mathbf{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



Average electricity use residuals by loans



Survival analysis by loans

| | All Data | No Loan | Loan |
|---------------------------------|--------------------------------|--------------------------------|-------------------------------|
| | (1) | (2) | (3) |
| Close-1 (2020-03-16) 52 days | 0.00013*** (4.59) 0.68% | 0.00016*** (4.44) 0.83% | 0.00002 (1.18) 0.10% |
| Open-1 (2020-05-08) 50 days | 0.00032*** (7.80) 1.60% | 0.00032*** (6.74) 1.60% | 0.00031*** (3.94) 1.55% |
| Close-2 (2020-06-28) 63 days | 0.00055*** (12.05) 3.47% | 0.00055*** (10.35) 3.47% | 0.00055*** (6.16) 3.47% |
| Open-2 (2020-08-31) 45 days | 0.00052*** (11.85) 2.34% | 0.00052*** (10.24) 2.34% | 0.00051*** (5.98) 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.

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

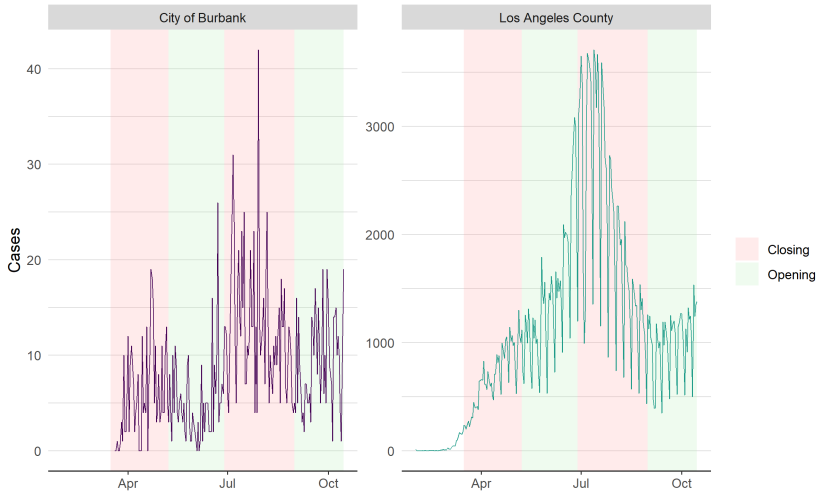
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Supplementary Material

References

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- 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.
- Schmidheiny, K. and Sieglöcher, S. (2019). On event study designs and distributed-lag models: Equivalence, generalization and practical implications. Working Paper 7481, Center for Economic Studies and the ifo Institute.

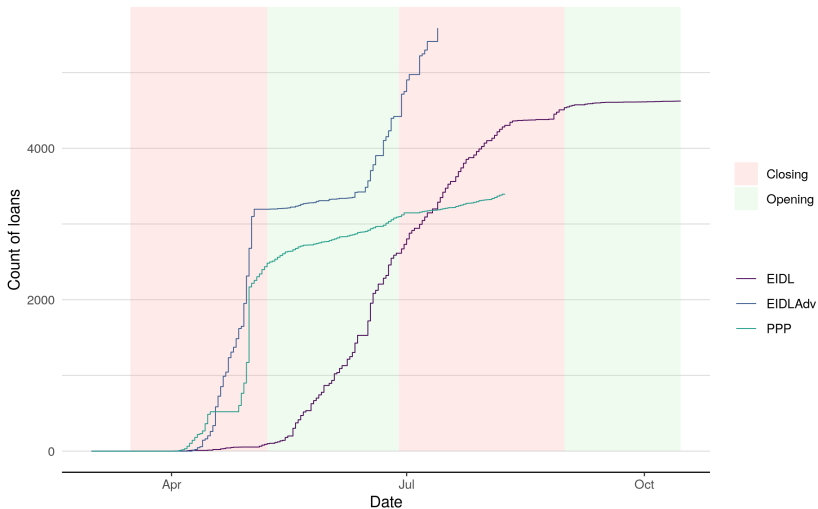
COVID cases



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. |

Loan count by date & program



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 |

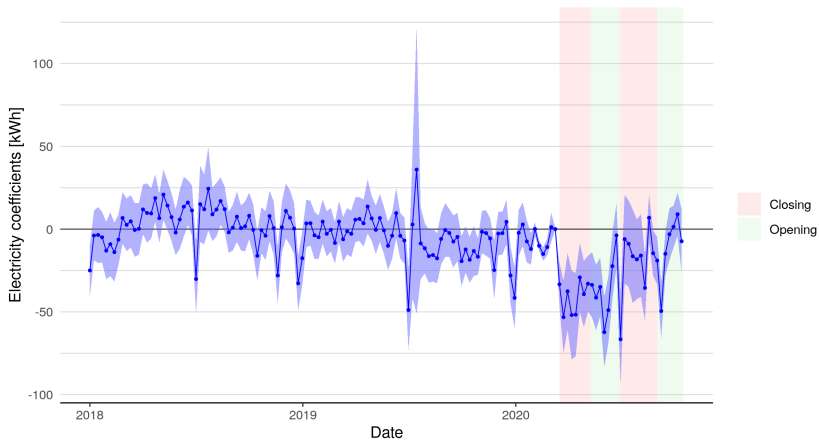
[Return](#)

Change in electricity use

| | (1) | (2) | (3) | (4) |
|----------------------|----------------------|----------------------|----------------------|----------------------|
| Close-1 (2020-03-16) | -64.70*** (-5.12) | -66.94*** (-5.11) | -71.40*** (-5.33) | -71.49*** (-5.33) |
| Open-1 (2020-05-08) | -51.14*** (-3.99) | -61.89*** (-4.48) | -61.87*** (-4.48) | -61.87*** (-4.48) |
| Close-2 (2020-06-28) | -63.50*** (-4.48) | -64.68*** (-4.39) | -64.00*** (-4.36) | -63.87*** (-4.36) |
| Open-2 (2020-08-31) | -26.04* (-2.27) | -43.26*** (-3.55) | -48.37*** (-3.88) | -48.50*** (-3.88) |
| Temperature | | 2.97*** (9.13) | 1.55*** (5.68) | 1.55*** (5.67) |
| HDD | | | 2.57*** (8.46) | 2.57*** (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.

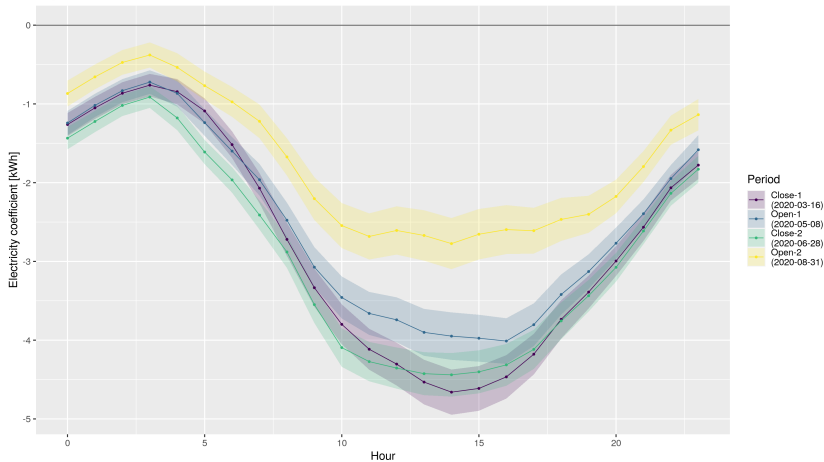
Change in electricity with Burbank cases



Change in electricity use by hour

Business hourly coefficients

Regressors: temperature, ID-month baseline euse, & business, day-of-week, & month-of-year FEs



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

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 | |

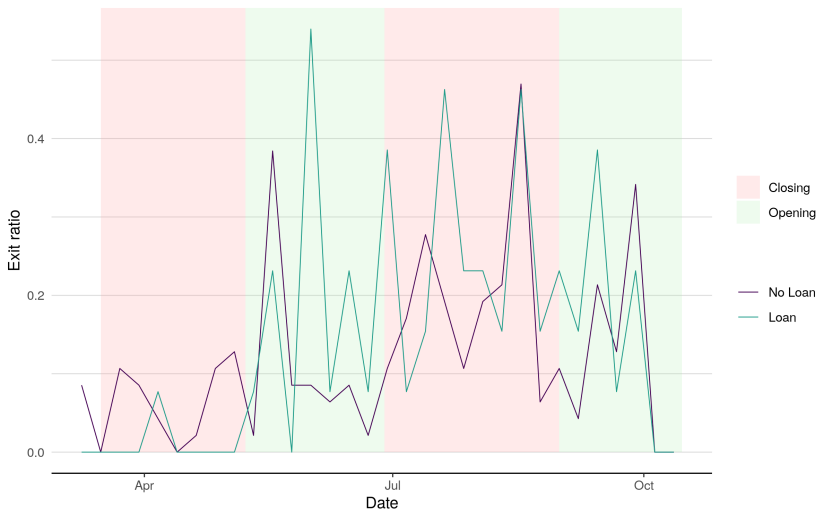
Notes: Standard deviations are in parentheses, with *t* statistics of the difference between 'no loan' and 'loan' businesses in brackets where *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Change in electricity use by loans

| | All Data | | No Loan | | Loan | |
|-------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Close-1 (2020-03-16) | -64.76*** (-5.13) | -70.05*** (-5.38) | -80.38*** (-4.61) | -86.54*** (-4.82) | -24.12*** (-9.69) | -27.05*** (-10.69) |
| Open-1 (2020-05-08) | -51.29*** (-4.01) | -60.78*** (-4.53) | -64.99*** (-3.68) | -76.47*** (-4.13) | -15.49*** (-6.63) | -19.59*** (-8.04) |
| Close-2 (2020-06-28) | -67.84*** (-4.58) | -65.79*** (-4.48) | -84.03*** (-4.13) | -81.60*** (-4.04) | -24.03*** (-9.10) | -23.03*** (-8.80) |
| Open-2 (2020-08-31) | -26.16* (-2.28) | -45.60*** (-3.75) | -32.26* (-2.04) | -55.48*** (-3.32) | -9.86*** (-4.25) | -19.02*** (-7.71) |
| Temperature | | 1.52*** (5.69) | | 1.91*** (5.24) | | 0.46*** (7.23) |
| HDD | | 2.51*** (8.49) | | 2.90*** (7.20) | | 1.45*** (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.

Exit count by date & program



Change in account numbers

| | (1) | (2) | (3) | (4) | (5) |
|-------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Close-1 (2020-03-16) | -0.62*** (0.09) | -0.47*** (0.10) | -0.45*** (0.10) | -0.47*** (0.10) | -0.46 (0.33) |
| Open-1 (2020-05-08) | -1.00*** (0.09) | -1.05** (0.11) | -0.96*** (0.11) | -1.00*** (0.11) | -1.00** (0.37) |
| Close-2 (2020-06-28) | -1.54*** (0.08) | -1.83*** (0.09) | -1.82*** (0.09) | -1.83*** (0.09) | -1.83*** (0.36) |
| Open-2 (2020-08-31) | -2.18*** (0.09) | -2.43*** (0.10) | -2.28*** (0.11) | -2.26*** (0.11) | -2.28*** (0.36) |
| Temp | | | -0.03*** (0.01) | -0.04*** (0.01) | -0.04*** (0.01) |
| HDD | | | | 0.03 (0.02) | 0.03*** (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.