

Supplementary material for
The Impact of COVID-19 on Small Business Employment and Hours:
Real-Time Estimates With Homebase Data*

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A Decompositions

Decomposition by establishment inactivity. We want to compute the part of total employment decline due to establishments becoming inactive. Reconsider our estimate of weekly employment in equation (1)

$$\hat{E}_t = \hat{E}_0 \times \frac{\sum_i \omega_i e_{it}}{\sum_i \omega_i e_{i0}}$$

and express it as

$$\hat{E}_t - \hat{E}_0 = \hat{E}_0 \times \frac{\sum_i \omega_i (e_{it} - e_{i0})}{\sum_i \omega_i e_{i0}}$$

Let \mathcal{C}_i denote the set of establishments in allocation cell i that continued to be active in all weeks between 0 and t ; let \mathcal{I}_i denote the set of establishments that were active in week 0 but are inactive in week t ; and

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let \mathcal{R}_i denote the set of establishments that are active in week t but had an inactivity spell in any week between 0 and $t-1$. Then $e_{it} = e_{it}^{\mathcal{C}_i} + e_{it}^{\mathcal{R}_i}$ by definition of inactive establishments having zero employment in t , and $e_{i0} = e_{i0}^{\mathcal{C}_i} + e_{i0}^{\mathcal{I}_i} + e_{i0}^{\mathcal{R}_i}$ since we only consider establishments that were active in the reference week 0 (there may be some establishments that were inactive in the reference week but return to activity in $t > 0$; we will include them in our calculations in future updates of this draft). Hence, we can decompose the above change in employment as

$$\widehat{E}_t - \widehat{E}_0 = \underbrace{\widehat{E}_0 \times \frac{\sum_i \omega_i (e_{it}^{\mathcal{C}_i} - e_{i0}^{\mathcal{C}_i})}{\sum_i \omega_i e_{i0}}}_{\text{Change from continuing estabs}} + \underbrace{\widehat{E}_0 \times \frac{\sum_i \omega_i (e_{it}^{\mathcal{R}_i} - e_{i0}^{\mathcal{R}_i})}{\sum_i \omega_i e_{i0}}}_{\text{Change from returning estabs}} + \underbrace{\widehat{E}_0 \times \frac{\sum_i \omega_i (-e_{i0}^{\mathcal{I}_i})}{\sum_i \omega_i e_{i0}}}_{\text{Change from closed estabs}}$$

Decomposition into hiring and separation flows. For any given establishment j , we can decompose employment growth into hiring and separations

$$e_{jt} - e_{jt-1} = h_{jt} - s_{jt}$$

where h_{jt} are all the employees in establishment j who work positive hours in week t but not in $t-1$, and s_{jt} are all the employees in establishment j who work positive hours in week $t-1$ but not in t (for firms with several establishments in the same city, we define hiring and separations at the firm level; i.e. if an employee works at one establishment in one week but another establishment of the same firm in another week, we do not count it as a separation / hire). Hence,

$$\widehat{E}_t - \widehat{E}_{t-1} = \underbrace{\widehat{E}_{t-1} \times \frac{\sum_i \omega_i \sum_{j \in i} h_{jt}}{\sum_i \omega_i e_{it-1}}}_{\text{Change from hiring}} - \underbrace{\widehat{E}_{t-1} \times \frac{\sum_i \omega_i \sum_{j \in i} s_{jt}}{\sum_i \omega_i e_{it-1}}}_{\text{Change from job separation}}$$

where

$$hrate_t = \frac{\sum_i \omega_i \sum_{j \in i} h_{jt}}{\sum_i \omega_i e_{it-1}} \quad \text{and} \quad srate_t = \frac{\sum_i \omega_i \sum_{j \in i} s_{jt}}{\sum_i \omega_i e_{it-1}}$$

denote, respectively, the hiring rate and separation rate in week t . Furthermore we can define the turnover rate as

$$turnover_{it} = (hrate_t + srate_t) - \frac{\sum_i \omega_i (e_{it} - e_{it-1})}{\sum_i \omega_i e_{it-1}}.$$

In the main text, we also report the recall rate of continuing and returning establishments. The recall rate in week t is defined as the ratio of the flow of recalled employees to the total number of employees who work positive hours in week t but not in $t-1$.

B Details on Homebase Data

Table 1a: Establishment Counts and Employment per Establishment in the QCEW and HB Data

NAICS 44-45 - Retail Trade								
	HB data				QCEW data			
	Estab.		Workers		Estab.		Workers	
	#	%	#	%	#	%	#	%
1-4	2,267	48.4	5,736	19.4	462,875	44.4	866,231	5.6
5-9	1,316	28.1	8,637	29.3	249,898	24.0	1,687,408	10.9
10-19	588	12.5	7,696	26.1	181,050	17.4	2,413,554	15.6
20-49	168	3.6	4,644	15.7	88,051	8.4	2,606,900	16.8
50-99	11	0.2	625	2.1	31,617	3.0	2,196,294	14.2
100+	1	0.0	126	0.4	29,554	2.8	5,709,010	36.9
Total	4,686	100.0	29,507	100.0	1,043,045	100.0	15,479,397	100.0
NAICS 61 - Educational Services								
	HB data				QCEW data			
	Estab.		Workers		Estab.		Workers	
	#	%	#	%	#	%	#	%
1-4	112	28.4	280	6.0	72,018	55.5	96,949	3.2
5-9	109	27.7	743	16.0	18,549	14.3	124,170	4.1
10-19	86	21.8	1,158	25.0	15,881	12.2	215,626	7.1
20-49	51	12.9	1,607	34.7	13,532	10.4	417,418	13.7
50-99	7	1.8	452	9.8	5,396	4.2	371,726	12.2
100+	1	0.3	111	2.4	4,387	3.4	1,828,348	59.9
Total	394	100.0	4,637	100.0	129,763	100.0	3,054,237	100.0
NAICS 62 - Health Care and Social Assistance								
	HB data				QCEW data			
	Estab.		Workers		Estab.		Workers	
	#	%	#	%	#	%	#	%
1-4	906	44.3	2,248	15.8	1,198,558	71.6	1,449,512	7.1
5-9	569	27.8	3,799	26.6	183,912	11.0	1,232,018	6.0
10-19	318	15.5	4,279	30.0	134,354	8.0	1,812,949	8.8
20-49	90	4.4	2,529	17.7	91,842	5.5	2,765,098	13.5
50-99	5	0.2	317	2.2	34,037	2.0	2,362,997	11.5
100+	0	0.0	0	0.0	30,115	1.8	10,867,115	53.0
Total	2,046	100.0	14,258	100.0	1,672,818	100.0	20,489,689	100.0

Notes: HB and QCEW data for February 2020. The columns titled “#” report the number of establishments by class size, and employment by establishment class size. The columns titled “%” show the distribution of establishments by class size and distribution of employment by establishment class size, expressed in percent.

Table 1b: Establishment Counts and Employment per Establishment in the QCEW and HB Data

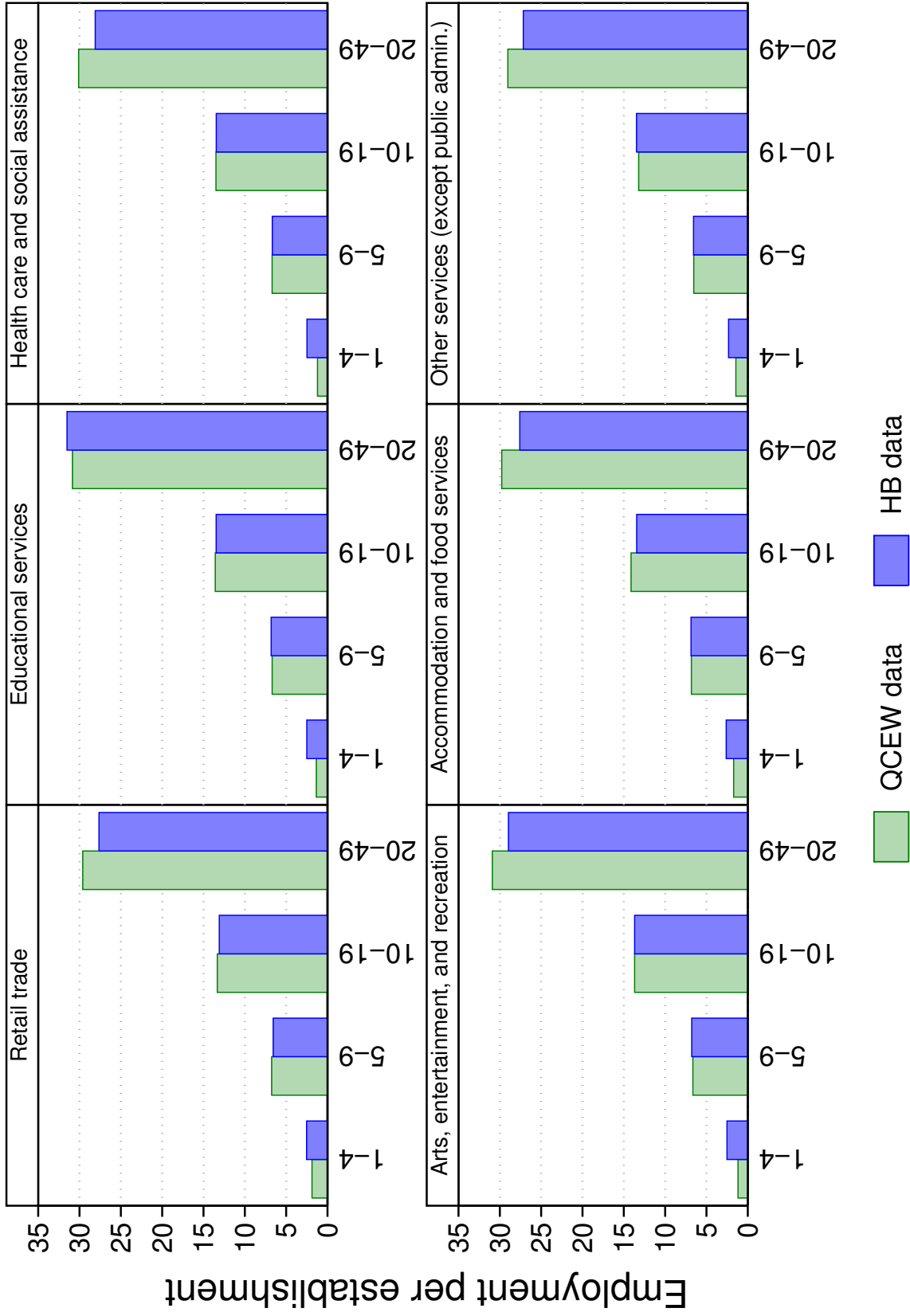
NAICS 71 - Arts, Entertainment, and Recreation								
	HB data				QCEW data			
	Estab.		Workers		Estab.		Workers	
	#	%	#	%	#	%	#	%
1-4	405	31.3	1,020	8.2	94,463	60.5	111,861	4.8
5-9	358	27.7	2,428	19.5	20,959	13.4	139,180	6.0
10-19	290	22.4	3,970	31.8	17,688	11.3	242,195	10.4
20-49	120	9.3	3,475	27.8	13,997	9.0	432,568	18.6
50-99	11	0.9	657	5.3	5,428	3.5	369,782	15.9
100+	1	0.1	103	0.8	3,610	2.3	1,034,713	44.4
Total	1,293	100.0	12,482	100.0	156,145	100.0	2,330,299	100.0

NAICS 72 - Accommodation and Food Services								
	HB data				QCEW data			
	Estab.		Workers		Estab.		Workers	
	#	%	#	%	#	%	#	%
1-4	3,878	23.4	10,138	6.2	213,943	29.2	366,976	2.6
5-9	5,270	31.7	36,178	22.1	127,287	17.4	868,922	6.2
10-19	4,528	27.3	60,856	37.3	163,584	22.3	2,309,873	16.4
20-49	1,482	8.9	40,884	25.0	173,978	23.7	5,179,205	36.7
50-99	64	0.4	3,878	2.4	42,383	5.8	2,785,566	19.7
100+	0	0.0	0	0.0	12,452	1.7	2,604,127	18.4
Total	16,600	100.0	163,354	100.0	733,627	100.0	14,114,669	100.0

NAICS 81 - Other Services (except Public Administration)								
	HB data				QCEW data			
	Estab.		Workers		Estab.		Workers	
	#	%	#	%	#	%	#	%
1-4	1,182	51.6	2,748	19.5	633,965	73.4	915,098	20.1
5-9	569	24.8	3,736	26.6	127,156	14.7	831,430	18.2
10-19	273	11.9	3,675	26.1	63,905	7.4	843,776	18.5
20-49	88	3.8	2,390	17.0	28,579	3.3	829,708	18.2
50-99	5	0.2	332	2.4	6,152	0.7	419,496	9.2
100+	0	0.0	0	0.0	3,577	0.4	718,597	15.8
Total	2,290	100.0	14,062	100.0	863,334	100.0	4,558,105	100.0

Notes: HB and QCEW data for February 2020. The columns titled “#” report the number of establishments by class size, and employment by establishment class size. The columns titled “%” show the distribution of establishments by class size and distribution of employment by establishment class size, expressed in percent.

Figure 1: Average Employment by Establishment by Establishment Size



Notes: Average employment by establishment size class for NAICS-2 sectors in HB data and in QCEW data for February 2020.

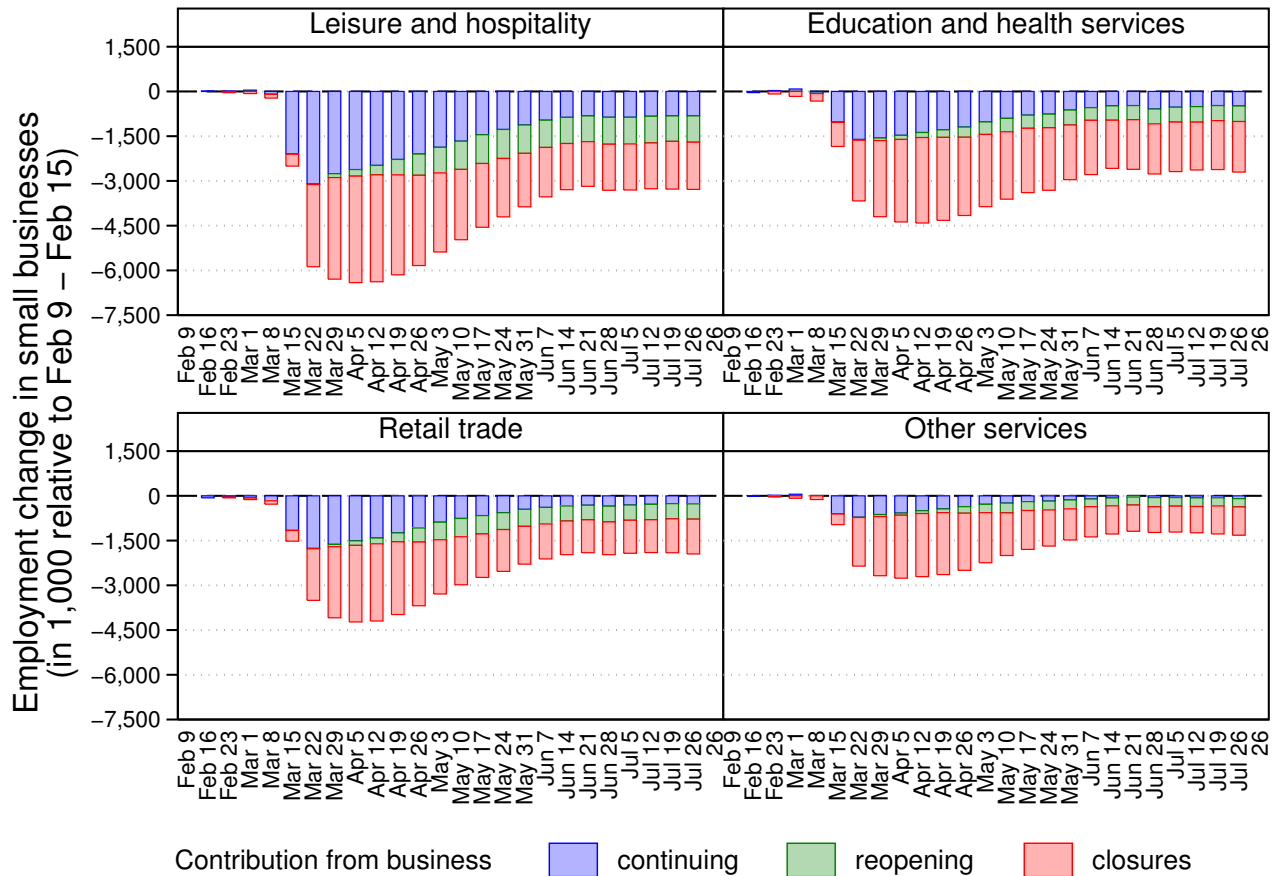
Table 2: Comparison between HB Industry Codes and NAICS-2 Obtained through Safegraph

	NAICS													Total	
	11-23	31-33	42	44-45	48	51	52-53	54-56	61	62	71	72	81		92
Beauty & personal care	0	1	1	42	0	0	2	1	2	16	2	5	218	0	290
Charities, education & membership	0	2	2	75	4	9	8	5	139	238	106	25	124	9	746
Food & drink	5	919	12	1,219	27	47	116	18	46	91	236	13,809	138	14	16,697
Health care and fitness	0	1	12	298	6	3	28	101	9	959	225	44	306	3	1,995
Home and repair	9	1	3	138	6	1	12	22	0	13	7	12	183	1	408
Leisure and Entertainment	0	9	36	119	2	24	6	2	17	10	183	125	45	1	579
Professional Services	1	14	5	162	9	7	117	91	18	94	16	57	142	2	735
Retail	3	81	118	3,549	22	43	97	28	33	88	81	594	325	5	5,067
Transportation	0	0	3	46	25	1	9	3	0	4	3	8	49	1	152
Other	5	69	56	710	21	25	97	94	77	230	206	520	469	12	2,591
Unknown	6	236	53	768	21	35	71	51	53	303	228	1,401	291	6	3,523
Total	29	1,333	301	7,126	143	195	563	416	394	2,046	1,293	16,600	2,290	54	32,783

Notes: HB data for February 2020. Table compares HB industry codes (in the first column of each row) to NAICS codes (in each column) obtained using Safegraph data (see Appendix D). Each cell is the count of establishments (including establishments with 50+ employees) that are active during the reference week (Feb 9 – Feb 15).

C Additional Tables and Figures

Figure 2: Contribution of Small Business Closures and Reopenings to Cumulative Employment Loss



Notes: Contribution to total employment change in the four selected service sectors by businesses that operated continuously from mid-February until at least week t (blue bars), employment changes by businesses that closed at some point between mid-February and week $t - 1$ but have reopened by week t (green bar), and employment changes from businesses that operated in mid-February but are closed in week t (red bars).

Table 3: February-to-April Employment Change in HB data and in CES

	HB data				HB data with QCEW-weights, relative to CES Feb. employment					CES
	1-4 (1)	5-9 (2)	10-19 (3)	20-49 (4)	1-4 (5)	5-9 (6)	10-19 (7)	20-49 (8)	Tot. (9)	
44-45	-50.9	-55.2	-56.6	-50.0	-3.7	-5.8	-8.7	-7.9	-26.1	-13.3
441	-39.1	-48.8	-55.2	-37.7	-2.0	-4.0	-8.4	-6.4	-20.8	-16.5
442	-48.3	-53.3	-54.3	-32.3	-6.1	-7.1	-10.8	-8.9	-32.9	-47.2
443	-43.1	-36.6	-51.6	-59.1	-4.7	-4.8	-9.0	-6.5	-25.0	-6.6
444	-30.2	-38.4	-37.5	-22.4	-1.7	-3.1	-5.3	-3.0	-13.0	4.6
445	-43.8	-51.3	-50.7	-40.5	-2.7	-2.9	-3.5	-4.2	-13.4	-1.5
446	-62.7	-54.9	-59.5	-34.0	-7.2	-8.4	-20.2	-8.4	-44.2	-9.7
447	-32.5	-41.2	-42.6	-44.2	-3.7	-10.4	-13.4	-9.5	-37.0	-4.3
448	-78.9	-75.0	-72.5	-71.7	-7.3	-13.0	-18.2	-18.9	-57.4	-59.4
451	-62.6	-74.6	-70.8	-73.0	-6.4	-11.3	-10.5	-23.5	-51.7	-36.8
452	-49.4	-62.8	-61.0	-81.1	-0.4	-3.4	-3.5	-4.6	-11.8	-1.8
453	-59.0	-61.6	-66.5	-62.7	-12.2	-11.7	-16.4	-15.8	-56.0	-32.6
61-62	-60.0	-52.1	-49.3	-56.7	-7.8	-2.8	-3.9	-6.9	-21.4	-10.5
611	-62.2	-65.9	-66.2	-75.2	-2.9	-2.0	-3.6	-7.5	-16.0	-12.2
621	-44.9	-49.2	-43.1	-41.0	-4.5	-5.5	-6.2	-7.2	-23.5	-15.5
622	-71.1	-51.8	–	–	-0.1	-0.06	–	–	-0.2	-2.5
623	-42.9	-32.8	-23.0	-57.1	-0.6	-1.1	-1.3	-6.8	-9.7	-3.3
624	-65.6	-65.7	-67.9	-73.1	-33.6	-3.4	-6.8	-13.9	-57.7	-15.4
71-72	-66.0	-63.0	-61.2	-68.9	-3.3	-3.9	-8.9	-21.9	-38.1	-46.8
711	-92.3	-57.5	–	-58.3	-25.3	-3.2	–	-8.7	-37.2	-40.0
712	-58.6	-62.6	-65.0	-70.0	-2.9	-3.4	-5.4	-9.2	-20.9	-20.5
713	-68.3	-77.1	-80.0	-84.5	-4.6	-4.7	-9.0	-16.8	-35.1	-57.7
721	-57.9	-56.7	-56.2	-65.5	-2.0	-2.0	-5.5	-13.8	-23.3	-42.2
722	-59.9	-62.0	-59.9	-68.2	-2.5	-4.1	-9.9	-24.7	-41.2	-46.7
81	-48.5	-58.7	-60.9	-53.8	-7.7	-8.0	-8.7	-7.1	-31.5	-21.4
811	-28.9	-42.0	-49.8	-57.4	-7.4	-9.3	-10.7	-10.7	-38.2	-15.9
812	-69.0	-69.4	-65.5	-55.8	-15.6	-14.3	-14.2	-10.4	-54.5	-52.7
813	-48.4	-68.1	-68.9	-47.3	-3.8	-4.3	-5.1	-3.7	-16.9	-8.0

Notes: Columns (1)–(4) report percent-changes in employment in each size class in HB data for small establishments from February (week of 9 to 15) to April (week of 12 to 18). Columns (5) to (8) report changes in employment in each size class in HB weighted by QCEW data, expressed as a % of CES February employment within each NAICS. Column (9) is the sum of columns (5) to (8), showing the February-to-April percent-change in employment implied by HB data for small establishments. Column (10) reports not-seasonally adjusted percent-changes in employment from February to April according to CES.

D Name Matching Procedure

1. Step 1: Pretreating the data

- (a) Clean company and location names in HB, and location names in Safegraph and Google by:
 - (1) removing company titles, such as “inc”, “incorporated”, “corp”, “corporation”, “llc”, (2) removing “and” and “the”, and (3) removing spaces and keeping only numeric and alphabetic characters.
- (b) Clean addresses in HB, Safegraph and Google using Stata’s `stnd.address` procedure. Then standardize addresses and city names by removing spaces and keeping only numeric and alphabetic characters.

2. Step 2: Merging

- (a) Merge is performed using 3 possible names for the establishment: HB location name, HB company name, and Google name retrieved using the Google place identifier.
- (b) Try merge using each of the name (sequentially in this order: HB location name, HB company name, and Google name) combined with the following information:
 - (At each level of the merge, we only keep the unique merges: i.e., a HB establishment gets linked to a unique Safegraph POI. We discard merges when a HB establishment merges to more than one Safegraph POI.)
 - i. Address and zip code;
 - ii. Address and city;
 - iii. Address and State;
 - iv. Address only.
- (c) Try merge without names, using only geographical information as described in the previous step.
- (d) Try merge using each of the name and broader geographical information:
 - i. Zip code;
 - ii. City;
 - iii. State.