Internet Appendix for "Flattening the Illiquidity Curve: Retail Trading during the COVID-19 Lockdown"

Table IA.1: State Stay-at-home Order Implementation Date

This table provides information on the implementation date of stay-at-home order issued by each U.S. state, district, region, and number of sample firms in each state.

No	State	# of Firms	Order Effective Date	No	State	# of Firms	Order Effective Date
1	Alabama (AL)	10	4/4/2020	27	Montana (MT)	2	3/28/2020
2	Alaska (AK)	1	3/28/2020	28	Nebraska (NE)	10	N/A
3	Arizona (AZ)	36	3/31/2020	29	Nevada (NV)	23	4/1/2020
4	Arkansas (AR)	12	N/A	30	New Hampshire (NH)	7	3/27/2020
5	California (CA)	369	3/19/2020	31	New Jersey (NJ)	72	3/21/2020
6	Colorado (CO)	50	3/26/2020	32	New Mexico (NM)	1	3/23/2020
7	Connecticut (CT)	44	3/23/2020	33	New York (NY)	176	3/22/2020
8	Delaware (DE)	10	3/24/2020	34	North Carolina (NC)	51	3/30/2020
9	District of Columbia (DC)	7	4/1/2020	35	North Dakota (ND)	3	N/A
10	Florida (FL)	84	4/1/2020	36	Ohio (OH)	78	3/23/2020
11	Georgia (GA)	65	4/3/2020	37	Oklahoma (OK)	15	N/A
12	Hawaii (HI)	9	3/25/2020	38	Oregon (OR)	12	3/23/2020
13	Idaho (ID)	6	3/25/2020	39	Pennsylvania (PA)	102	4/1/2020
14	Illinois (IL)	104	3/21/2020	40	Puerto Rico (PR)	5	3/15/2020
15	Indiana (IN)	37	3/24/2020	41	Rhode Island (RI)	8	3/28/2020
16	Iowa (IA)	16	N/A	42	South Carolina (SC)	13	4/7/2020
17	Kansas (KS)	12	3/30/2020	43	South Dakota (SD)	6	N/A
18	Kentucky (KY)	12	3/26/2020	44	Tennessee (TN)	39	3/31/2020
19	Louisiana (LA)	13	3/23/2020	45	Texas (TX)	206	4/2/2020
20	Maine (ME)	6	4/2/2020	46	Utah (UT)	21	N/A
21	Maryland (MD)	36	3/30/2020	47	Vermont (VT)	2	3/25/2020
22	Massachusetts (MA)	143	3/24/2020	48	Virginia (VA)	70	3/30/2020
23	Michigan (MI)	41	3/24/2020	49	Washington (WA)	45	3/23/2020
24	Minnesota (MN)	44	3/27/2020	50	West Virginia (WV)	7	3/24/2020
25	Mississippi (MS)	7	4/3/2020	51	Wisconsin (WI)	42	3/25/2020
26	Missouri (MO)	30	4/6/2020	52	Wyoming (WY)	0	N/A

Table IA.2: Impact of Institutional Holdings

This table reports results of the OLS regression in Table 4 *with different levels of institutional holdings*. Each day, firms are divided into two groups based on their institutional ownership ratio (*IO*) as of December 31, 2019. The dependent variable is the average percent effective spread (ESPREAD) based on Lee and Ready (1991) trade classification. Results based on the normal and lockdown periods, and lockdown and reopen periods are reported in Panel A and B, respectively. LOCKDOWN is a dummy variable equal to one between March 16th and May 7th. REOPEN is a dummy variable equal to one since May 8th. Lockdown and reopening dates are identified based on the US driving mobility index published by Apple (https://www.apple.com/COVID19/mobility). COVERAGE is a dummy variable equal to one if the ratio of a firm's daily COVID-19-related articles to its total daily media coverage is greater than zero, and zero otherwise. RETAIL is the daily log number of Robinhood trading accounts for each firm. All regression models include past week returns (PRET) and firm fixed effects. The *t*-statistics reported in square brackets are based on standard errors clustered at firm and day levels. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | Sorted by Institutional Ownership (IO) | | | | | |
| *Dep. Var* = ESPREAD *(%)* | Panel A: Normal v.s. Lockdown | | | Panel B: Lockdown v.s. Reopen | | |
	(1) Low	(2) High	Diff (H-L)	(1) Low	(2) High	Diff (H-L)
COVERAGE	0.224***	0.093***		-0.075**	-0.033**	
	[9.78]	[7.82]		[-2.57]	[-2.40]	
RETAIL	-0.027*	0.011		-0.183***	-0.082***	
	[-1.68]	[1.61]		[-8.54]	[-6.33]	
COVERAGE × RETAIL	-0.028***	-0.010***		0.011***	0.004**	
	[-8.92]	[-6.24]		[2.77]	[2.57]	
LOCKDOWN	0.523***	0.285***				
	[9.00]	[8.29]				
RETAIL × LOCKDOWN	**-0.059***	**-0.028***	**0.032***			
	[-7.91]	**[-7.02]**	**[5.54]**			
COVERAGE × LOCKDOWN	-0.352***	-0.152***				
	[-8.68]	[-6.77]				
COVERAGE × RETAIL × LOCKDOWN	**0.047***	**0.017***	**-0.030***			
	[8.07]	**[5.74]**	**[-5.57]**			
REOPEN				-0.287***	-0.184***	
				[-5.67]	[-6.48]	
RETAIL × REOPEN				**0.035***	**0.019***	**-0.017***
				[5.37]	**[5.66]**	**[-3.18]**
COVERAGE × REOPEN				0.131***	0.047**	
				[3.25]	[2.37]	
COVERAGE × RETAIL × REOPEN				**-0.018***	**-0.006**	**0.012***
				[-3.32]	**[-2.16]**	**[2.62]**
PRET	-0.233***	-0.140***		-0.076**	-0.073***	
	[-4.00]	[-4.13]		[-2.08]	[-2.69]	
Firm FE	Yes	Yes		Yes	Yes	
N	85,813	85,934		69,953	70,046	
Adj. R^2	0.828	0.773		0.862	0.813	

Table IA.3: Liquidity Timing of Insider Trading

This table reports conditional logit regression results of insider sales and buys on the number of retail trading accounts and COVID-19-related media coverage using weekly observations for the sample from January 21, 2020 through June 11, 2020. The dependent variable is SALE (or BUY), a dummy variable equal to one if there is an open market *sale* (or *purchase*) by any insider at the weekly frequency and zero otherwise. Results based on the normal and lockdown periods, and lockdown and reopen periods are reported in Panel A and B, respectively. LOCKDOWN is a dummy variable equal to one between March 16th and May 7th. REOPEN is a dummy variable equal to one since May 8th. Lockdown and reopening dates are identified based on the US driving mobility index published by Apple (https://www.apple.com/COVID19/mobility). COVERAGE is a dummy variable equal to one if the weekly average ratio of a firm's daily COVID-19-related articles to its total daily media coverage is greater than zero, and zero otherwise. RETAIL is the daily log number of Robinhood trading accounts for each firm. All regression models include past week returns (PRET) and firm fixed effects. The t-statistics reported in square brackets are based on standard errors clustered at firm level. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dep. Var	Panel A: Normal v.s. Lockdown			Panel B: Lockdown v.s. Reopen		
	SALE	BUY	Diff	SALE	BUY	Diff
	(1)	(2)	p-val	(1)	(2)	p-val
RETAIL	-0.652***	-0.317***		-0.345*	-1.069***	
	[-4.55]	[-2.60]		[-1.85]	[-4.11]	
COVERAGE	-0.800**	-0.387		-0.175	-0.554	
	[-2.53]	[-1.12]		[-0.46]	[-1.44]	
COVERAGE × RETAIL	0.142***	0.191***		0.017	0.141**	
	[3.21]	[3.44]		[0.30]	[2.19]	
LOCKDOWN	-1.817***	-1.027***				
	[-5.38]	[-3.68]				
RETAIL × LOCKDOWN	**0.151*****	**0.021**				
	[2.79]	**[0.38]**	**(0.08)**			
COVERAGE × LOCKDOWN	0.655	-0.415				
	[1.47]	[-0.91]				
COVERAGE × RETAIL × LOCKDOWN	**-0.127****	**-0.004**				
	[-1.96]	**[-0.05]**	**(0.20)**			
REOPEN				1.902***	1.617***	
				[4.92]	[3.56]	
RETAIL × REOPEN				**-0.099**	**-0.200****	
				[-1.59]	**[-2.45]**	**(0.32)**
COVERAGE × REOPEN				0.394	-0.101	
				[0.84]	[-0.17]	
COVERAGE × RETAIL × REOPEN				**-0.028**	**0.042**	
				[-0.40]	**[0.43]**	**(0.55)**
PRET	0.221	-4.690***		0.253	-1.227***	
	[0.88]	[-15.05]		[1.02]	[-4.56]	
Firm FE	Yes	Yes		Yes	Yes	
N	15,650	13,551		11,040	7,553	

Table IA.4: Alternative Measures of Illiquidity and Volatility

This table reports results of regressions in Table 4 using alternative illiquidity and volatility measures. The dependent variables are the simple averaged percent *price impact* (PIMPACT) and *realized spread* (RSPREAD) based on Lee and Ready (1991) trade classification, and trade-based intraday VOLATILITY, respectively. Results based on the normal and lockdown periods, and lockdown and reopen periods are reported in Panel A and B, respectively. LOCKDOWN is a dummy variable equal to one between March 16th and May 7th. REOPEN is a dummy variable equal to one since May 8th. Lockdown and reopening dates are identified based on the US driving mobility index published by Apple (https://www.apple.com/COVID19/mobility). COVERAGE is a dummy variable equal to one if the ratio of a firm's daily COVID-19-related articles to its total daily media coverage is greater than zero, and zero otherwise. RETAIL is the daily log number of Robinhood trading accounts for each firm. All regression models include past-week returns (PRET) and firm fixed effects. The *t*-statistics reported in square brackets are based on standard errors clustered at firm and day levels. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Panel A: Normal v.s. Lockdown			Panel B: Lockdown v.s. Reopen		
	(1)	(2)	(3)	(1)	(2)	(3)
Dep. Var (%)	PIMPACT	RSPREAD	VOLATILITY	PIMPACT	RSPREAD	VOLATILITY
RETAIL	-0.004	0.005	0.000	-0.104***	-0.018*	-0.001***
	[-0.42]	[1.09]	[0.84]	[-8.28]	[-1.86]	[-7.82]
COVERAGE	0.119***	0.037***	0.002***	-0.014	-0.036**	-0.001***
	[10.11]	[3.40]	[8.85]	[-1.42]	[-2.58]	[-3.40]
COVERAGE × RETAIL	-0.012***	-0.006***	-0.000***	0.002*	0.005**	0.000***
	[-8.43]	[-3.88]	[-8.46]	[1.98]	[2.44]	[3.68]
LOCKDOWN	0.267***	0.139***	0.004***			
	[10.06]	[6.53]	[8.35]			
RETAIL × LOCKDOWN	**-0.026***	-0.017***	-0.000***			
	[-10.25]	[-5.46]	[-7.93]**			
COVERAGE × LOCKDOWN	-0.167***	-0.089***	-0.003***			
	[-10.92]	[-4.13]	[-8.77]			
COVERAGE×RETAIL×LOCKDOWN	**0.019***	0.013***	0.000***			
	[10.38]	[4.16]	[8.56]**			
REOPEN				-0.115***	-0.117***	-0.002***
				[-5.53]	[-4.99]	[-6.74]
RETAIL × REOPEN				**0.011***	0.015***	0.000***
				[5.32]	[4.50]	[6.68]**
COVERAGE×REOPEN				0.030**	0.055**	0.001***
				[2.30]	[2.43]	[4.81]
COVERAGE×RETAIL×REOPEN				**-0.003*	-0.008**	-0.000***
				[-1.75]	[-2.62]	[-5.15]**
PRET	-0.236***	0.050**	-0.001***	-0.132***	0.053**	-0.000**
	[-4.28]	[2.12]	[-3.92]	[-2.93]	[2.16]	[-2.26]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	171,603	171,623	171,788	139,868	139,890	140,035
Adj. R^2	0.550	0.685	0.668	0.602	0.697	0.736

Table IA.5: Noise or Informed Retail Trading

This table reports results using dependent variables as the percentage ratio of *price impact* to effective spread (PI_RATIO) and the percentage ratio of *realized spread* (RS_RATIO) to effective spread based on Lee and Ready (1991) trade classification, respectively. Results based on the normal and lockdown periods, and lockdown and reopen periods are reported in Panel A and B, respectively. LOCKDOWN is a dummy variable equal to one between March 16th and May 7th. REOPEN is a dummy variable equal to one since May 8th. Lockdown and reopening dates are identified based on the US driving mobility index published by Apple (https://www.apple.com/COVID19/mobility). COVERAGE is a dummy variable equal to one if the ratio of a firm's daily COVID-19-related articles to its total daily media coverage is greater than zero, and zero otherwise. RETAIL is the daily log number of Robinhood trading accounts for each firm. All regression models include past-week returns (PRET) and firm fixed effects. The *t*-statistics reported in square brackets are based on standard errors clustered at firm and day levels. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Panel A: Normal v.s. Lockdown		Panel B: Lockdown v.s. Reopen	
Dep. Var (%)	(1) PI_RATIO	(2) RS_RATIO	(1) PI_RATIO	(2) RS_RATIO
COVERAGE	16.741***	-16.754***	1.478	-1.417
	[4.80]	[-4.92]	[0.89]	[-0.85]
RETAIL	-2.159	2.142	-12.625***	12.631***
	[-0.94]	[0.93]	[-4.39]	[4.41]
COVERAGE × RETAIL	-1.346***	1.351***	0.125	-0.136
	[-2.90]	[2.96]	[0.55]	[-0.59]
LOCKDOWN	14.011***	-14.359***		
	[7.75]	[-7.95]		
RETAIL × LOCKDOWN	**-1.616***	**1.665***		
	[-4.05]	**[4.16]**		
COVERAGE × LOCKDOWN	-19.413***	19.539***		
	[-5.07]	[5.21]		
COVERAGE × RETAIL × LOCKDOWN	**2.121***	**-2.145***		
	[4.22]	**[-4.33]**		
REOPEN			3.869*	-3.479
			[1.79]	[-1.60]
RETAIL × REOPEN			**-0.293**	**0.236**
			[-0.83]	**[0.67]**
COVERAGE × REOPEN			0.845	-1.163
			[0.35]	[-0.48]
COVERAGE × RETAIL × REOPEN			**-0.039**	**0.082**
			[-0.12]	**[0.25]**
PRET	-52.123***	52.203***	-33.170***	-33.258***
	[-4.10]	[4.11]	[-2.94]	[2.95]
Firm FE	Yes	Yes	Yes	Yes
N	171,603	171,617	139,868	139,884
Adj. R^2	0.200	0.197	0.178	0.175

Table IA.6: Robustness: Alternative Reopening Dates

This table reports results of regressions in Table 4 using alternative reopening dates. The dependent variables are the daily time-weighted percent quoted spread (QSPREAD) and daily averaged percent effective spread (ESPREAD) based on Lee and Ready (1991) trade classification. Panel A and B reports results using either April 30th or May 14th as the end of lockdown date when the U.S. mobility score recovered to its 80% or 100% pre-COVID-19 level, respectively. Lockdown and reopening dates are identified based on the US driving mobility index published by Apple (https://www.apple.com/COVID19/mobility). COVERAGE is a dummy variable equal to one if the ratio of a firm's daily COVID-19-related articles to its total daily media coverage is greater than zero, and zero otherwise. RETAIL is the daily log number of Robinhood trading accounts for each firm. All regression models include past week returns (PRET) and firm fixed effects. The t-statistics reported in square brackets are based on standard errors clustered at firm and day levels. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dep. Var (%)	Panel A: Lockdown Ends on April 30th		Panel B: Lockdown Ends on May 14th	
	(1) QSPREAD	(2) ESPREAD	(1) QSPREAD	(2) ESPREAD
RETAIL	-0.019	0.008	-0.056**	-0.008
	[-0.96]	[0.93]	[-2.52]	[-0.85]
COVERAGE	0.469***	0.172***	0.462***	0.170***
	[10.13]	[10.45]	[10.27]	[10.41]
COVERAGE × RETAIL	-0.058***	-0.021***	-0.058***	-0.020***
	[-9.76]	[-9.47]	[-9.82]	[-9.32]
LOCKDOWN	1.278***	0.458***	1.151***	0.413***
	[10.93]	[9.35]	[9.91]	[8.77]
RETAIL × LOCKDOWN	**-0.145***	**-0.290***	**-0.130***	**-0.045***
	[-10.12]	**[-8.99]**	**[-9.24]**	**[-7.86]**
COVERAGE × LOCKDOWN	-0.818***	-0.286***	-0.789***	-0.276***
	[-11.42]	[-9.06]	[-11.22]	[-9.01]
COVERAGE × RETAIL × LOCKDOWN	**0.109***	**0.038***	**0.104***	**0.036***
	[10.95]	**[8.35]**	**[10.76]**	**[8.36]**
PRET	-0.504***	-0.198***	-0.440***	-0.174***
	[-4.55]	[-4.71]	[-3.87]	[-3.99]
Firm FE	Yes	Yes	Yes	Yes
N	160,488	160,460	183,063	183,030
Adj. R^2	0.792	0.829	0.791	0.827

Table IA.7: Robustness: Alternative Model Specifications

This table reports results of regressions in Table 4 with time fixed effects added as well as with lockdown and reopen dummies combined in one regression. The dependent variable is the average percent effective spread based on Lee and Ready (1991) trade classification. LOCKDOWN is a dummy variable equal to one since March 16th. REOPEN is a dummy variable equal to one since May 8th. Lockdown and reopening dates are identified based on the US driving mobility index published by Apple (https://www.apple.com/COVID19/mobility). COVERAGE is a dummy variable equal to one if the ratio of a firm's daily COVID-19-related articles to its total daily media coverage is greater than zero, and zero otherwise. RETAIL is the daily log number of Robinhood trading accounts for each firm. All regression models include past week returns (PRET) and firm and day fixed effects. The *t*-statistics reported in square brackets are based on standard errors clustered at firm and day levels. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dep. Var =ESPREAD (%)	(1)	(2)	(3)
RETAIL	0.029***	-0.045***	0.018***
	[5.17]	[-4.44]	[3.28]
COVERAGE	0.170***	-0.035*	0.160***
	[11.04]	[-1.98]	[10.32]
COVERAGE × RETAIL	-0.024***	0.005**	-0.023***
	[-11.28]	[2.26]	[-10.68]
LOCKDOWN	.		.
	[.]		[.]
RETAIL × LOCKDOWN	**-0.048***		**-0.047***
	[-8.45]		**[-8.43]**
COVERAGE × LOCKDOWN	-0.244***		-0.241***
	[-8.27]		[-8.20]
COVERAGE × RETAIL × LOCKDOWN	**0.035***		**0.034***
	[8.58]		**[8.49]**
REOPEN		.	.
		[.]	[.]
RETAIL × REOPEN		**0.029***	**0.029***
		[5.87]	**[5.99]**
COVERAGE × REOPEN		0.082***	0.090***
		[2.99]	[3.44]
COVERAGE × RETAIL × REOPEN		**-0.011***	**-0.012***
		[-3.04]	**[-3.44]**
PRET	0.020	0.015	0.020
	[1.41]	[1.07]	[1.63]
Firm FE	Yes	Yes	Yes
Day FE	Yes	Yes	Yes
N	171,747	139,999	225,910
Adj. R^2	0.847	0.875	0.848

Table IA.8: Google Search Volume on Popular Retail Trading Platforms during Lockdown

This table reports the Google search volume on popular retail trading platforms for the sample from January 21, 2020, through May 7th, 2020. For each state on a specific date, STVI is the daily log number of searches by users in that U.S. state (district) on search terms (i.e., popular retail trading platform names), scaled by its time-series average, obtained via Google Trend (http://www.google.com/trends). LOCKDOWN is a dummy variable equal to one since the U.S. state (district) issues stay-at-home order (Table IA.1 provides stay-at-home implementation dates for each state (district)). All regression models include day fixed effects. The t-statistics reported in square brackets are based on standard errors clustered at state and day levels. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dep. Var=STVI	(1) Robinhood	(2) TD Ameritrade	(3) E-Trade	(4) Fidelity	(5) Charles Schwab
LOCKDOWN	0.243	0.443*	0.741***	0.469**	0.843***
	[1.18]	[1.89]	[4.06]	[2.19]	[3.42]
Day FE	Yes	Yes	Yes	Yes	Yes
N	5,508	5,508	5,508	5,508	5,508
Adj. R^2	0.159	0.193	0.146	0.116	0.096