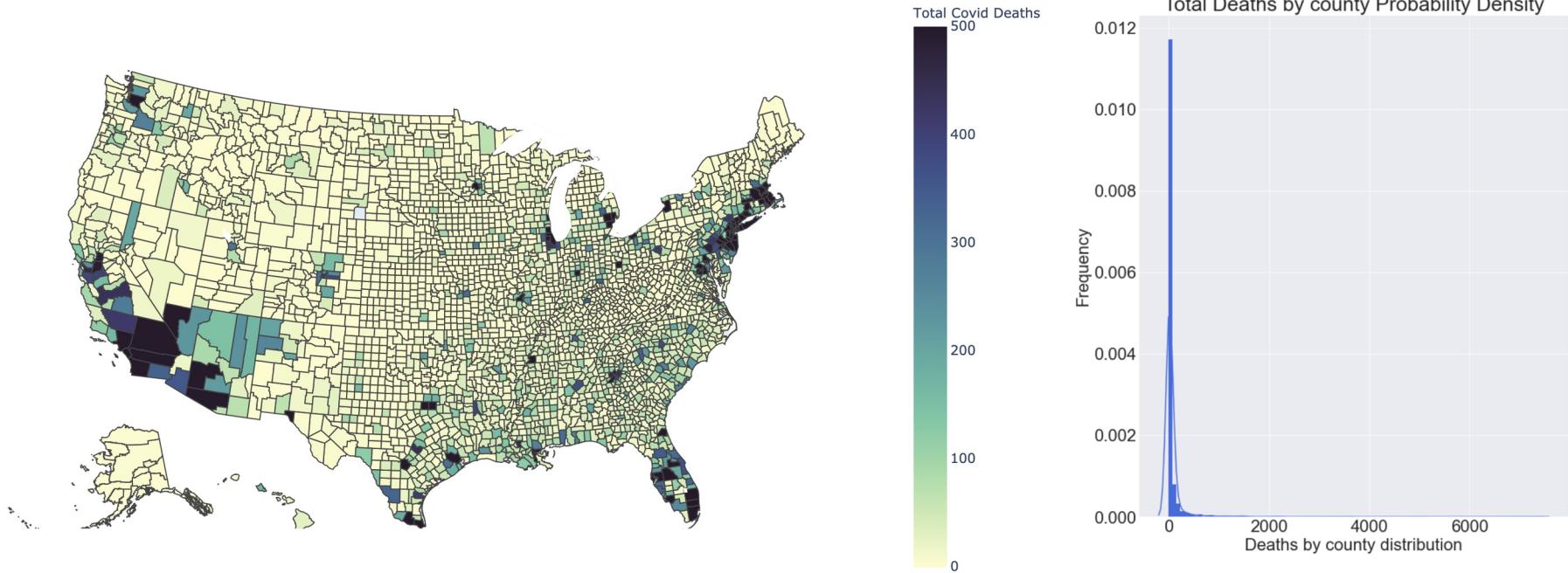
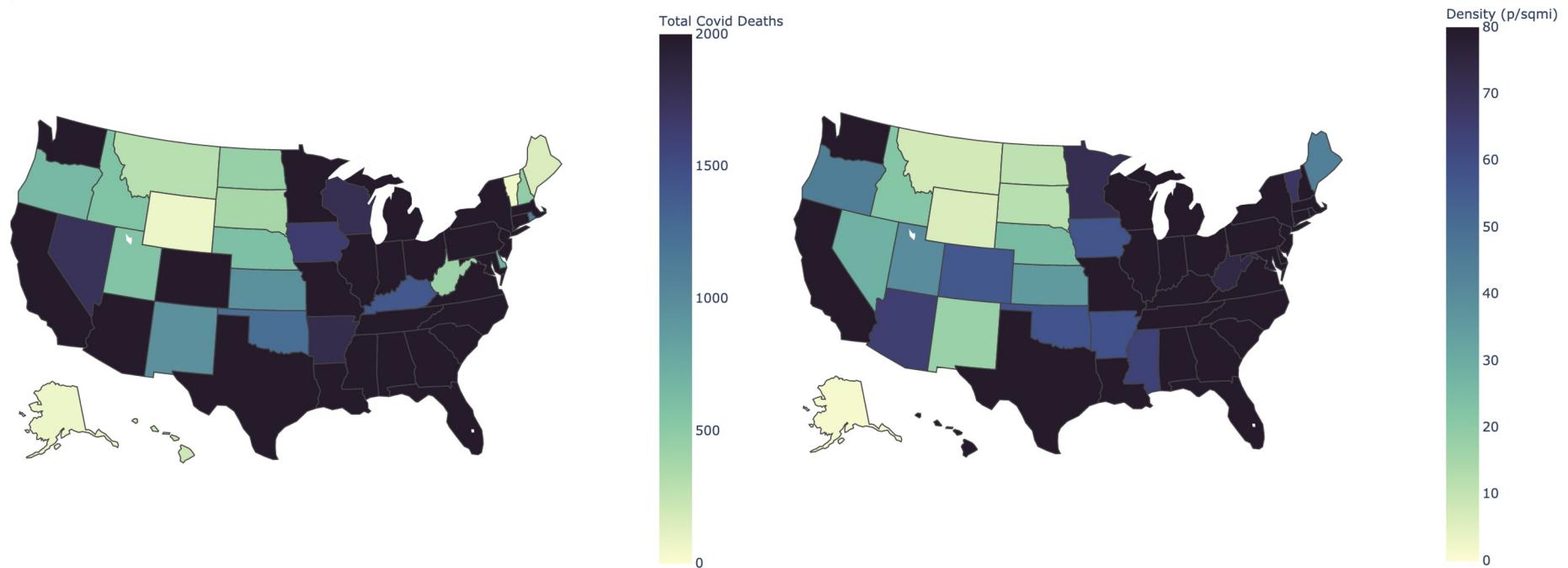


COVID-19 cases and impact at a glance

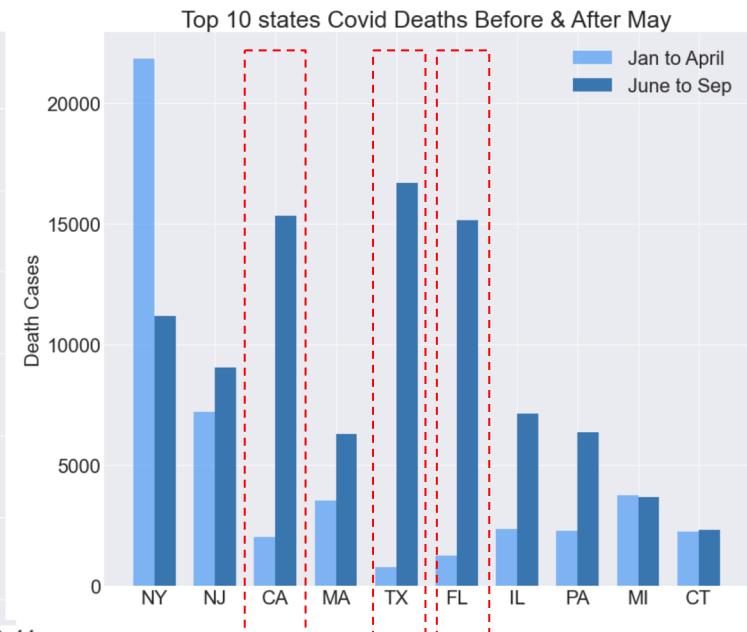
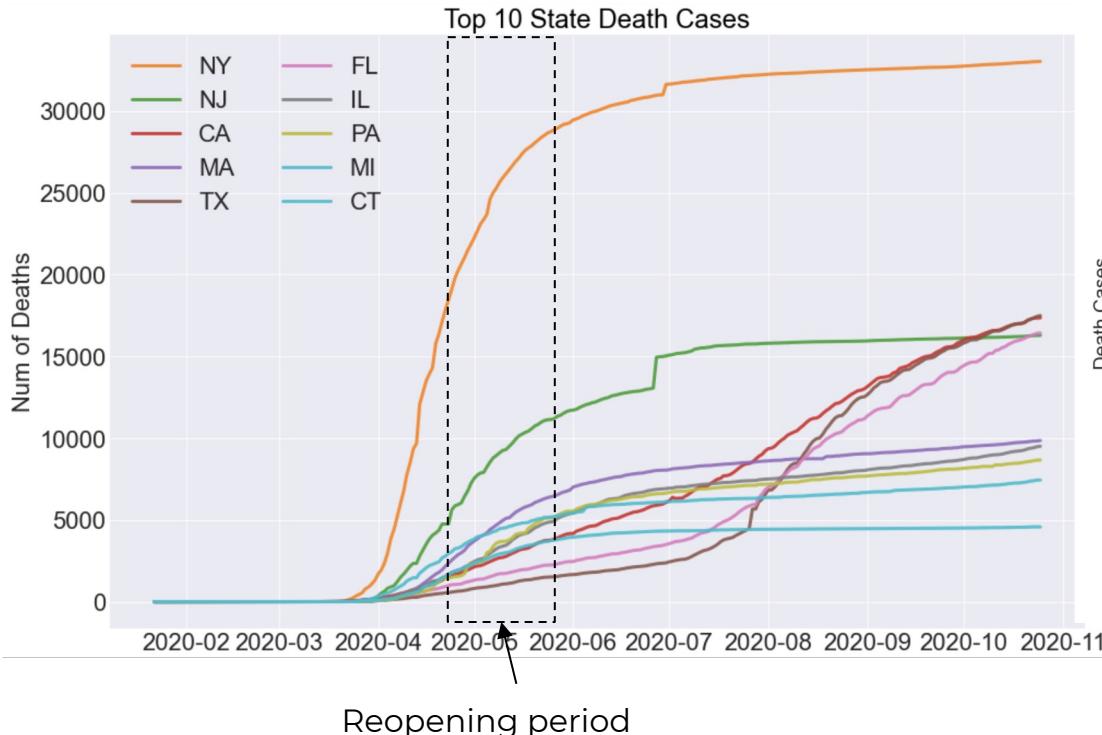
**Covid Deaths by county distribution is extremely right skewed.
Top 10 counties (LA, NYC, Miami, etc.) accounted for 21% of all
death cases.**



Covid Deaths by state and Population Density by state heatmap resembles each other.



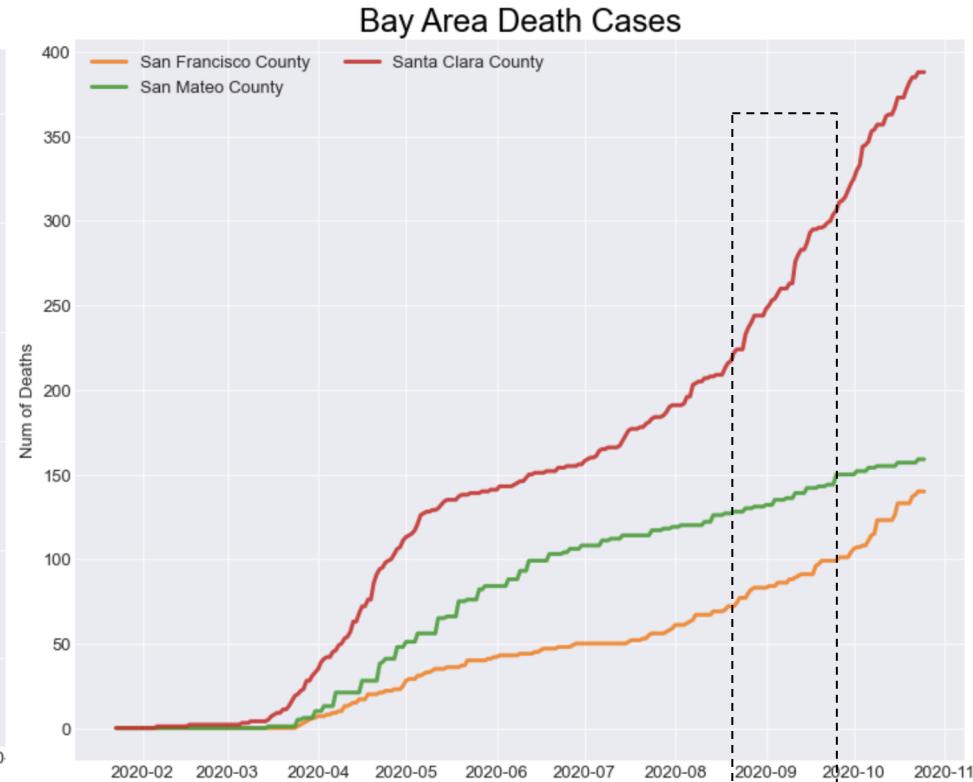
States including CA, TX, FL failed to “flatten the curve” after reopening.



Financial market responded quickly and is barely impacted by Covid-19.



Interest rate decreased to 0% on Mar. 15.



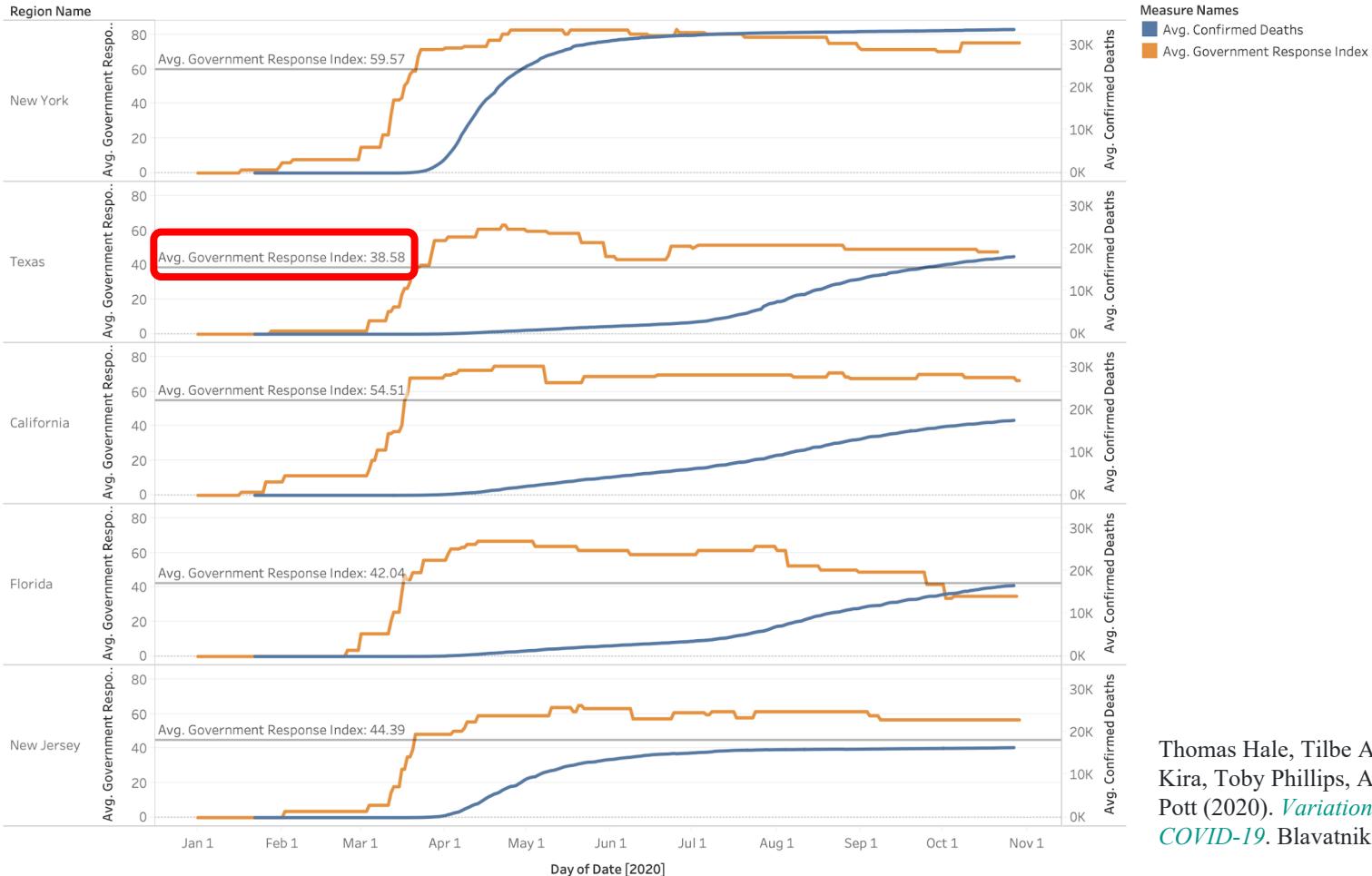
NASDAQ took a hit when Santa Clara county deaths increased exponentially. 5

How government and people are responding to pandemic

And how responses may further affect its spread

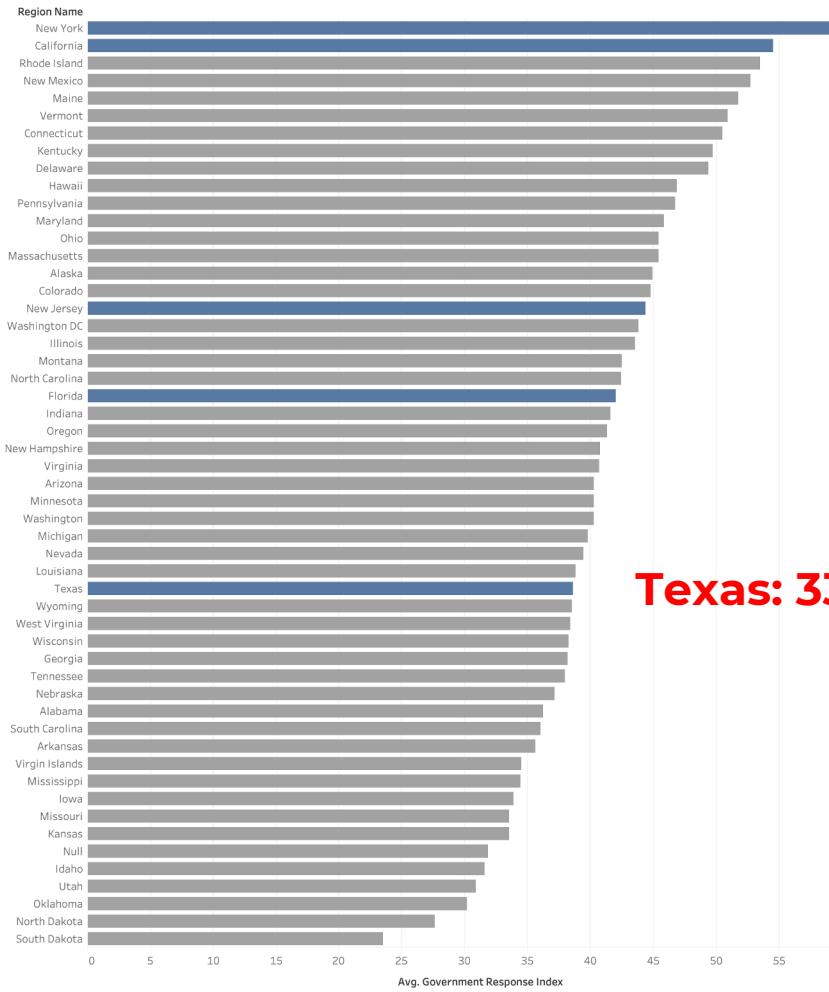
- **Government Responses**
 - **Population Behavior Shift**
 - **Case study: College Cases**
-

Government Responses and Cumulative Death Trend



Thomas Hale, Tilbe Atav, Laura Hallas, Beatriz Kira, Toby Phillips, Anna Petherick, and Annalena Pott (2020). *Variation in US states' responses to COVID-19*. Blavatnik School of Government.

Avg Government Responses By State



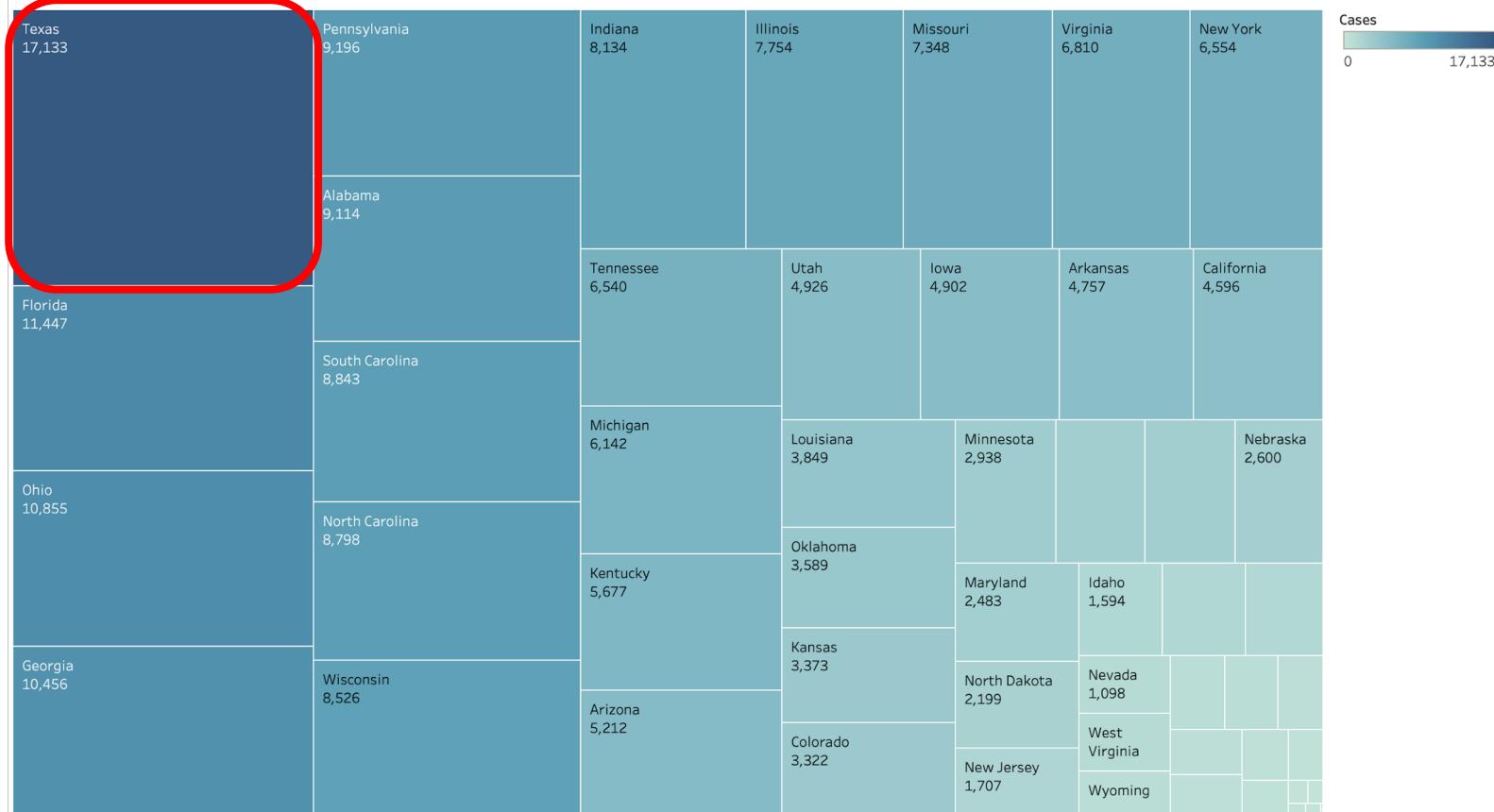
Texas: 33th

Thomas Hale, Tilbe Atav, Laura Hallas, Beatriz Kira, Toby Phillips, Anna Petherick, and Annaleena Pott (2020). *Variation in US states' responses to COVID-19*. Blavatnik School of Government.

Worn a face mask outside your home (e.g. when on public transport, going to a supermarket, going to a main road)



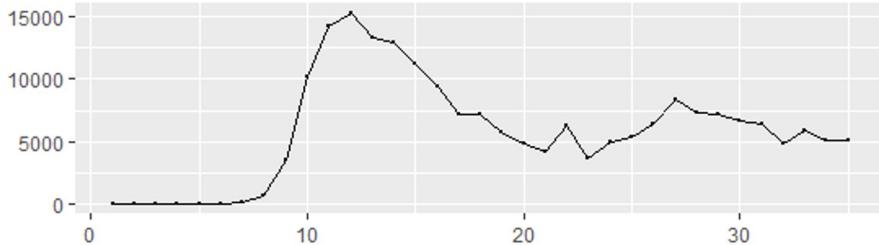
College Cases By State



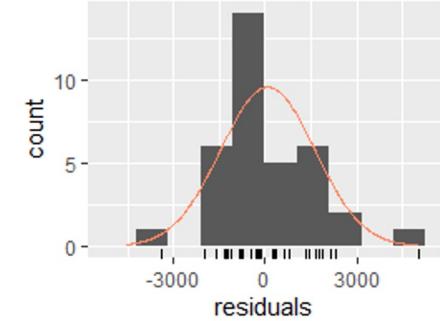
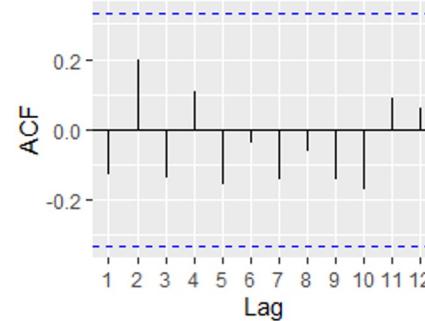
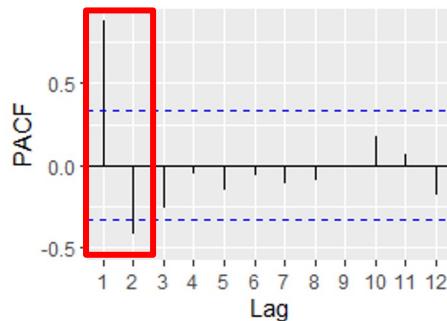
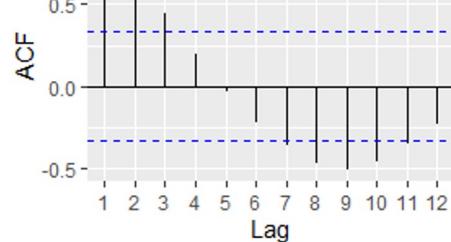
* Data from The New York Times, based on reports from state and local health agencies.

ARIMA - Weekly Observations Nationwide

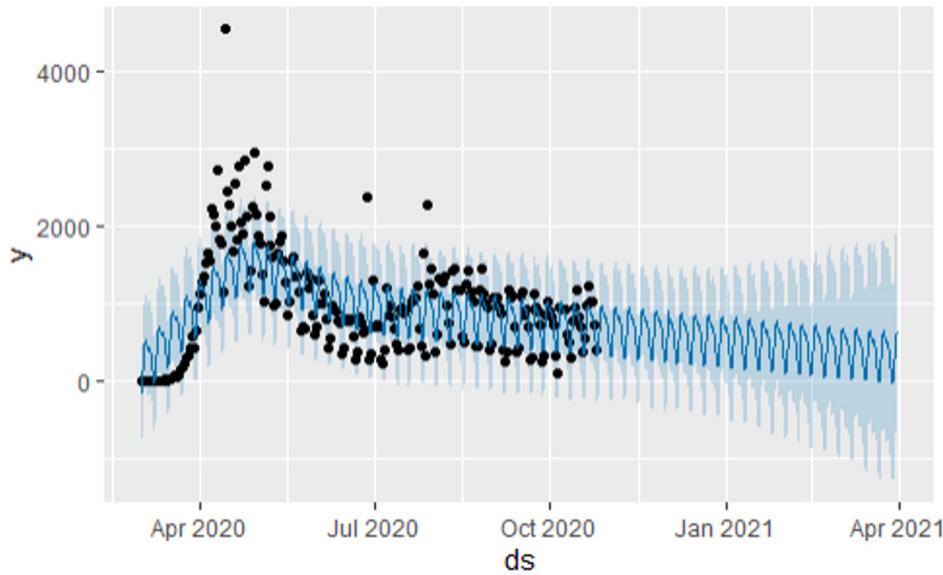
ARMA(2, 0)



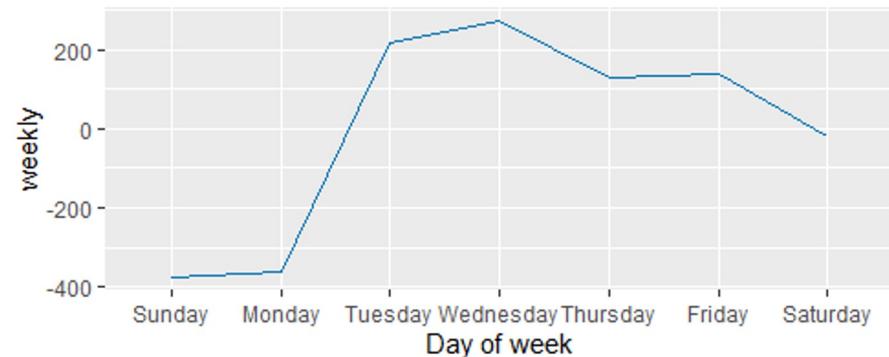
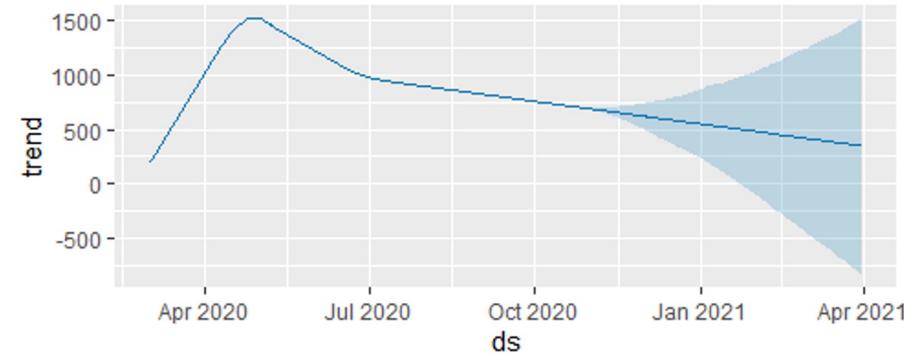
Residuals from ARIMA(2,0,0) with non-zero mean



Prophet - Daily COVID-19 Deaths Forecast



The forecast results suggest continuous decrease in daily deaths nationwide till March 2021. The weekly breakdown indicates higher deaths in midweek.



Structural Regression Model and Reasoning

$$Death_i = \beta_0 + \beta_1 Death_{i-1} + \beta_2 Face_Cover_Policy_{i-2} + \beta_3 Retail_Recreation_Mobil_{i-2} + \overrightarrow{\beta_4 State} + \varepsilon$$

- **Death i-1:** The number of current month death is largely depend on the previous month death count.
- **Face_Cover_Policy i-2, Retail_Recreation_Mobil i-2:** Face covering policy (4 levels) and population-weighted Retail/Recreation Mobility Change two months ago are used because our analysis suggest that it takes about two months to show the effect of policy implementation and behavior change on Covid death cases.
- Feb - Oct, 2020. State-fixed effect.

Coefficients:	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	291.73866	525.98185	0.555	0.59707
death_previous_month	0.18730	0.06495	2.884	0.004327 **
facial_covering_policy	-257.71004	75.35293	-3.420	0.000749 ***
retail_and_recreation	21.04152	6.20410	3.392	0.000827 ***
factor(State)AL	694.09406	738.54274	0.940	0.348367
factor(State)AR	433.07001	736.13383	0.588	0.556946
factor(State)AZ	1058.91512	744.39191	1.423	0.156324
factor(State)CA	2884.80031	768.44421	3.754	0.000224 ***
factor(State)CO	623.09572	741.51919	0.840	0.401676
factor(State)CT	1062.32860	744.01127	1.428	0.154789
factor(State)DC	992.60505	781.22755	1.271	0.205254
factor(State)DE	492.06379	739.55788	0.665	0.506541
factor(State)FL	2642.64021	758.35421	3.485	0.000597 ***
factor(State)GA	924.95115	743.73387	1.244	0.214979
factor(State)HI	821.40681	760.67357	1.080	0.281423
factor(State)IA	322.74908	739.04550	0.437	0.662759
factor(State)ID	9.11453	737.12811	0.012	0.990146
factor(State)IL	1494.06379	745.23137	2.005	0.046235 *
factor(State)IN	832.51662	1112.09932	0.749	0.454917
factor(State)KS	272.99589	738.06568	0.370	0.711836
factor(State)KY	409.49504	737.60178	0.555	0.579355
factor(State)LA	1042.00852	741.13869	1.406	0.161181
factor(State)MA	1823.43211	752.39107	2.424	0.016198 *
factor(State)MD	965.18842	744.18900	1.297	0.196033
factor(State)ME	158.66760	735.78921	0.216	0.829471
factor(State)MI	1205.28855	742.43750	1.623	0.105965
factor(State)MN	617.57012	1105.10903	0.559	0.576858
factor(State)MO	459.85940	736.82739	0.624	0.533219
factor(State)MS	550.10953	736.09936	0.747	0.455681
factor(State)MT	97.50802	735.53321	0.133	0.894659
factor(State)NC	930.85568	741.12461	1.256	0.210478
factor(State)ND	12.26707	741.59969	0.017	0.986818
factor(State)NE	222.85382	738.36341	0.302	0.763080
factor(State)NH	211.76834	737.15808	0.287	0.774177
factor(State)NJ	2552.26007	763.51487	3.343	0.000978 ***
factor(State)NM	548.12841	740.93123	0.740	0.460239
factor(State)NV	713.62597	744.30233	0.959	0.338744
factor(State)NY	4382.35774	807.04136	5.430	1.52e-07 ***
factor(State)OH	1011.33209	1112.84858	0.909	0.364485
factor(State)OK	319.32830	735.66584	0.434	0.664675
factor(State)OR	456.62378	740.64980	0.617	0.538205 *
factor(State)PA	1622.84435	776.81140	2.089	0.037874

Signif. codes:	0 '***'	0.001 '**'	0.01 '*'	0.05 '.'
1				
Residual standard error:	1374	on 215 degrees of freedom		
(253 observations deleted due to missingness)				
Multiple R-squared:	0.4042,	Adjusted R-squared:	0.2906	
F-statistic:	3.557	on 41 and 215 DF,	p-value:	8.394e-10

Output & Takeaways

- For every **1 more level of face covering** policy issued (0-4 levels with 4 being the most strict), it reduces, on average, **257.7 deaths cases** in the month after the following month.
- For every additional **1 percent mobility reduction** in retail and recreation, it reduces **21 new covid deaths** in the month after the next month.

Wear Masks and Limit Unnecessary Trips!
It saves lives, including your own.