

COVID19 Time Series Analysis, Worldwide and U.S.

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26 March 2020

Source data: 2019 Novel Coronavirus COVID-19 (2019-nCoV) Data Repository by Johns Hopkins CSSE;
<https://github.com/CSSEGISandData/COVID-19>

Source code: <https://github.com/opencedar/covid19>

The visualizations in this document are heavily indebted to Edward Tufte and his use of sparklines—small, clutter-free time series lines—to show how many different panels or categories of data are changing through time; check out https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0001OR.

Worldwide

Worldwide Summary

Sorted by total number of cases. Percent growth in total cases in the past seven days is last column.

Table 1: Worldwide Summary

Country_Region	days_50	conf	deaths	new_conf	conf_lag7	l7_rate
China	64	81661	3285	70	81102	0%
Italy	33	74386	7503	5210	35713	108%
US	31	65778	942	12038	7786	744%
Spain	25	49515	3647	9630	13910	256%
Germany	26	37323	206	4337	12327	204%
Iran	31	27017	2077	2206	17361	56%
France	27	25600	1333	2978	9052	184%
Switzerland	23	10897	153	1020	3028	260%
United Kingdom	15	9640	466	1476	2642	264%
Korea, South	35	9137	126	100	8413	8%
Netherlands	21	6438	357	858	2056	212%
Austria	20	5588	30	305	1646	240%
Belgium	21	4937	178	668	1486	232%
Canada	19	3251	30	461	657	396%
Norway	22	3084	14	221	1550	100%
Portugal	15	2995	43	633	448	568%
Brazil	14	2554	59	307	372	588%
Sweden	21	2526	62	240	1279	96%
Turkey	8	2433	59	561	98	2,384%
Israel	16	2369	5	439	433	448%
Australia	22	2364	8	320	568	316%
Denmark	17	1862	34	144	1115	68%
Malaysia	22	1796	20	172	790	128%
Czechia	15	1654	6	260	464	256%
Ireland	13	1564	9	235	292	436%
Luxembourg	12	1333	8	234	203	556%
Japan	39	1307	45	114	889	48%
Ecuador	9	1173	28	91	111	956%
Chile	12	1142	3	220	238	380%

Country_Region	days_50	conf	deaths	new_conf	conf_lag7	l7_rate
Pakistan	11	1063	8	91	299	256%
Poland	13	1051	14	150	251	320%
World	22	443438	20758	45789	206579	116%

Ln (Seven-Day-Lagged New Cases) Impact on Ln (New Cases)

In other words, elasticity. How does this elasticity change through time, from days since the 50th case?

An elasticity under 1 indicates that over a seven-day period, new cases are decreasing.

The black line shows the best curve fit for elasticity changing over time. All countries generally are moving to cap the rate of exponential growth. Countries above the line are doing worse than average, and those below the line are doing better than average. A rate below 1 indicates that new cases are declining over an average 7-day period.

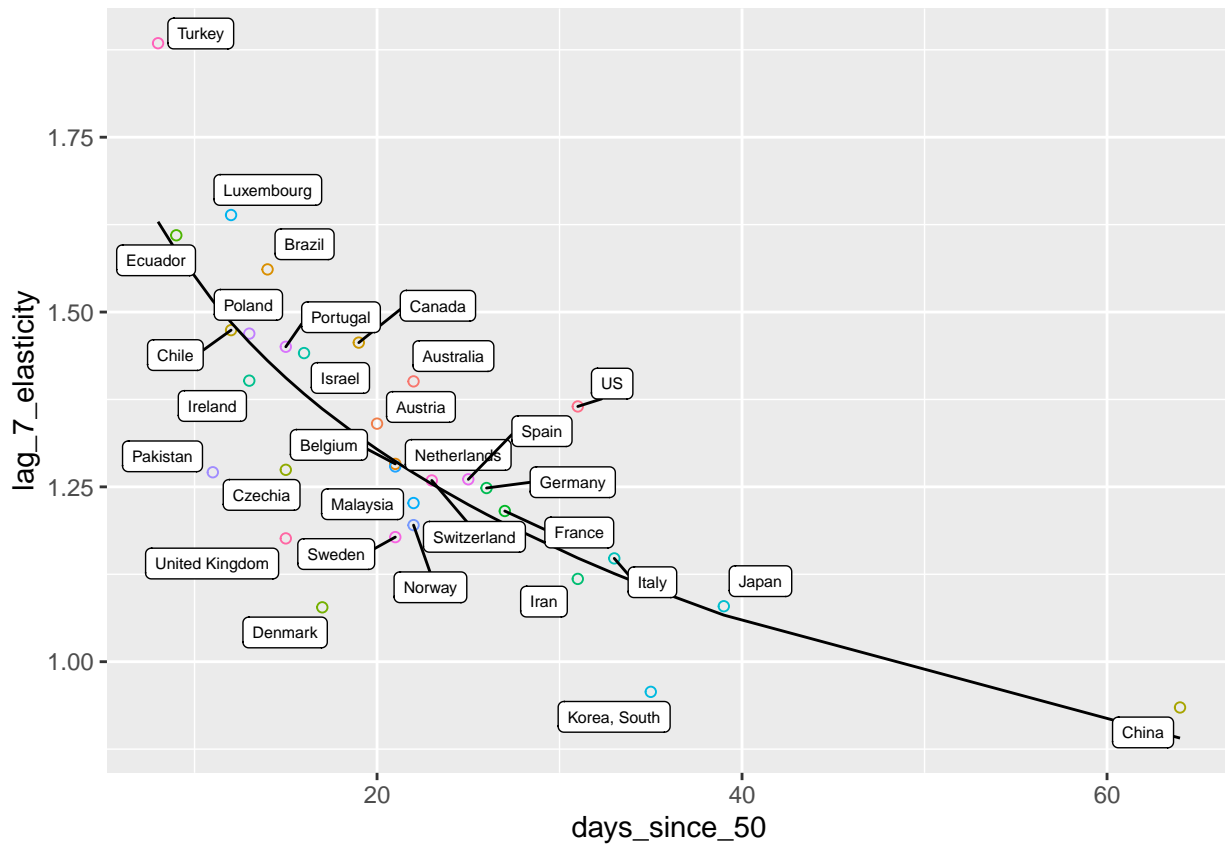


Table 2: Countries by Predicted vs. Actual Lag 7 New Case Elasticity on Today's Cases

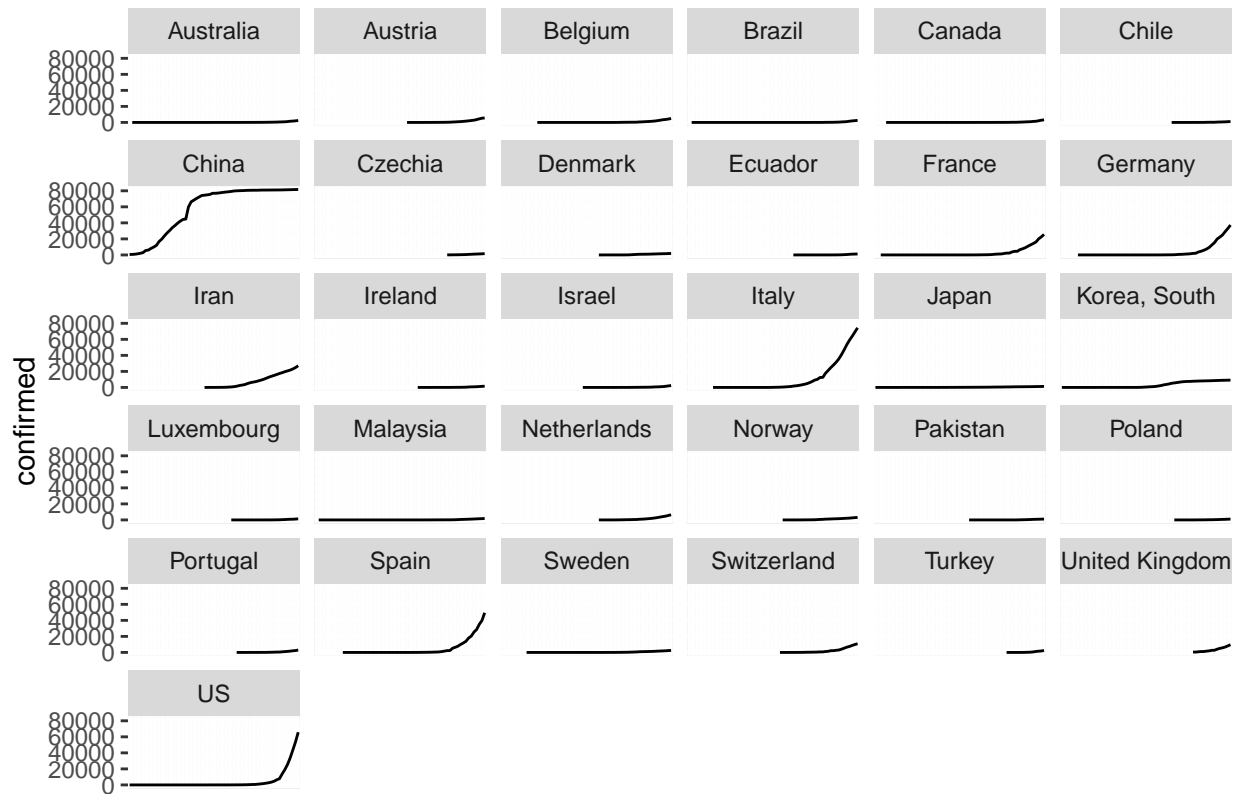
country	days_since_50	lag_7_elasticity	prediction	residual
Turkey	8	1.88	1.63	0.26
Ecuador	9	1.61	1.59	0.02
Pakistan	11	1.27	1.52	-0.25
Chile	12	1.47	1.49	-0.01
Luxembourg	12	1.64	1.49	0.15
Ireland	13	1.40	1.46	-0.05
Poland	13	1.47	1.46	0.01

country	days_since_50	lag_7_elasticity	prediction	residual
Brazil	14	1.56	1.43	0.13
United Kingdom	15	1.18	1.41	-0.23
Czechia	15	1.27	1.41	-0.13
Portugal	15	1.45	1.41	0.04
Israel	16	1.44	1.38	0.06
Denmark	17	1.08	1.36	-0.28
Canada	19	1.46	1.32	0.13
Austria	20	1.34	1.30	0.04
Sweden	21	1.18	1.29	-0.11
Netherlands	21	1.28	1.29	-0.01
Belgium	21	1.28	1.29	0.00
Norway	22	1.20	1.27	-0.07
Malaysia	22	1.23	1.27	-0.04
Australia	22	1.40	1.27	0.13
Switzerland	23	1.26	1.25	0.01
Spain	25	1.26	1.22	0.04
Germany	26	1.25	1.21	0.04
France	27	1.22	1.20	0.02
Iran	31	1.12	1.15	-0.03
US	31	1.36	1.15	0.22
Italy	33	1.15	1.13	0.02
Korea, South	35	0.96	1.11	-0.15
Japan	39	1.08	1.07	0.01
China	64	0.93	0.89	0.04

Sparklines

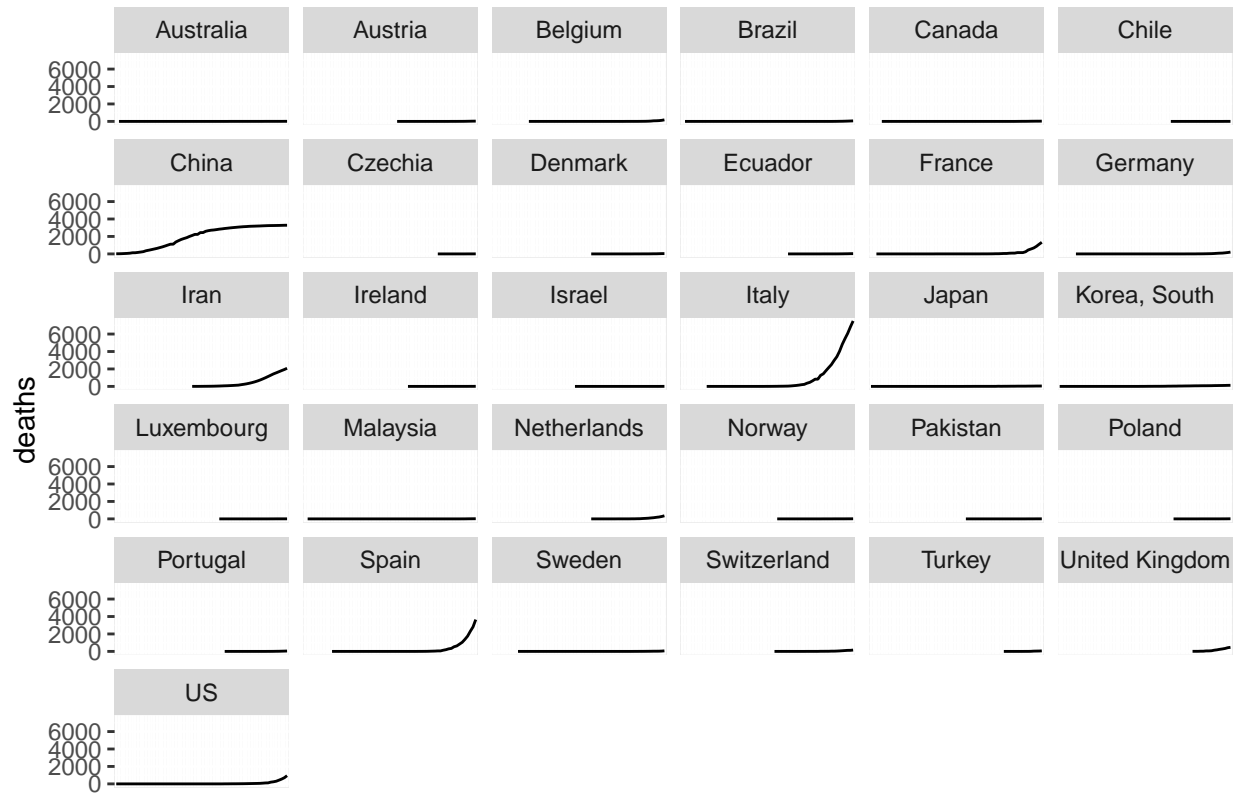
Confirmed Cases

Confirmed COVID19 Cases Through 26 March 2020



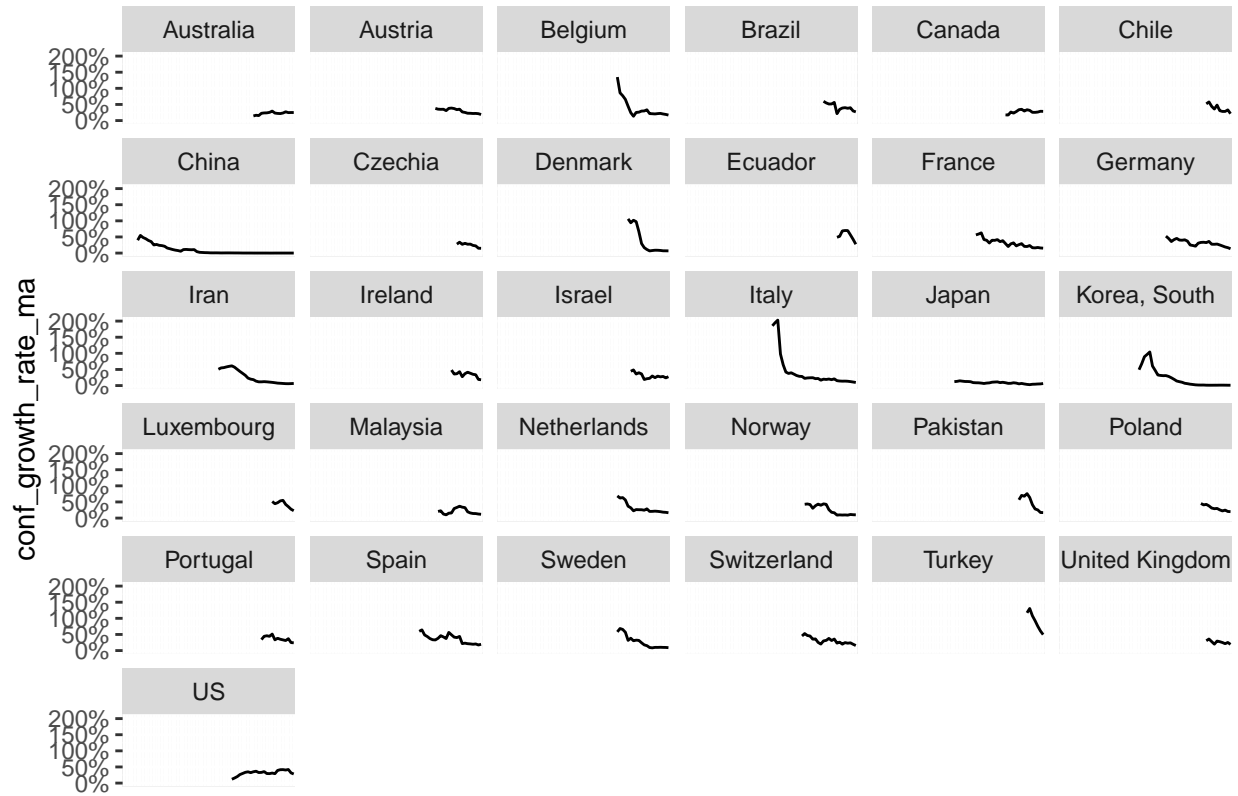
Deaths

Cumulative COVID19 Deaths Through 26 March 2020



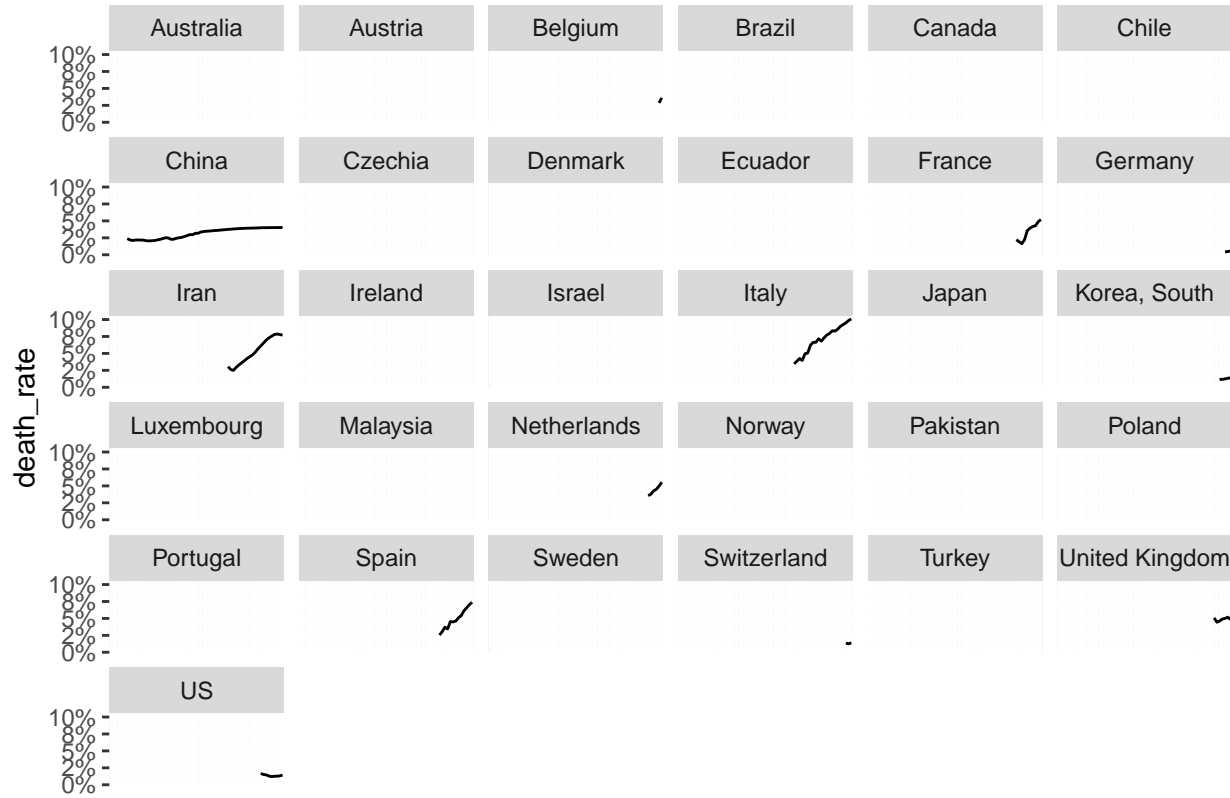
Confirmed Growth Rate 5-Day Moving Average

5-Day MA Confirmed Growth Rate Through 26 March 2020



Death Rate

Death Rate Through 26 March 2020



U.S. Analysis

State Summary

Sorted by total number of cases. Percent growth in total cases in the past seven days is last column.

Table 3: State-by-State Summary

Province_State	days_50	conf	deaths	new_conf	conf_lag7	l7_rate
New York	19	30841	285	5160	2495	1,136%
New Jersey	12	4402	62	727	267	1,548%
California	21	2998	65	460	751	300%
Washington	21	2591	133	263	1014	156%
Michigan	10	2296	43	503	83	2,668%
Illinois	12	1865	19	328	162	1,052%
Massachusetts	16	1838	15	679	218	744%
Louisiana	12	1795	65	407	257	600%
Florida	13	1682	23	270	314	436%
Pennsylvania	11	1260	15	314	152	728%
Georgia	12	1247	40	221	199	528%
Texas	12	1229	15	274	173	612%
Colorado	12	1021	16	298	184	456%
Tennessee	10	916	3	144	79	1,060%
Connecticut	9	875	19	257	68	1,188%

Province_State	days_50	conf	deaths	new_conf	conf_lag7	l7_rate
Ohio	10	704	11	137	86	720%
Wisconsin	9	621	7	140	92	576%
North Carolina	9	590	2	95	70	744%
Indiana	7	477	14	109	39	1,124%
Maryland	9	425	4	76	85	400%
South Carolina	7	424	7	82	47	804%
Arizona	6	401	6	75	27	1,384%
Virginia	9	396	9	103	77	416%
Alabama	7	381	1	139	46	728%
Mississippi	7	377	3	57	34	1,008%
Missouri	6	354	8	97	18	1,868%
Utah	9	340	1	42	51	568%
Nevada	9	323	6	45	55	488%
Minnesota	10	286	1	25	77	272%
Arkansas	7	280	2	61	33	748%
Oregon	9	266	10	56	68	292%
Kentucky	5	197	5	35	27	628%
District of Columbia	6	187	2	46	31	504%
Oklahoma	5	164	5	58	19	764%
Iowa	5	146	1	22	29	404%
Maine	7	142	0	24	42	240%
Kansas	5	134	3	34	18	644%
Rhode Island	6	132	0	8	33	300%
Vermont	4	125	8	30	18	596%
Delaware	4	119	0	15	19	528%
New Mexico	4	113	1	13	23	392%
New Hampshire	5	108	1	7	26	316%
US	9	65068	936	11936	7606	756%

Ln (Seven-Day-Lagged New Cases) Impact on Ln (New Cases)

In other words, elasticity. How does this elasticity change through time, from days since the 50th case?

An elasticity under 1 indicates that over a seven-day period, new cases are decreasing.

The black line is the best fit for elasticity for the states that have had 50 cases as they progress. Above the line: worse than average; below-the-line: better than average.

The blue line is the best fit for elasticity for countries across the world. It's apparent that the U.S. is not doing as well as the rest of the world in containing exponential growth—probably due to initial testing failures.

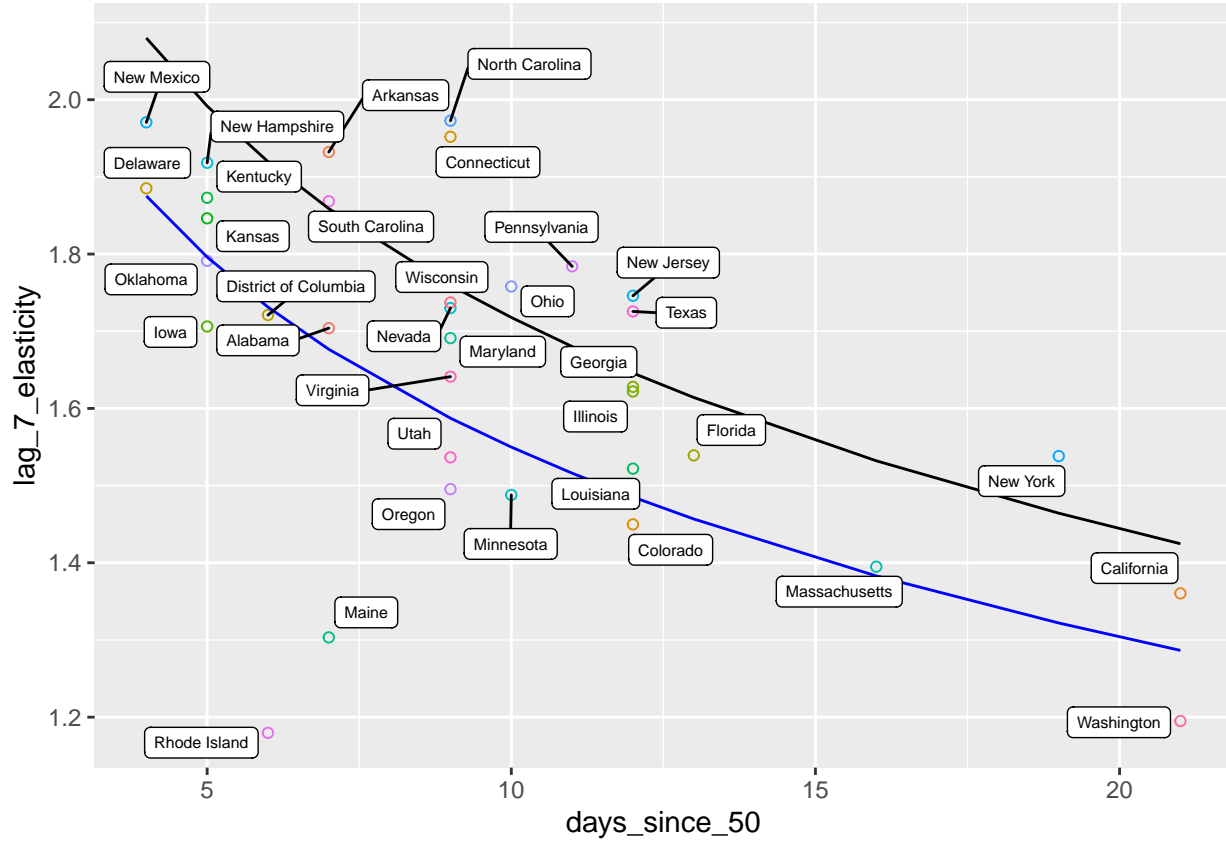


Table 4: States by Predicted vs. Actual Lag 7 New Case Elasticity on Today's Cases

state	days_since_50	lag_7_elasticity	prediction_us	prediction_ww	us_residual	ww_residual
Delaware	4	1.89	2.08	1.88	-0.19	0.01
New Mexico	4	1.97	2.08	1.88	-0.11	0.10
Iowa	5	1.71	1.99	1.80	-0.29	-0.09
Oklahoma	5	1.79	1.99	1.80	-0.20	0.00
Kansas	5	1.85	1.99	1.80	-0.15	0.05
Kentucky	5	1.87	1.99	1.80	-0.12	0.08
New Hampshire	5	1.92	1.99	1.80	-0.07	0.12
Rhode Island	6	1.18	1.92	1.73	-0.74	-0.55
District of Columbia	6	1.72	1.92	1.73	-0.20	-0.01
Maine	7	1.30	1.86	1.68	-0.56	-0.37
Alabama	7	1.70	1.86	1.68	-0.15	0.03
South Carolina	7	1.87	1.86	1.68	0.01	0.19
Arkansas	7	1.93	1.86	1.68	0.07	0.26
Oregon	9	1.50	1.76	1.59	-0.26	-0.09
Utah	9	1.54	1.76	1.59	-0.22	-0.05
Virginia	9	1.64	1.76	1.59	-0.12	0.05
Maryland	9	1.69	1.76	1.59	-0.07	0.10
Nevada	9	1.73	1.76	1.59	-0.03	0.14
Wisconsin	9	1.74	1.76	1.59	-0.02	0.15
Connecticut	9	1.95	1.76	1.59	0.19	0.36
North Carolina	9	1.97	1.76	1.59	0.21	0.39
Minnesota	10	1.49	1.72	1.55	-0.23	-0.06

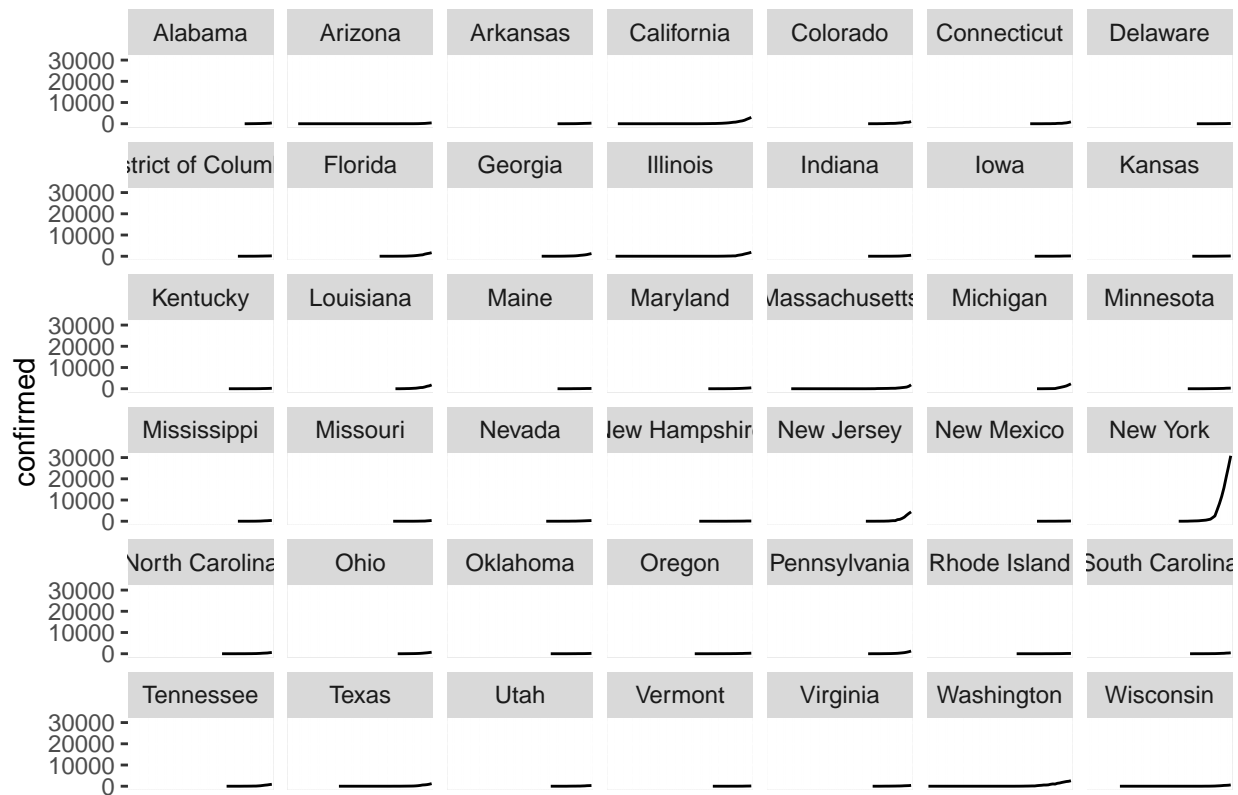
state	days_since_50	lag_7_elasticity	prediction_us	prediction_ww	us_residual	ww_residual
Ohio	10	1.76	1.72	1.55	0.04	0.21
Pennsylvania	11	1.78	1.68	1.52	0.10	0.27
Colorado	12	1.45	1.65	1.49	-0.20	-0.04
Louisiana	12	1.52	1.65	1.49	-0.12	0.04
Illinois	12	1.62	1.65	1.49	-0.02	0.14
Georgia	12	1.63	1.65	1.49	-0.02	0.14
Texas	12	1.73	1.65	1.49	0.08	0.24
New Jersey	12	1.75	1.65	1.49	0.10	0.26
Florida	13	1.54	1.61	1.46	-0.08	0.08
Massachusetts	16	1.39	1.53	1.38	-0.14	0.01
New York	19	1.54	1.46	1.32	0.07	0.22
Washington	21	1.19	1.42	1.29	-0.23	-0.09
California	21	1.36	1.42	1.29	-0.06	0.07

Sparklines

We only look at states with more than one hundred cases today. For moving average growth rates, we only look at states with deaths and recoveries over 25.

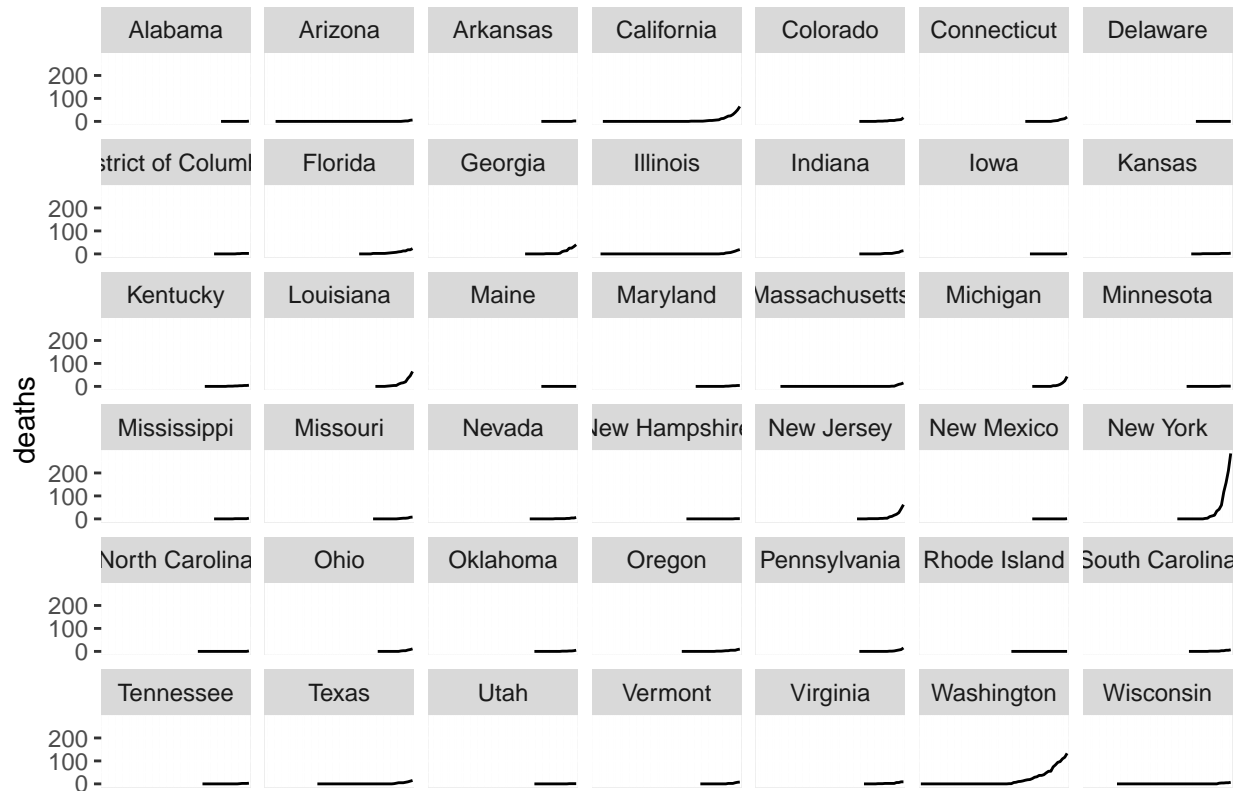
Confirmed Cases

Confirmed COVID19 Cases Through 26 March 2020



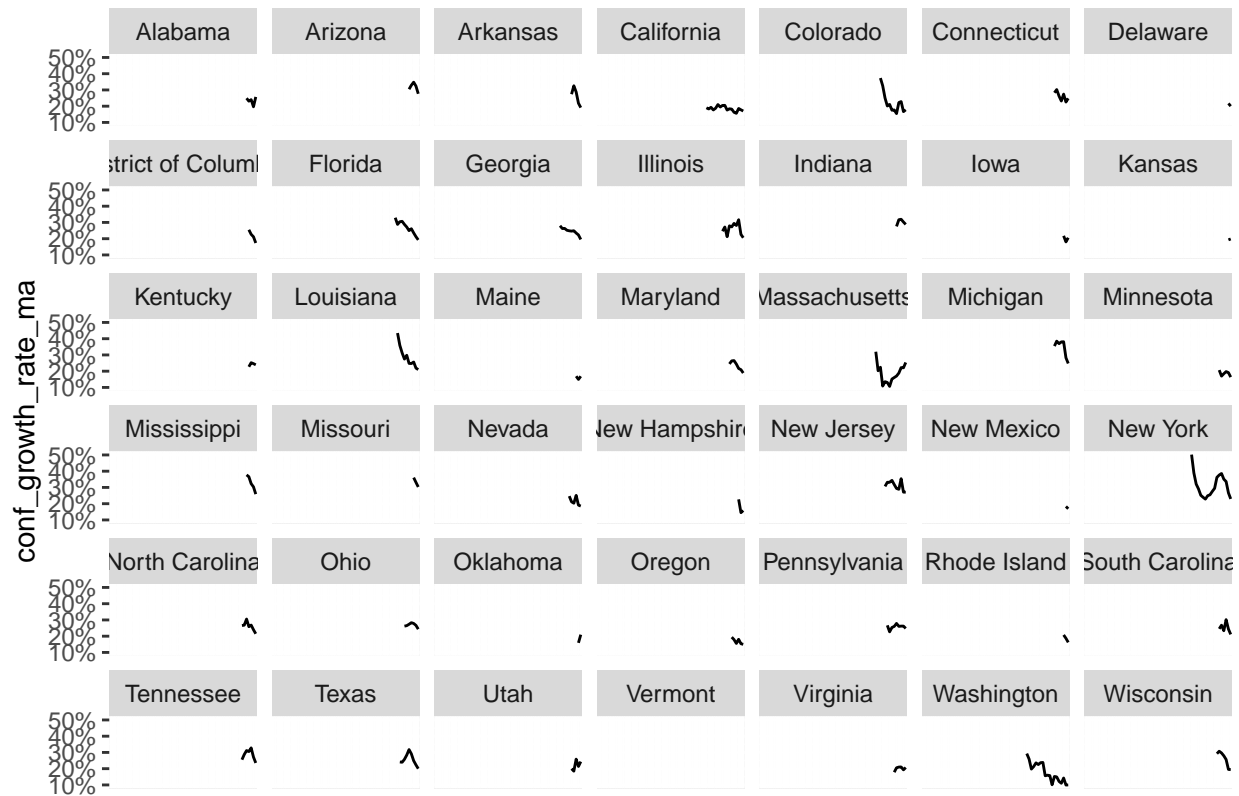
Deaths

Cumulative COVID19 Deaths Through 26 March 2020



Confirmed Growth Rate 5-Day Moving Average

Confirmed Growth Rate Through 26 March 2020



Death Rate 5-Day Moving Average

Only states with >25 deaths are shown

Death Rate Through 26 March 2020



Log / Time for States After 50th Case

Log-10 by States: Confirmed Cases by Day After 50th Confirmed Case

Log-10 of Confirmed Cases Since 50th Case by State as of 26 March 2020

