July 10, 2020 11:38 AM GMT

Biotechnology | North America

COVID-19: Reopening Tracker

We provide tracking metrics for US States and Ex-US countries which are re-opening. As we have highlighted, open States have a flat or increasing number of new cases compared with closed States and European countries. Aggregate plots are below while individual State/Country plots are inside.

Reopening regions and how are their metrics tracking

United States

Below we provide the list of which states are open or closed. We acknowledge that some judgement is required, but generally speaking states where the stay-at-home order has expired or been replaced with a "stay safer" order, we have noted as open. The trend of new cases in the United States has continued to worsen. Amid rising case-counts, we note that some states, including Texas and Florida, have partially reversed previous reopening orders, as indicated by bars and restaurants shifting from yellow-green (open with occupancy limit) to yellow (partially open with limits). As a reminder, we have included two additional datapoints in the reopening heatmap: whether or not a state-wide mask order has been instituted, and the broad status of reopening (if plans have been reversed, delayed, or are unchanged). In states where restrictions have been re-instituted following earlier relaxation, the majority of cases refer to the closure of bars and/or restaurants. Generally, the extension of the State of Emergency order does not necessarily mean a state is closed.

alphawise α

MORGAN STANLEY & CO. LLC

Matthew Harrison
EQUITY ANALYST
Matthew.Harrison@morganstanley.com +1 212 761-8055

Kostas Biliouris, Ph.D.
RESEARCH ASSOCIATE
Kostas.Biliouris@morganstanley.com +1 +1-212-761-1648

Zhen Zeng, Ph.D.
RESEARCH ASSOCIATE
Zhen.Zeng@morganstanley.com +1 +1-212-761-2745

Connor Meehan
RESEARCH ASSOCIATE
Connor.Meehan@morganstanley.com +1 212 761-8266

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Exhibit 1: U.S. State-level Reopening Status Tracker

Jurisdiction	Open/Closed	Schools	Public Gatherings	Non-Essential Businesses	Parks/Public Facilities	Bars and Restaurants	Expiry of Most Recent Order	State-wide Mask Order?	Status of Reopening?
Alabama	Open						7/31/2020	Yes (Employees)	Unchanged
Alaska	Open						Indefinitely	Partial	Unchanged
Arizona	Open						7/27/2020	Partial (Employees)	Reversal
Arkansas	Open						Indefinitely	Partial (Employees)	Delayed
California	Open						Indefinitely	Yes	Reversal
Colorado	Open						7/30/2020	Yes (Employees)	Reversal
Connecticut	Open						Indefinitely	Yes	Delayed
Delaware	Open						Indefinitely	Yes	Reversal
District of Columbia	Open						Indefinitely	Yes	Unchanged
Florida	Open						Indefinitely	Partial	Reversal
Georgia	Open						7/15/2020	Partial (Employees)	Unchanged
Hawaii	Open						7/31/2020	Yes	Unchanged
Idaho	Open						Indefinitely	Partial	Reversal
Illinois	Open						Indefinitely	Yes	Unchanged
Indiana	Open						7/17/2020	Yes (Employees)	Delayed
Iowa	Open						7/25/2020	No	Unchanged
Kansas	Open						Indefinitely	Yes	Delayed
Kentucky	Open						Indefinitely	Partial	Unchanged
Louisiana	Open						7/20/2020	Yes (Employees)	Delayed
Maine	Open						Indefinitely	Yes	Delayed
Maryland	Open						Indefinitely	Yes	Unchanged
Massachusetts	Open						Indefinitely	Yes	Delayed
Minnesota	Open						Indefinitely	Partial	Unchanged
Mississippi	Open						7/20/2020	Partial	Delayed
Missouri	Open						12/30/2020	Partial	Unchanged
Montana	Open						Indefinitely	No	Unchanged
Nebraska	Open						Indefinitely	Yes (Employees)	Unchanged
Nevada	Open						7/31/2020	Yes	Delayed
New Hampshire	Open						8/1/2020	Partial	Unchanged
New Jersey	Open						Indefinitely	Yes	Reversal
New Mexico	Open						7/15/2020	Yes	Delayed
New York	Open						7/15/2020	Yes	Delayed
North Carolina	Open						7/17/2020	Yes	Delayed
North Dakota	Open						Indefinitely	Partial	Unchanged
Ohio	Open						Indefinitely	Partial	Delayed
Oklahoma	Open						7/12/2020	Partial	Delayed
Oregon	Open						Indefinitely	Yes	Reversal
Pennsylvania	Open						Indefinitely	Yes	Delayed
Rhode Island	Open						Indefinitely	Yes	Unchanged
South Carolina	Open						7/10/2020	Partial	Unchanged
South Dakota	Open						12/30/2020	No	Unchanged
Tennessee	Open						8/29/2020	Partial	Reversal
Texas	Open						Indefinitely	Yes	Reversal
Utah	Open						7/10/2020	No	Delayed
Vermont	Open						7/15/2020	Yes (Employees)	Unchanged
Virginia	Open						Indefinitely	Yes	Delayed
West Virginia	Open						Indefinitely	Yes	Unchanged
Wisconsin	Open						Invalidated	No	Unchanged
Wyoming	Open						7/15/2020	Partial	Delayed
Michigan	Closed						Indefinitely	Yes	Reversal
Washington	Closed						8/6/2020	Yes	Delayed

Open with few Restrictions
Partially Open with Limits
Closed
Open with Occupancy Limit

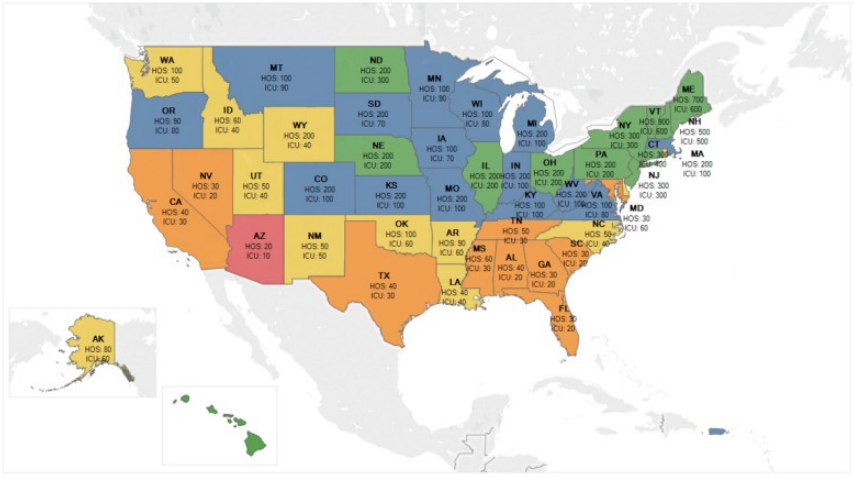
Source: Morgan Stanley Research

Hospital Utilization

With some states reporting high occupancy (up to ~85-90%) of their hospital/ICU beds mainly due to COVID-19 cases, we have generated a heat map to identify the strain on hospital systems in each state. We use red/orange/yellow/blue/green color to illustrate states that have 0-10 / 11-30 / 31-60 / 61-100 / 101+ remaining days before their hospital/ICU beds are fully occupied (number of remaining days until full occupation is listed on each state in the map). Our estimation assumes the following: *(1)* The trend in cases will remain the same as the previous week; *(2)* ~10% / 2% of the cases will be admitted in the hospital/ICU. While we do not directly model discharge rates, since the map is updated weekly, we believe it is directionally indicative of the potential strain on the system.

As Exhibit 2 demonstrates, similar to last week, AZ has the lowest number of days remaining before its hospital (20 days) or ICU (10 days) beds become fully occupied. States that remained in the orange zone (11-30 days prior to full bed occupancy) over the past week include NV, TN, AL, GA, FL, SC, and MD, while states that transitioned to the orange zone this week (ie bed occupancy was increased) comprise CA, TX, and MS, all of which are characterized by accelerating number of cases/hospitalizations (our note here).

Exhibit 2: Hospitalization/ICU bed capacity map.



Source: Morgan Stanley Research and Alphawise Research, Tableau, The COVID Tracking Project.

Overall Risk Map

We have developed a methodology to establish overall COVID-19 risk ratings for each U.S. state (incl. Washington DC). ***These ratings are on a colored scale: red (highest risk), orange (high risk), yellow (moderate risk), and green (lowest risk).*** An overall color is determined by aggregating data from three key metrics: case count trend over a 7 day period, hospital/ICU occupancy levels (days left until ICUs and hospitals are full), and test positivity rate. Though many permutations of arriving at each overall score exist, we note the following commonalities:

- All green states have demonstrated a w/w trend down in cases, a test positivity rate of lower than 5%, and greater than 60 days until ICUs/hospitals are fully occupied
- All yellow states have a test positivity rate below 10%
- All orange states have either, a) less than 60 days until ICUs/hospitals are a fully occupied, and a test positivity rate below 10%, or b) greater than 60 days until ICUs/hospitals are fully occupied, and a test positivity rate above 10%,
- All red states have a w/w trend up in cases, a test positivity rate of greater than 10%, and less than 60 days until ICUs/hospitals are fully occupied

We note the following key week-on-week *declines* in risk status (non-exhaustive):

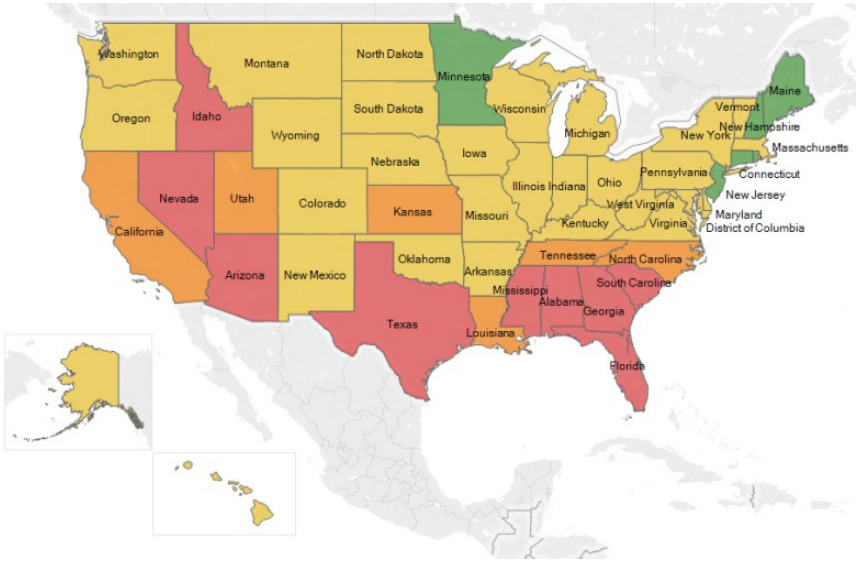
- California (yellow to orange)
- Washington DC (green to yellow)
- Idaho (orange to red)
- New York (green to yellow)

Key week-on-week *improvements* in risk status:

- Arkansas (orange to yellow)

- Maine (yellow to green)
- New Hampshire (yellow to green)
- Utah (red to orange)

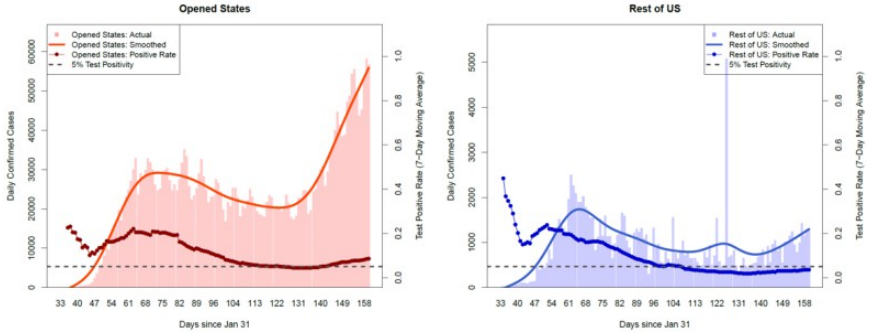
Exhibit 3: Case Trend, Test Positivity, and Hospitalization Aggregate Risk Score, by State



Source: Morgan Stanley Research and Alphawise Research, Tableau, The COVID Tracking Project.

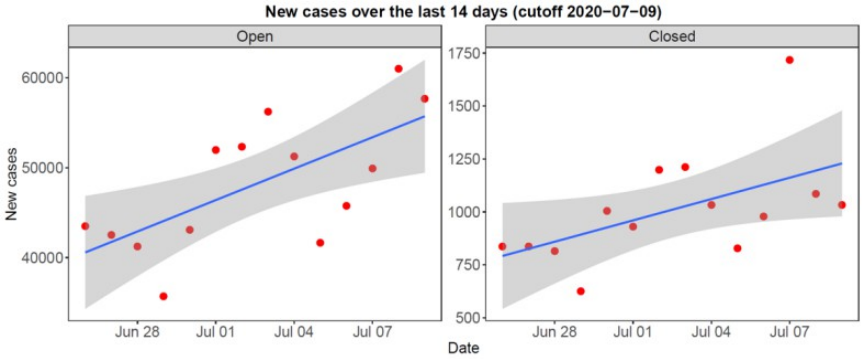
Daily cases, testing positivity rate, and volume of tests: Comparing the open states vs. closed states in the US, daily new cases exhibit an accelerating upward trend in open states, and a slower increasing trend among the closed states (Exhibit 4Exhibit 5). The daily testing positivity rate is above 5% among open states and below 5% among closed states. Importantly, despite that the testing volume has been increasing dramatically in both open and closed states, a upward trend can be observed for both groups. ***Importantly, most of the reopened States have experienced a new peak or a prolonged flat period in daily cases after their initial reopening date.*** We provide regional static models to track the evolvement of outbreak in each US state during the past a couple of weeks in the Individual plots for each region section.

Exhibit 4: Daily cases and testing positivity rate of the US opened states vs. closed states (aggregated)



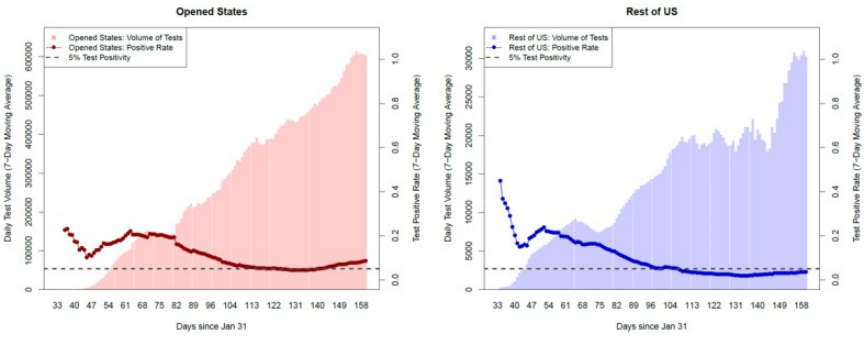
Source: Morgan Stanley Research, https://covidtracking.com/, NY Times.

Exhibit 5: Number of new cases for open (left) versus closed (right) US states. The red dots represent the real data, while the blue line reflects a smoothing line through the data and the gray area shows the confidence intervals.



Source: Morgan Stanley, The COVID Tracking Project

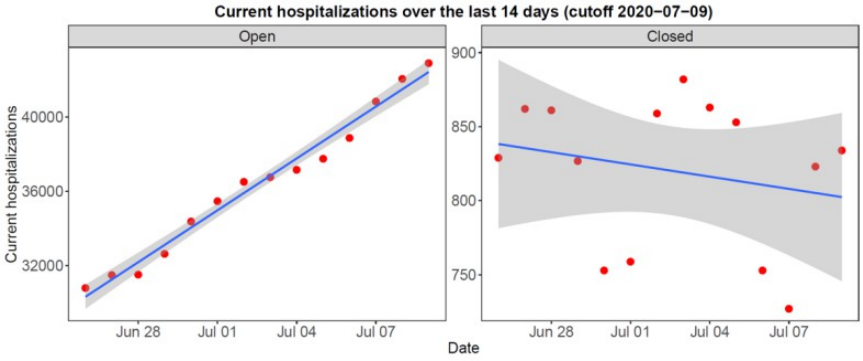
Exhibit 6: Volume of tests and testing positivity rate of the US opened states vs. closed states (aggregated)



Source: Morgan Stanley Research, https://covidtracking.com/.

Number of current hospitalizations: The number of current hospitalizations in open states (left) is exhibiting a clear upward trend, with a relatively large slope demonstrating the high rate of new hospitalizations, while the closed-states hospitalizations are relatively flat with high day-to-day variability. This trend represents a deterioration for the closed states compared to last week, wherein the hospitalizations were trending downwards (our note here). Note, however, that NY that was likely driving the downward trend of closed states last week is now moved to the open states. We highlight that states with an increasing trend in the number of hospitalized patients over the past 7 days include AK, AL, AR, AZ, CA, CO, GA, IA, ID, KY, LA, MO, MS, MT, NC, ND, NM, NV, OH, OK, OR, SC, TN, TX, VA, VT, WI, WV, and WY (see plots inside). Note, however, that some states do not make hospitalization data available and inconsistencies between different hospitalization datasets may exist.

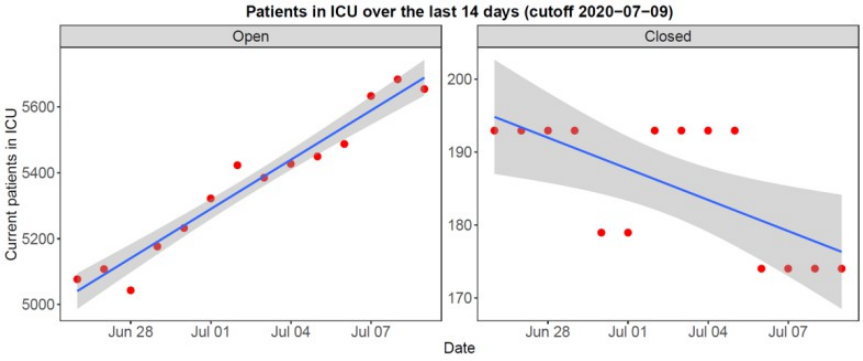
Exhibit 7: Number of current hospitalizations for open (left) versus closed (right) US states. The red dots represent the real data, while the blue line reflects a smoothing line through the data and the gray area shows the confidence intervals.



Source: Morgan Stanley, The COVID Tracking Project

Number of patients in ICU: The number of ICU patients over the past 14 days exhibits a clearly increasing trend in the open states, while in closed states it has been relatively constant. This represents a worsening compared to last week, wherein the number of ICU patients was exhibiting a clear trend downwards both in the open and in closed states (our note here). For the ICU bed capacity in each state see Exhibit 2. We highlight that states with an increasing trend in the number of ICU patients over the past 7 days include AZ, CA, IA, ID, KY, ME, MS, NV, OH, OK, OR, UT, and WV (see plots inside). Note that most of the states do not make ICU data available.

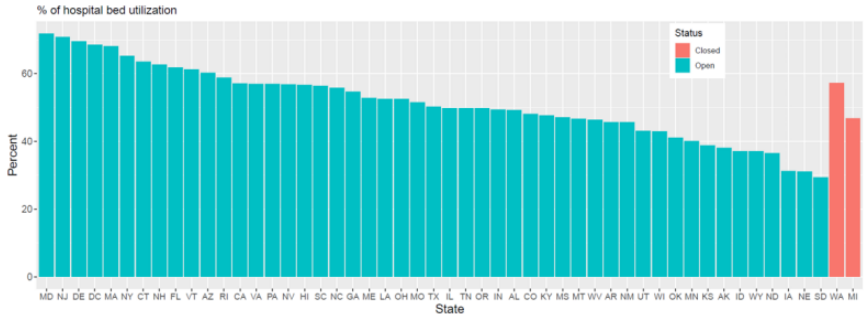
Exhibit 8: Number of patients in ICU for open (left) versus closed (right) US states. The red dots represent the real data, while the blue line reflects a smoothing line through the data and the gray area is the confidence interval.



Source: Morgan Stanley, The COVID Tracking Project

Percentage of hospital bed utilization: Among the open States, MD, NJ, DE, DC, MA, NY, CT, NH, FL, VT, and AZ, have 60% hospital bed utilization or more. Among the closed States, none has over 60% hospital bed utilization.

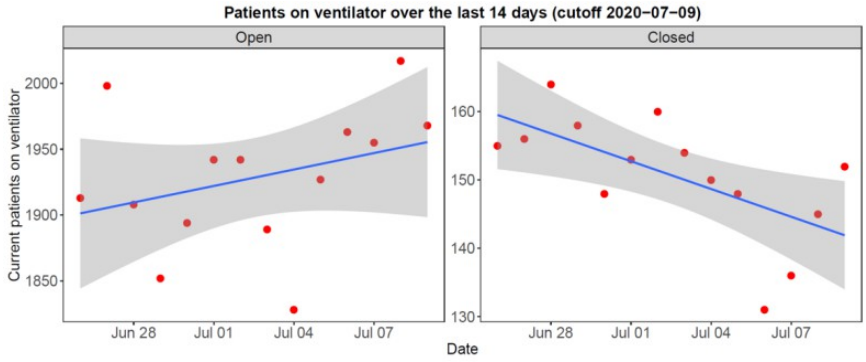
Exhibit 9: Percentage of hospital bed utilization for open (left) versus closed (right) US States.



Source: Morgan Stanley Research, AlphaWise, University of Maryland COVID-19 Impact Analysis Platform.

Number of patients on ventilator: The number of patients on ventilator (Exhibit 10) exhibits a slightly increasing trend in the open states and a decreasing trend in the closed states over the past 2 weeks, with the open states exhibiting higher day-to-day variability. This is a worsening for the open states compared to last week, wherein the number of patients on ventilator was trending downwards (our note here). We underscore that states with an increasing trend in the number of patients on ventilator over the past 7 days include AK, AR, AZ, LA, ME, MO, MS, NV, OH, and WV (see plots inside). Recall that most of the states do not make ventilator data available.

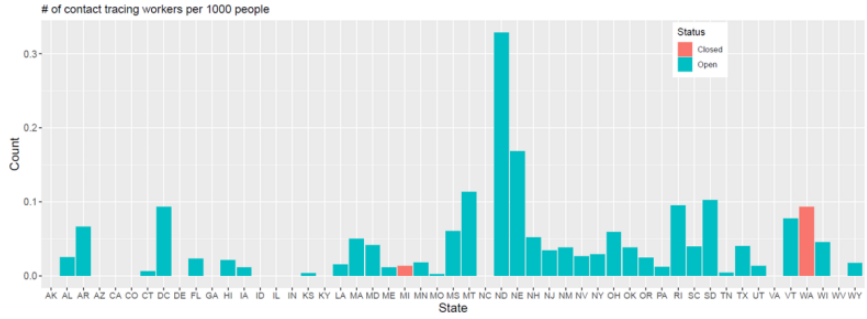
Exhibit 10: Number of patients on ventilator for open (left) versus closed (right) US states. The red dots represent the real data, while the blue line reflects a smoothing line through the data and the gray area is the confidence interval.



Source: Morgan Stanley, The COVID Tracking Project

Number of contact tracing workers per 1,000 people: We highlight the large heterogeneity observed across the States and the un-availability of data for 13 States.

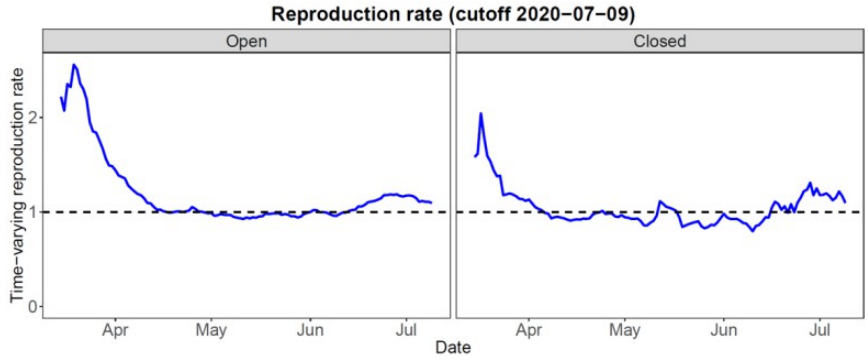
Exhibit 11: Number of contact tracing workers per 1,000 people for closed (orange) versus open (cyan) US states. Blank indicates the data is not available for the corresponding States.



Source: Morgan Stanley Research, AlphaWise, University of Maryland COVID-19 Impact Analysis Platform.

Time-varying reproduction rate: Unlike last week, wherein the R value of the open states was slightly larger than the closed states (our note here), this week the R value of the open states is similar to closed states and the nationwide R value (~1.12). Recall that R values above 1 suggest that the spreading of COVID-19 is ongoing. We underscore that ~50% of the states exhibit an increasing trend in R over the past 5 days that is coupled with an R value above 1 (see curves in red in Exhibit 29). We will be monitoring changes in the R trend across all states to identify signals of a second wave of infection in each state.

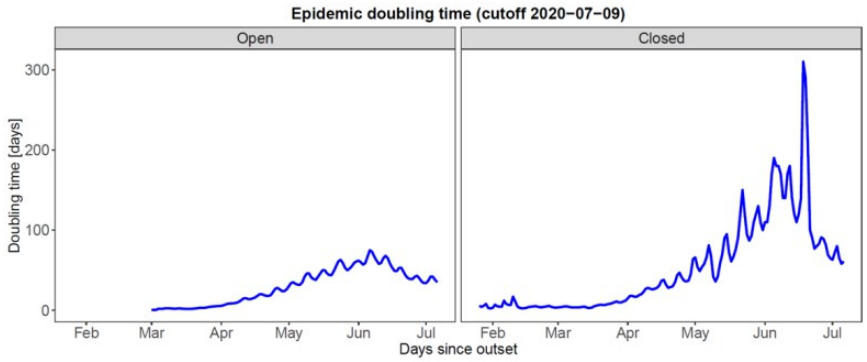
Exhibit 12: Time varying reproduction rate for open (left) versus closed (right) US states.



Source: Morgan Stanley, The COVID Tracking Project

Epidemic doubling time: Recall that the higher the doubling time, the better is the containment of the spread as the cases need longer time to double. The epidemic doubling time of the closed states is similar to the open states (~40 days) and to the nationwide doubling rate (~38 days vs 42 days last week). As Exhibit 30 shows curves in red), ~50% of the states are characterized by a decreasing trend in doubling time over the past 10 days, indicating acceleration of the spreading. Note that the high variability in the doubling time of the closed states is partially attributed to the fact that currently there are only two closed states (Michigan and Washington).

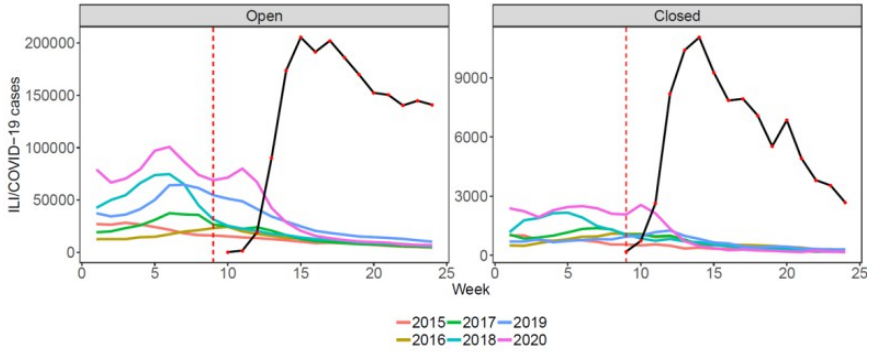
Exhibit 13: Epidemic doubling time for open (left) versus closed (right) US states.



Source: Morgan Stanley, The COVID Tracking Project

Cases of Influenza-like illness (ILI) and COVID-19 cases: Exhibit 14 illustrates weekly ILI data in the US during 2015-2020 and COVID cases in open vs closed states. We note that the ILI dynamics of both the open and the closed states have been similar, and specifically the number of ILI cases has been declining from week 11 to date in all states. However, we note that in the nationwide data up to week 26, as well as the emergency department visits for ILI and Covid-like illness (CLI) cases, start exhibiting an increasing trend that is commensurate with the recent overall increase in cases (see Exhibit 35). We will continue to monitor the ILI/CLI trends to explore any potential similarities with the number of cases and how this similarity and be leveraged to predict future patterns in number of cases.

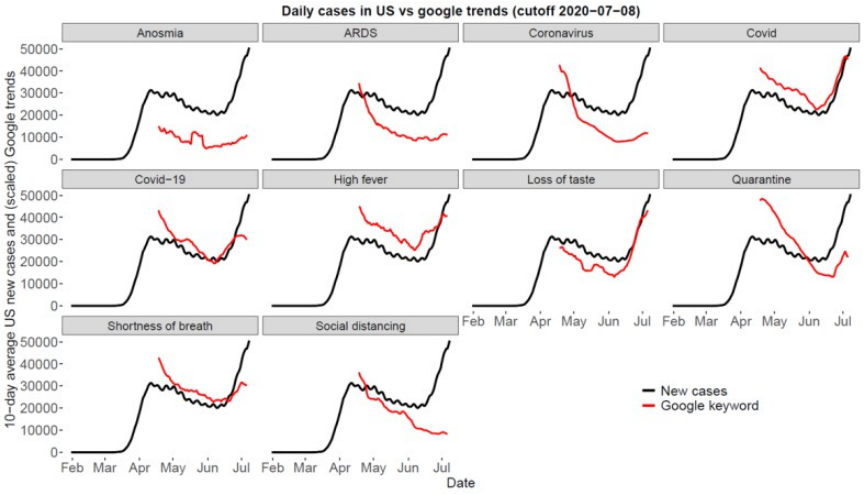
Exhibit 14: ILI cases from 2015-2020 (different colors) vs COVID-19 cases (black color) in closed (left) and open (right) states. The red dashed line (vertical) represents the timing of the COVID-19 outbreak.



Source: Morgan Stanley, COVIDView, ILINet, Johns Hopkins CSSE.

Google trends: Exhibit 15 provides the overlap between google trends key words and the number of new cases in the US. Overall, we underscore that the rate at which COVID-19 keywords are searched on Google recapitulates the trend of new cases in the US, and especially the keywords "*Covid*" and "*Loss of taste*" whose trend parallels the overall trend and recent uptick in cases. Given that certain Google trends appear to constitute a leading factor of the new cases, we believe that Google trends can be leveraged towards potentially seeing early signals of subsequent waves of infections at the state or national level.

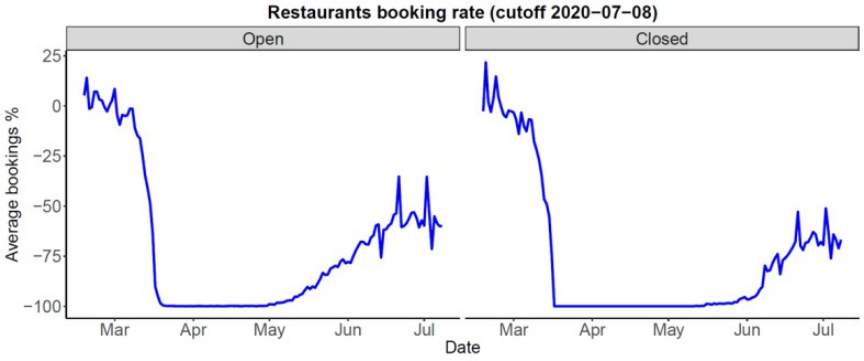
Exhibit 15: Google trends for keywords related to COVID-19 overlaid with the number of new COVID-19 cases in the US.



Source: Google, Johns Hopkins CSSE.

Restaurant reservations trends: Restaurant reservation rates can be employed as a means to gauge the extent of reopening in a state. We have retrieved restaurant reservations data from OpenTable to assess the rate at which reservations are made in reopening states. In Exhibit 16we plot the average bookings of all open (left) and all closed (right) states compared to the period prior to pandemic. We observe two key trends: *(1)* The reservation rate dropped by ~100% for ~2 months due to the pandemic and lockdown rules in nearly all the states; and *(2)* Interestingly, in open states the booking rates are ~55% lower than the pre-pandemic rates, while in closed states the rates lie ~65% below the pre-pandemic rates. This trend reflects the rise in the various activities that are ongoing in states that are progressively reopening. Overall, we believe that the restaurant booking rate is one of the most sensitive parameters to "reopening", as most of the states exhibit a rapid increase in bookings right after their reopening date (see state-level plots inside).

Exhibit 16: Restaurant reservations rate in open (left) vs closed (right) states based on data from ~20,000 restaurants.



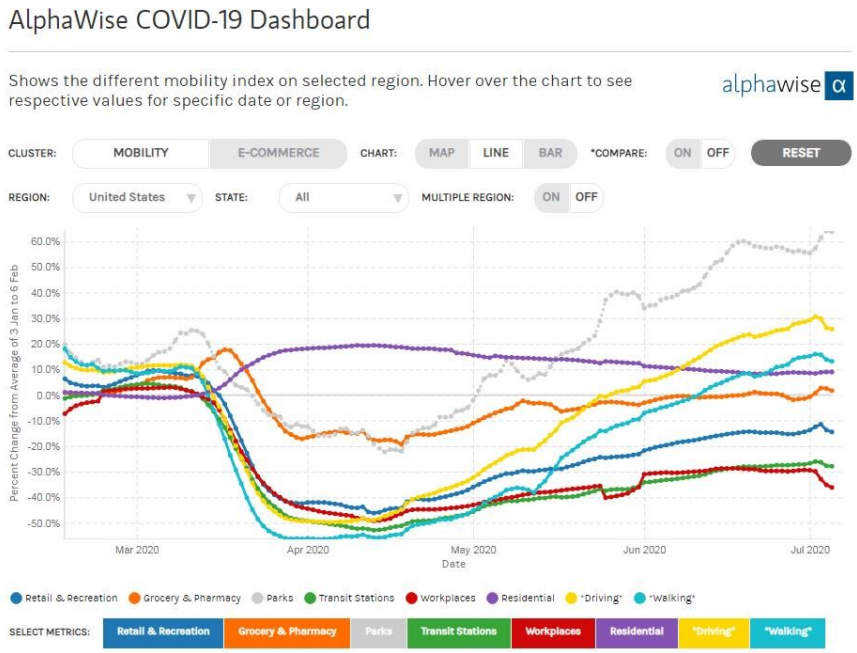
Source: Morgan Stanley Research, OpenTable

Mobility indices: We work with AlphaWise to track two sets of metrics from Google and Apple for the level of social activities in each of the US States and also in other key countries. The scores measure change in overall mobility with respect to the pre-outbreak level from various aspects. Compared to the open States, we note that the 2 closed States currently appear to demonstrate similar

levels of outdoor activities. See the interactive panel below or Individual plots for each region for Google and Apple mobility indices for specific regions of interest.

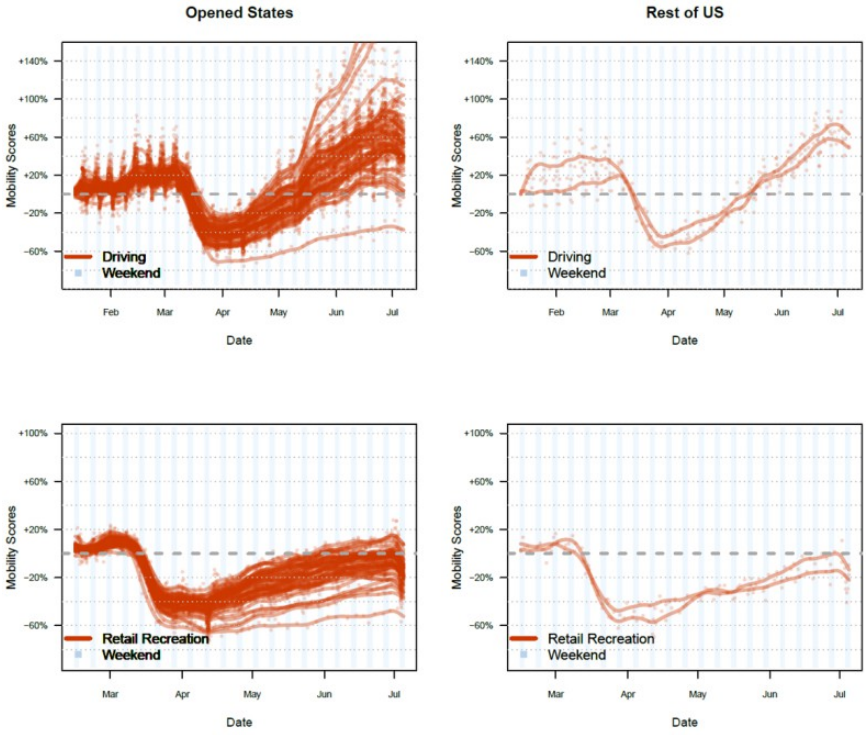
Interactive panel for regional mobility data (red vertical line in an individual US state indicates its initial reopening date):

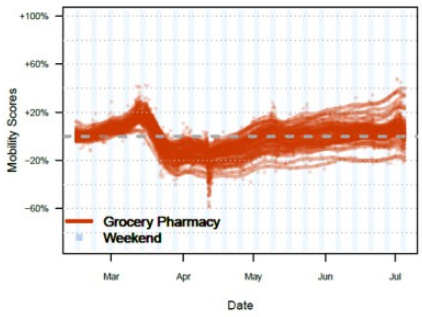
AlphaWise COVID-19 Dashboard



AlphaWise, Google LLC "Google COVID-19 Community Mobility Reports.", Apple Mobility Data, Morgan Stanley Research

Exhibit 17: Social activities of the US open States vs. closed States




+100%
+60%
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-60%
Mobility Scores
Grocery Pharmacy
Weekend
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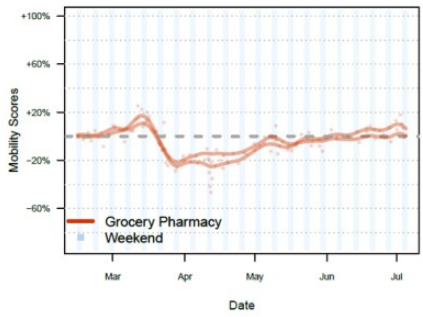
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Mobility Scores
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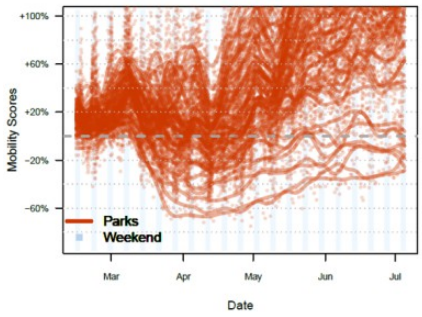
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Mobility Scores
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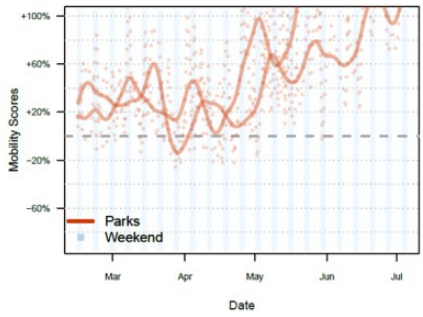
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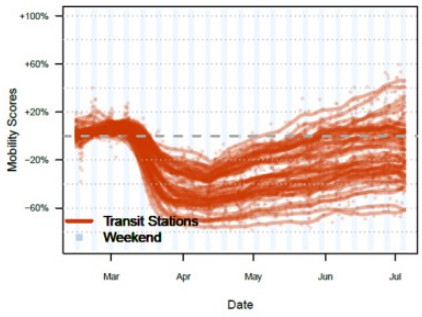
+100%
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Mobility Scores
Transit Stations
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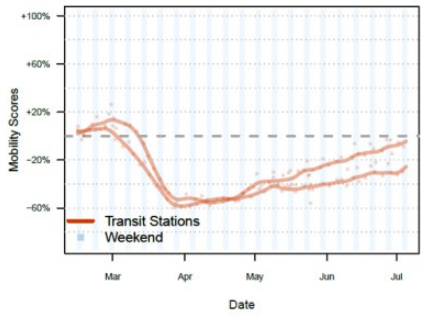
+100%
+60%
+20%
-20%
-60%
Mobility Scores
Transit Stations
Weekend
Mar
Apr
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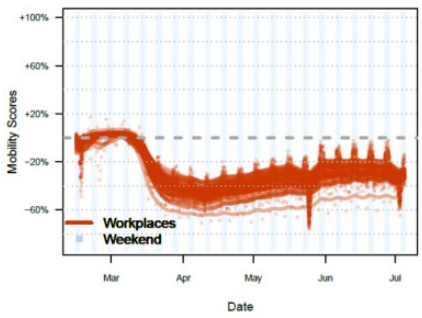
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Mobility Scores
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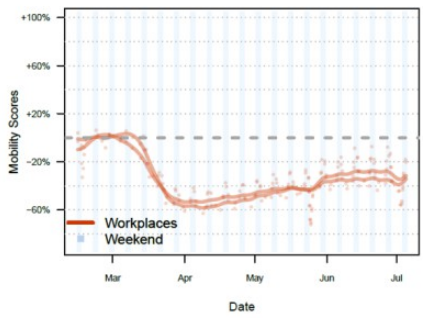
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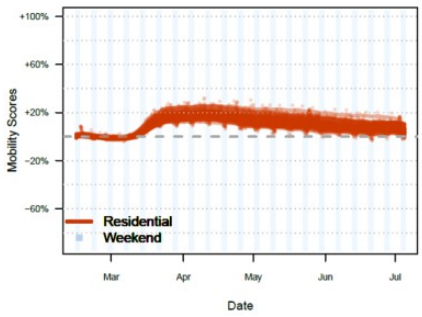
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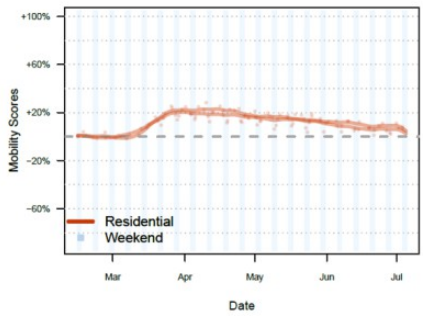
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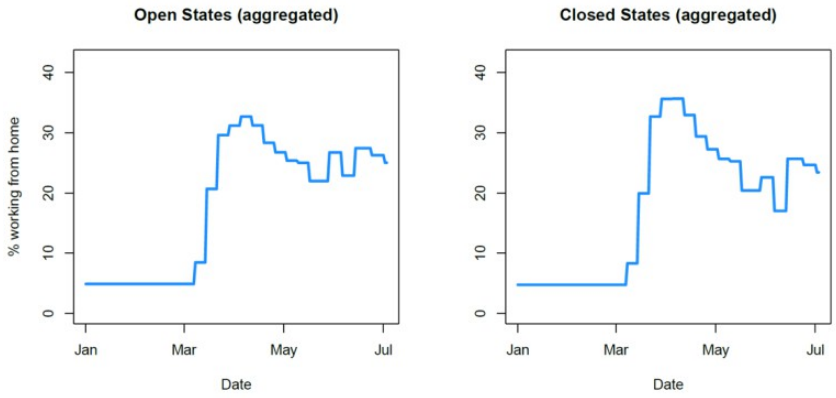
Mobility Scores
Residential
Weekend
Mar
Apr
May
Jun
Jul
Date

Source: Morgan Stanley Research, https://www.google.com/covid19/mobility/, https://www.apple.com/covid19/mobility..

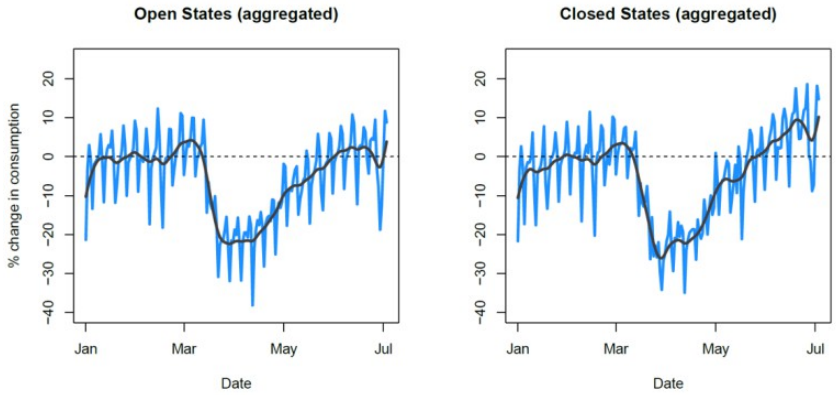
Economic indicators: We track University of Maryland COVID-19 Impact Analysis Platform for percent working from home and percent change in consumption in each of the US States, which are indicative of changes in economic activities over time. Working from home is similarly prevalent between closed States and open States, and interestingly, both closed and open States appear to have a recent increase in working from home again. In terms of consumption level, now both open and closed States have recovered to the pre-pandemic level.

Exhibit 18: Percent working from home for open (left) versus closed (right) US states. Data are aggregated across States and weighed by population.



Source: Morgan Stanley Research, AlphaWise, University of Maryland COVID-19 Impact Analysis Platform.

Exhibit 19: Percent change in consumption for open (left) versus closed (right) US states. Dark grey lines indicate the trend after smoothing. Data are aggregated across States and weighed by population.



Source: Morgan Stanley Research, AlphaWise, University of Maryland COVID-19 Impact Analysis Platform.

Outside the United States

We have provided a similar, though abridged, heatmap for select ex-U.S. locations below. Similar color-coding applies.

Exhibit 20: Ex-U.S. Reopening Status Tracker

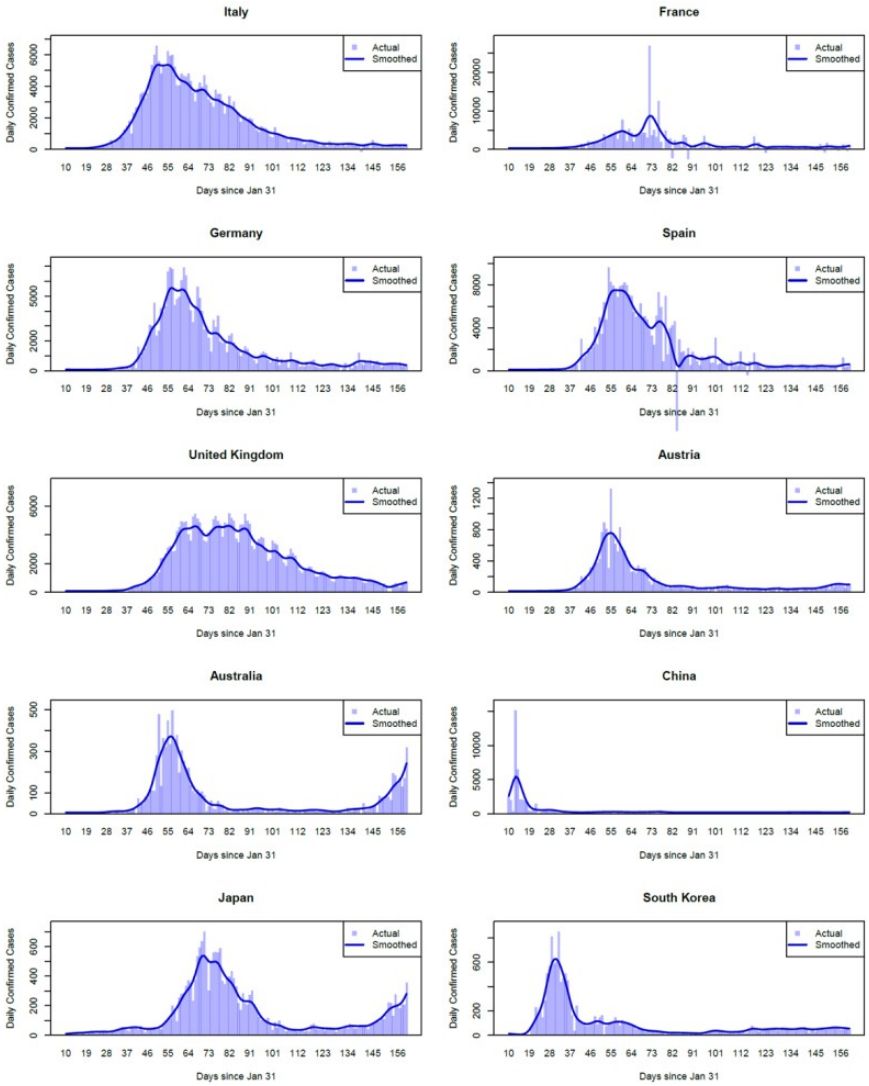
Country	Start of National Lockdown	Non-Essential Production	Non-Essential Shops/Retail	Restaurants / Cafes	Schools
China	1/23/2020				
Italy	3/10/2020				
Spain	3/16/2020				
Austria	3/16/2020				
France	3/17/2020				
Belgium	3/18/2020				
Portugal	3/20/2020				
Germany	3/22/2020				
Netherlands	3/23/2020				
Greece	3/23/2020				
New Zealand	3/23/2020				
Australia	3/23/2020				
UK	3/24/2020				
Ireland	3/27/2020				
Singapore	4/3/2020				
Japan	4/7/2020				
South Korea	N/A				

Open with few Restrictions
Partially Open with Limits
Closed

Source: Morgan Stanley Research

Daily cases: For most key EU and Asia/Pacific countries currently open, the daily case numbers have dropped to a remarkably low level. However, we highlight two countries, Australia and Japan, where sustained increase in daily cases has already developed into a new wave.

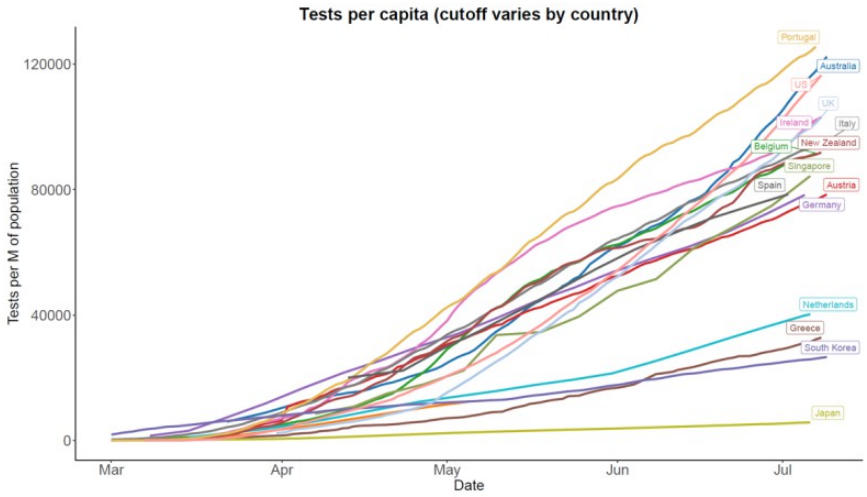
Exhibit 21: Actual daily cases of the key countries in reopening.



Source: Morgan Stanley Research, https://www.apple.com/covid19/mobility.

Number of cumulative tests per capita: Note that the testing data presented in Exhibit 22 stems from different sources, which may be incomplete (may only capture data from public and not private labs), but we believe that the overall trend is representative of each country's capacity for testing. We highlight that countries with a high number of tests per capita include Portugal, US, and Australia, while countries with relatively low number of tests per capita include Japan, S. Korea, and Greece. We note that US has performed ~110K (vs 97K last week) tests per million people to date.

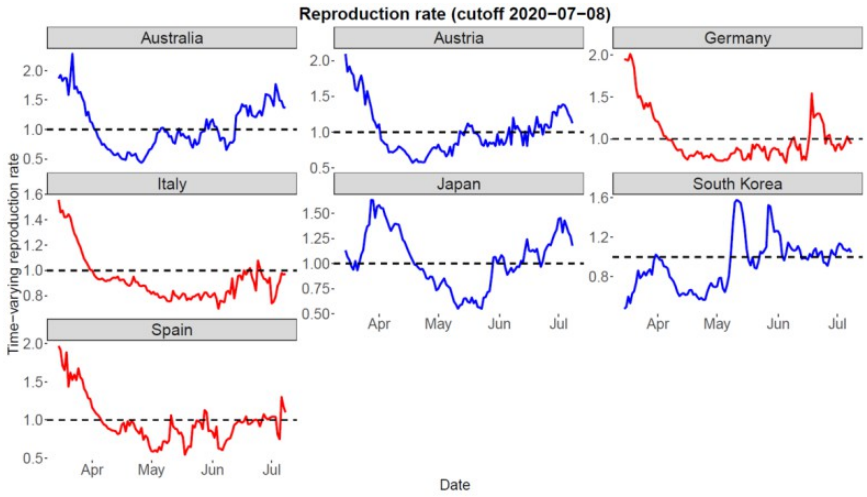
Exhibit 22: Number of tests per million people for various countries.



Source: Morgan Stanley, The COVID Tracking Project, Johns Hopkins CSSE, The World in Numbers, Wikipedia.

Time-varying reproduction rate: A positive slope in R is indicative of an R value that is overall trending upward implying acceleration of the spread and potentially a second wave of infections. Among the countries shown below, Germany, Italy ,and Spain (in red) exhibit an overall increasing trend in R over the past 5 days (for the R value of additional countries see Exhibit 38). We also note that nearly all countries shown below (except from Germany and Italy) have a value of R above 1, which is indicative of an ongoing spread (note that the nationwide R in US is ~1.11 vs ~1.17 last week).

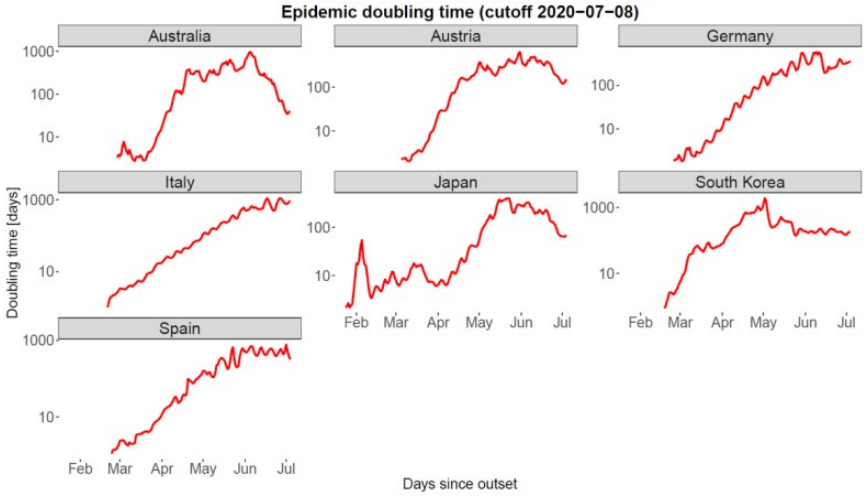
Exhibit 23: Time-varying effective reproduction number. The black dashed line represents R=1.



Source: Morgan Stanley Research, JHU CSSE, NY Times Github.

Epidemic doubling time: Interestingly, all countries shown below are characterized by a negative slope in their epidemic doubling time over the past 10 days, suggesting acceleration of the new cases (for additional countries see Exhibit 39). Recall that the nationwide epidemic doubling time in the US is ~38 days (vs ~42 days last week). We note that the doubling time is highly variable and, therefore, should be used in combination with other metrics.

Exhibit 24: Epidemic doubling time for various countries.



Source: Morgan Stanley, The COVID Tracking Project, Johns Hopkins CSSE.

Recent COVID-19 research

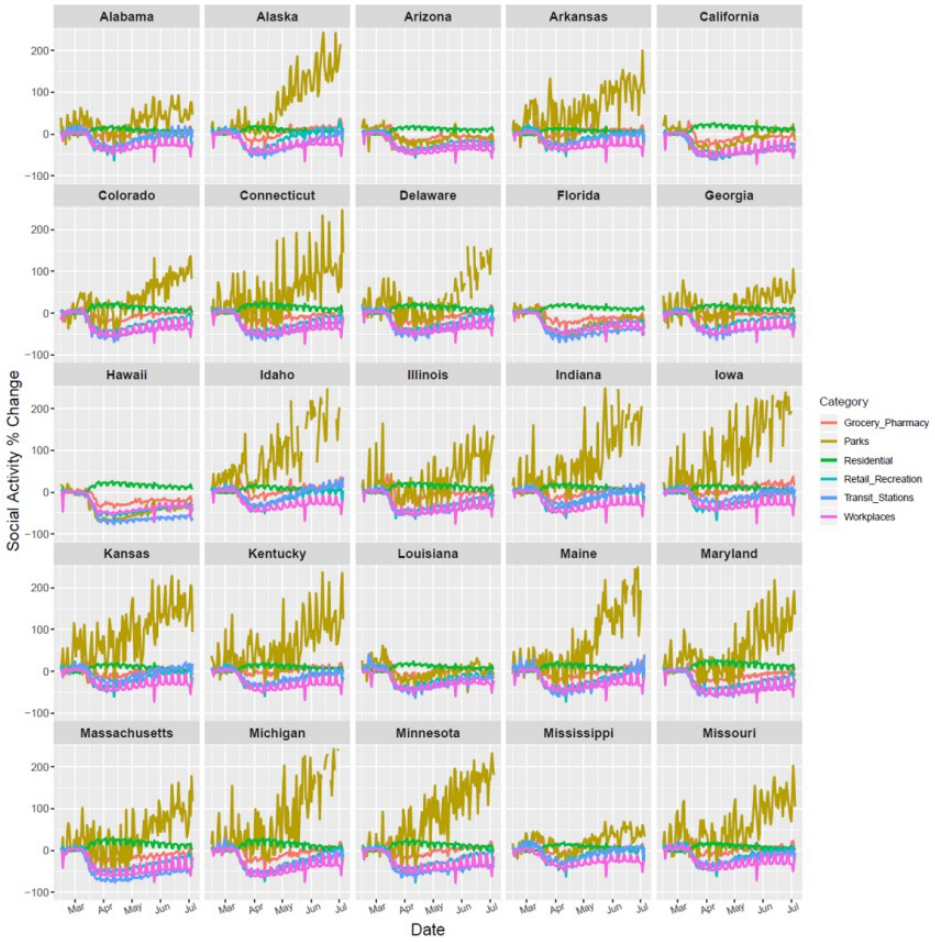
- Biotechnology: COVID-19: Second Wave Scenarios and Context From The Spanish Flu (17 Jun 2020)
- Biotechnology: COVID-19: Ongoing Spread Rather Than Increasing Tests Drives New Cases in Accelerating States (11 Jun 2020)
- Biotechnology: COVID-19: US Plateau In New Cases Raises Concern As Reopening Starts (8 May 2020)
- Biotechnology: COVID-19: When Do US States Meet Criteria For Phase One Reopening And What Are The Risks (23 Apr 2020)
- Biotechnology: COVID-19: Weekly Update To US State-Level Outbreak Models and Epidemiological Variables (17 Apr 2020)
- Biotechnology: COVID-19: US State-Level Modeling Confirms Long Tail, ~1.4M Total Cases (13 Apr 2020)
- Biotechnology: COVID-19: Detailed US State Level Epidemiological Variables and Comparison With Key Countries (13 Apr 2020)
- Biotechnology: COVID-19: A Prescription To Get The US Back To Work (3 Apr 2020)
- Biotechnology: Overview of Potential COVID-19 Therapies in Development (2 Apr 2020)

- Biotechnology: COVID-19: Updating US Forecast For Greater Spread, Potentially Worse Trajectory Than Italy (30 Mar 2020)
- Biotechnology: COVID-19 Cases Growing Faster Than Tests As US Capacity Is Still Too Low (29 Mar 2020)
- Biotechnology: COVID-19: New Detailed Italy Model Calls For Sustainable Decline In New Case Growth In ~10 Days (25 Mar 2020)
- Biotechnology: What's The Most Complete COVID-19 Dataset? (20 Mar 2020)
- Biotechnology: Introducing Two Key Epidemiologic Variables in Our COVID-19 Reports (17 Mar 2020)
- Gilead Sciences Inc.: Is Remdesivir A Market Catalyst? (17 March 2020)
- Moderna Inc: First Patient Dosed in COVID-19 Vaccine Trial (16 March 2020)
- Biotechnology: Potential U.S. COVID-19 Outbreak Dynamics (15 March 2020)
- Biotechnology: COVID-19 Outbreak Dynamics - An Update On Actuals Vs Our Model + New EU Countries (9 Mar 2020)
- Biotechnology: Current Status of COVID-19 Diagnostics (5 Mar 2020)
- Moderna Inc: COVID-19 Vaccine Patient Dosing Expected Soon (4 Mar 2020)
- Biotechnology: Key Takeaways From COVID-19 Expert Call (3 Mar 2020)
- Biotechnology: COVID-19 Potential Outbreak Dynamics - Using China As A Model (2 Mar 2020)
- Moderna Inc: Next Steps For COVID-19 Vaccine Development (1 Mar 2020)
- Biotechnology: COVID-19 Potential Therapeutic Options from Ongoing Clinical Trials (28 Feb 2020)

Individual plots for each region

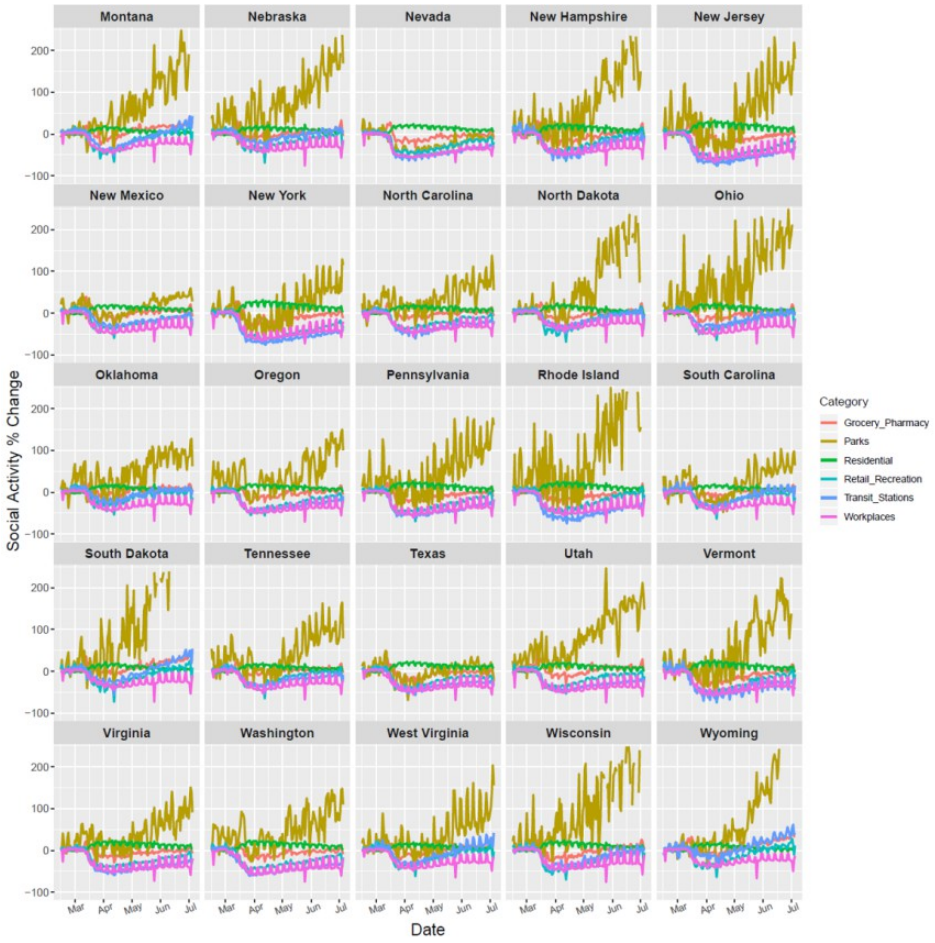
Mobility and economic indicators: We provide panel plots for each state in the US and each country that we are tracking below.

Exhibit 25: Google mobility data for each of the US States - (Part 1 of 2)



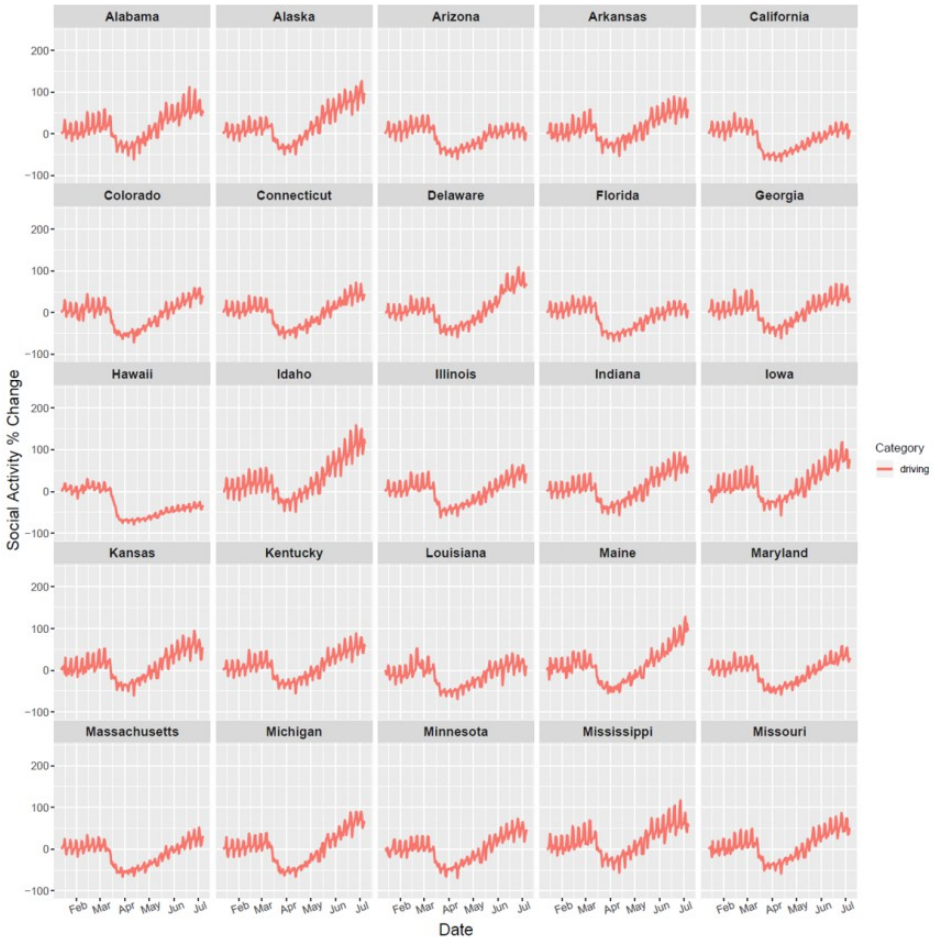
Source: Morgan Stanley Research, https://www.google.com/covid19/mobility/.

Exhibit 26: Google mobility data for each of the US states - (Part 2 of 2)



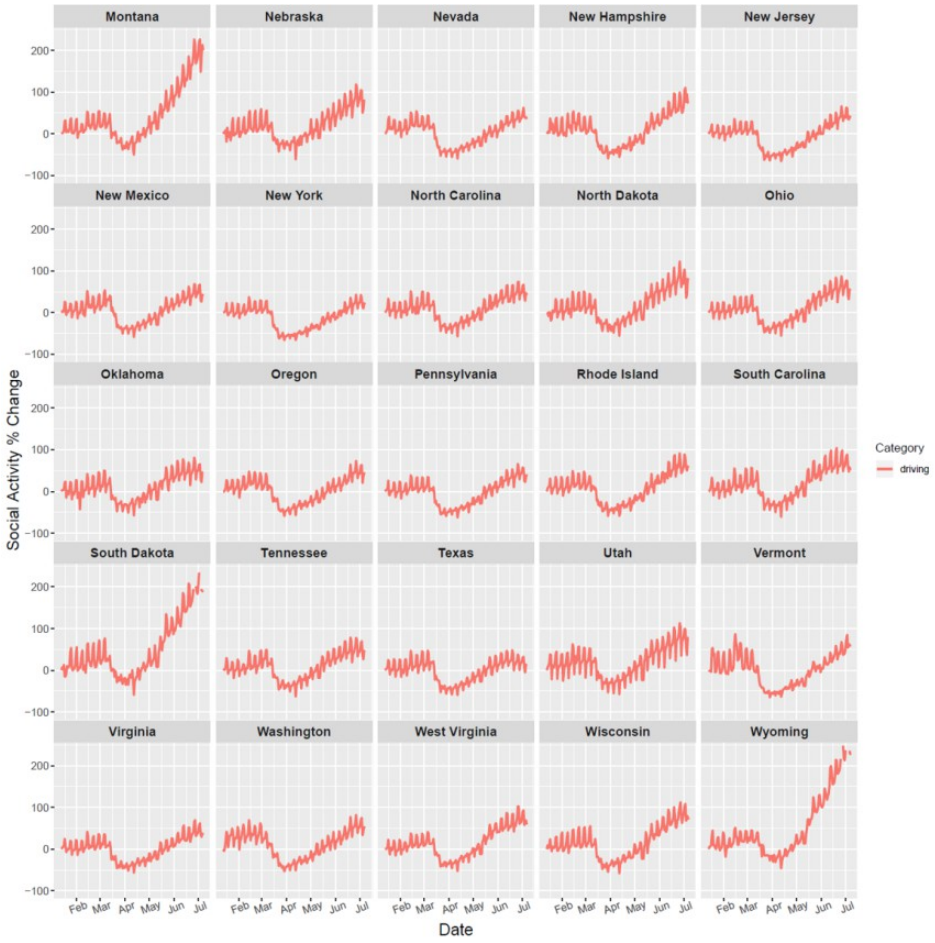
Source: Morgan Stanley Research, https://www.google.com/covid19/mobility/.

Exhibit 27: Apple mobility data for each of the US states - (Part 1 of 2)



Source: Morgan Stanley Research, https://www.apple.com/covid19/mobility.

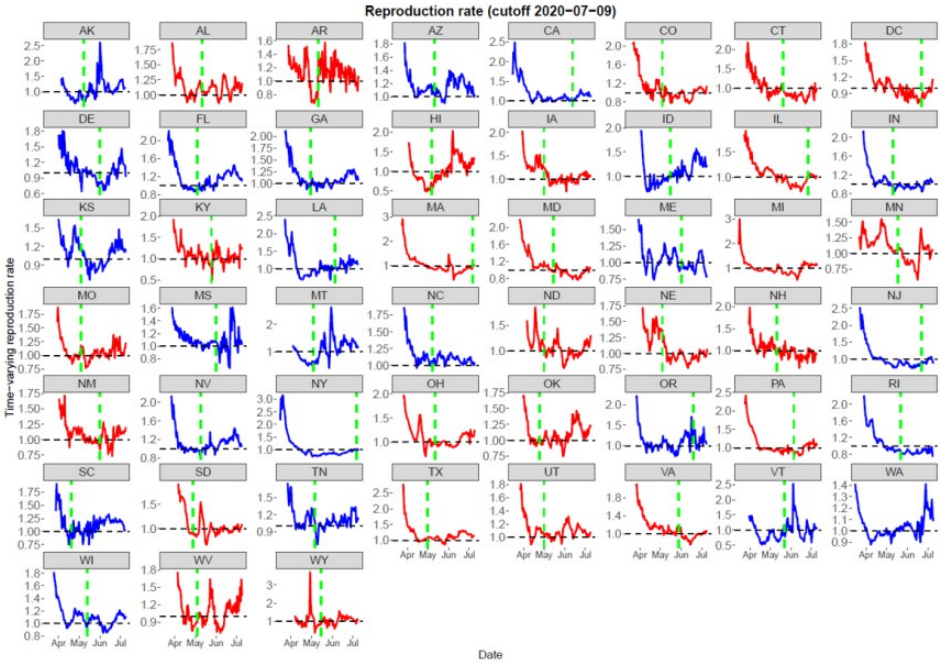
Exhibit 28: Apple mobility data for each of the US states - (Part 2 of 2)



Source: Morgan Stanley Research, https://www.apple.com/covid19/mobility.

Time-varying reproduction rate: In blue are the states wherein R follows a downward trend, while in red we illustrate the states wherein the slope of R over the past 5 days is positive. A positive slope in R is indicative of an R value that is overall trending upward implying acceleration of the spread and potentially a second wave of infections. The green vertical line reflects the opening date of the state.

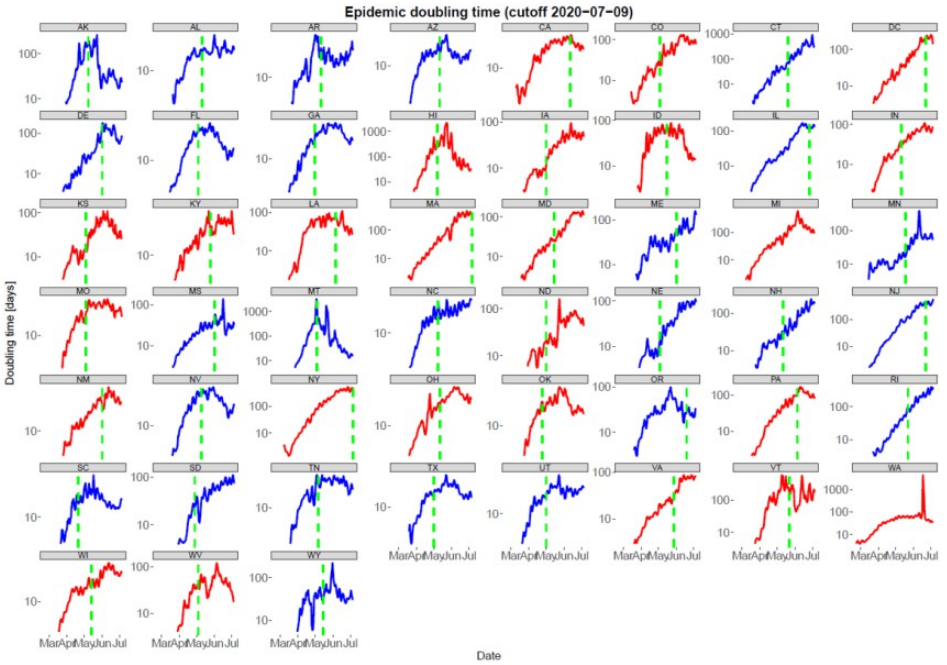
Exhibit 29: Time varying reproduction rate for the US states. The dashed black line represents R value equal to 1 (containment of the spread).



Source: Morgan Stanley, The COVID Tracking Project

Epidemic doubling time: In blue are states wherein the doubling time follows an upward trend, while in red we illustrate the states wherein the slope of the doubling time over the past 10 days has been negative. A negative slope in doubling time is indicative of a doubling time value that is overall trending downward suggesting acceleration of the spread (number of cases doubles faster) and potentially a second wave of infections. Note that the epidemic doubling time is characterized by high variability and it should, therefore, be used with other metrics.

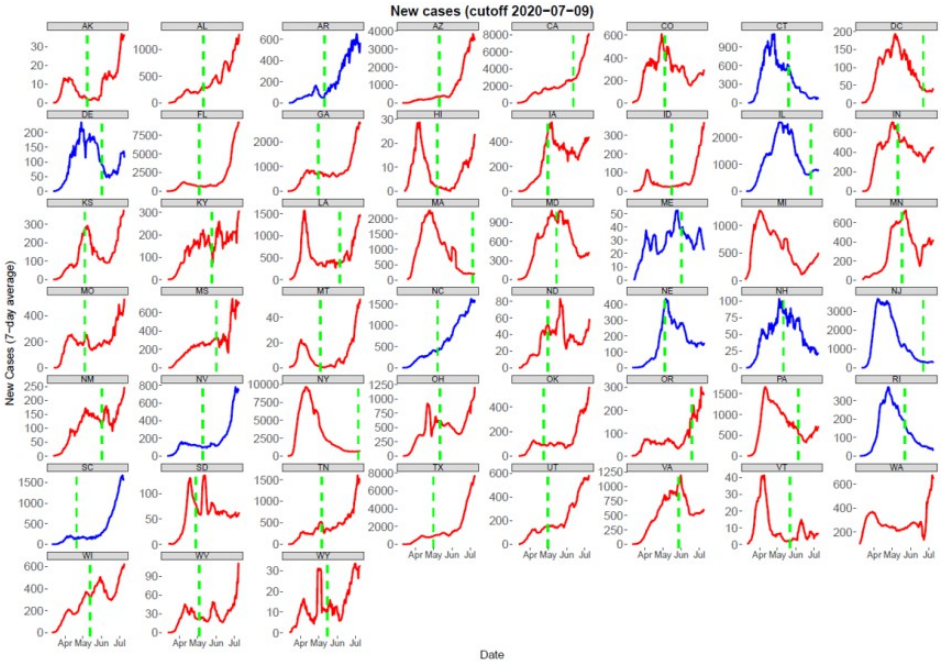
Exhibit 30: Epidemic doubling time for the US states.



Source: Morgan Stanley, The COVID Tracking Project

New cases: In blue are the states wherein the number of new cases follows a downward trend, while in red we illustrate the states wherein the slope of the new cases over the past 7 days has been positive. A positive slope in new cases is indicative of spread acceleration and potentially a second wave of infections. The green vertical line reflects the opening date of the state.

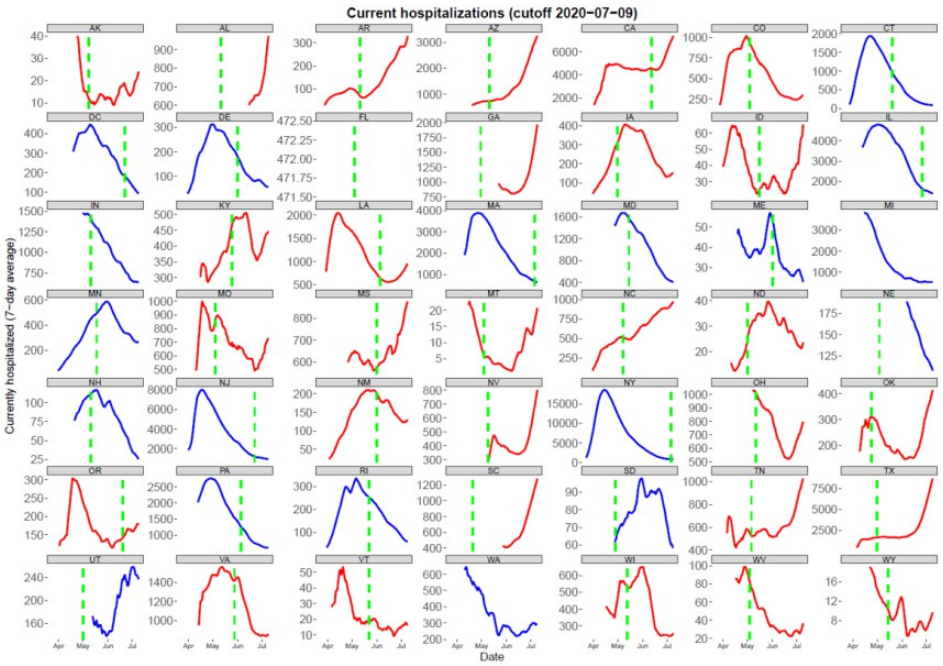
Exhibit 31: Number of new cases for all US states.



Source: Morgan Stanley, The COVID Tracking Project

Number of current hospitalizations: In blue are the states wherein the number of hospitalized patients follows a downward trend, while in red we illustrate the states wherein the slope of the hospitalized patients over the past 7 days has been positive. A positive slope in hospitalized patients may be indicative of spread acceleration and potentially a second wave of infections. The green vertical line reflects the opening date of the state.

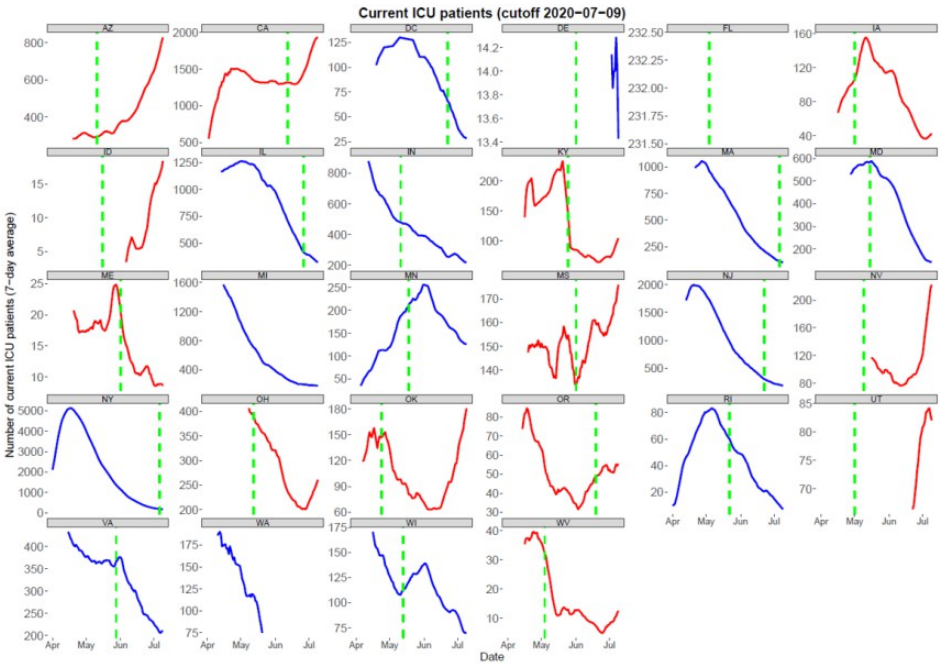
Exhibit 32: Number of current hospitalizations for certain US states.



Source: Morgan Stanley, The COVID Tracking Project

Number of patients in ICU: In red we show states with increasing number of ICU patients over the past 7 days. The green vertical line reflects the opening date of the state.

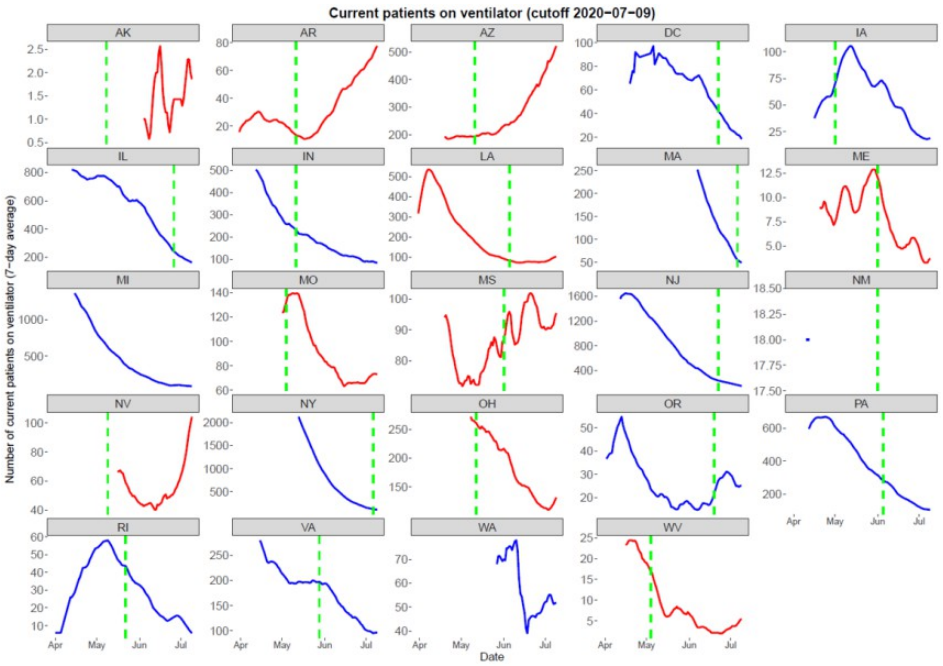
Exhibit 33: Number of patients in ICU for certain US states.



Source: Morgan Stanley, The COVID Tracking Project

Number of patients on ventilator: In red we show states with increasing number of patients on ventilator over the past 7 days. The green vertical line reflects the opening date of the state.

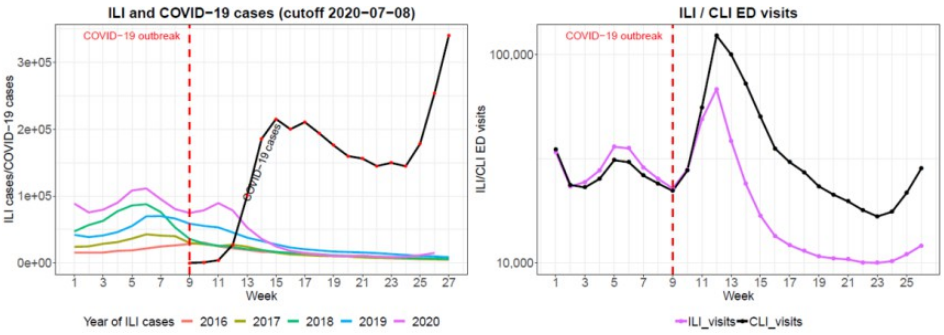
Exhibit 34: Number of patients on ventilator for certain US states.



Source: Morgan Stanley, The COVID Tracking Project

Cases of Influenza-like illness (ILI), COVID-19-like illness (CLI) and pertinent ED visits: Exhibit 14 illustrates weekly ILI data in the US during 2016-2020 (left panel) and ED visits related to ILI or COVID-like illness (CLI, right panel). We highlight that following many weeks of a downward trend, for the first time we see both the ILI cases (left) as well as the ILI/CLI ED visits to exhibit a trend upwards over the past two weeks. This change is in line with the recent increase we saw in the number of cases (left panel, week 24) and we will continue to monitor the ILI/CLI cases for interesting trends.

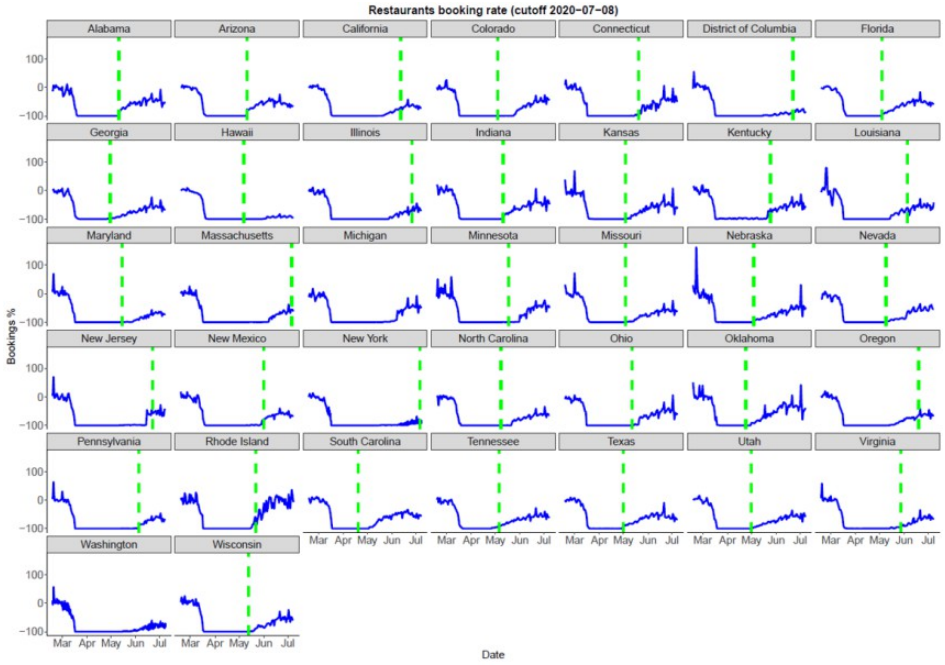
Exhibit 35: ILI and COVID-19 cases (left) and Emergency Department visits related to ILI and COVID-like illness (CLI) (right) in the US.



Source: Morgan Stanley, COVIDView, ILINet, Johns Hopkins CSSE.

Restaurant reservation rates: Broadly, unlike the closed states (plots without a green vertical line), in open states we see an overall increasing trend in the bookings rates which reflects the activity of the reopening.

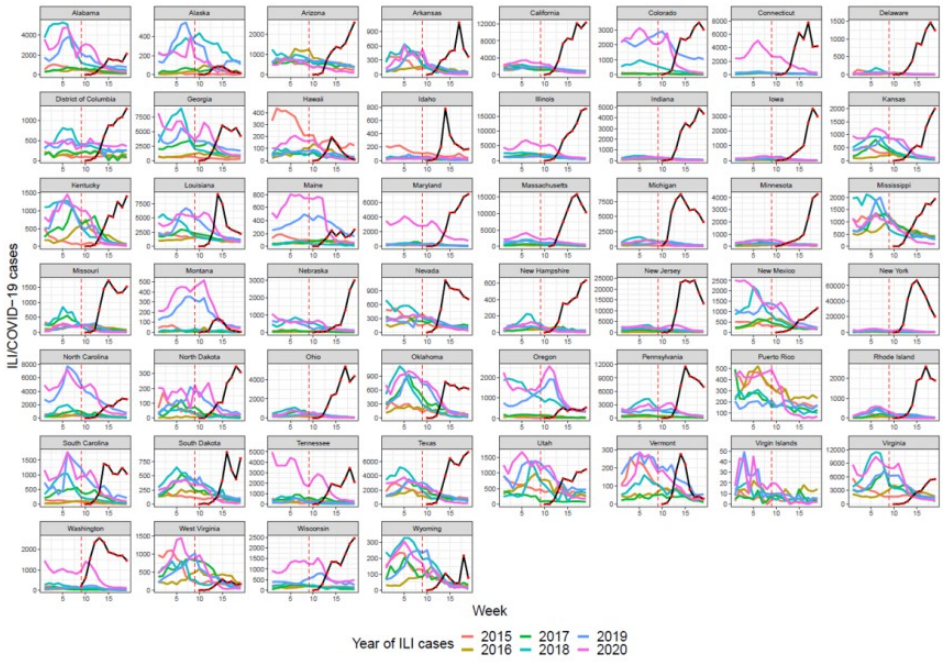
Exhibit 36: Restaurant reservation rates in each state. The green vertical line reflects the opening date of the state.



Source: Morgan Stanley Research, OpenTable.

State-level ILI data: Broadly, unlike the closed states (plots without a green vertical line), in open states we see an overall increasing trend in the bookings rates which reflects the activity of the reopening.

Exhibit 37: ILI cases from 2015-2020 (different colors) vs COVID-19 cases (black color). The red dashed line (vertical) represents the timing of the COVID-19 outbreak.

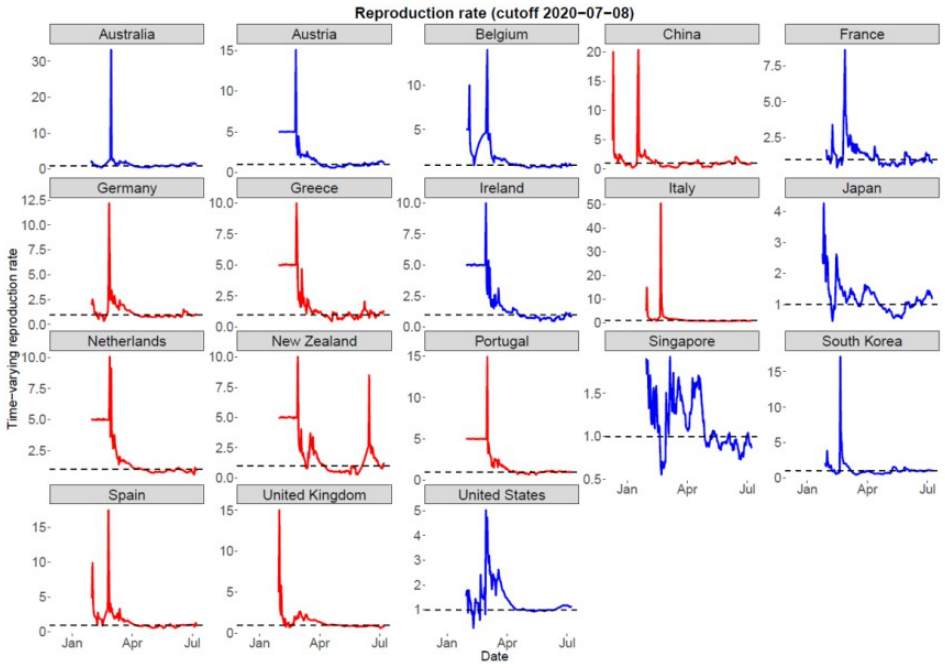


Source: Morgan Stanley, COVIDView, ILINet, Johns Hopkins CSSE.

Data from Outside the US

Time-varying reproduction rate: In blue are the countries wherein R follows a downward trend, while in red we illustrate the countries wherein the slope of R over the past 5 days has been positive. A positive slope in R is indicative of an R value that is overall trending upward implying acceleration of the spread and potentially a second wave of infections.

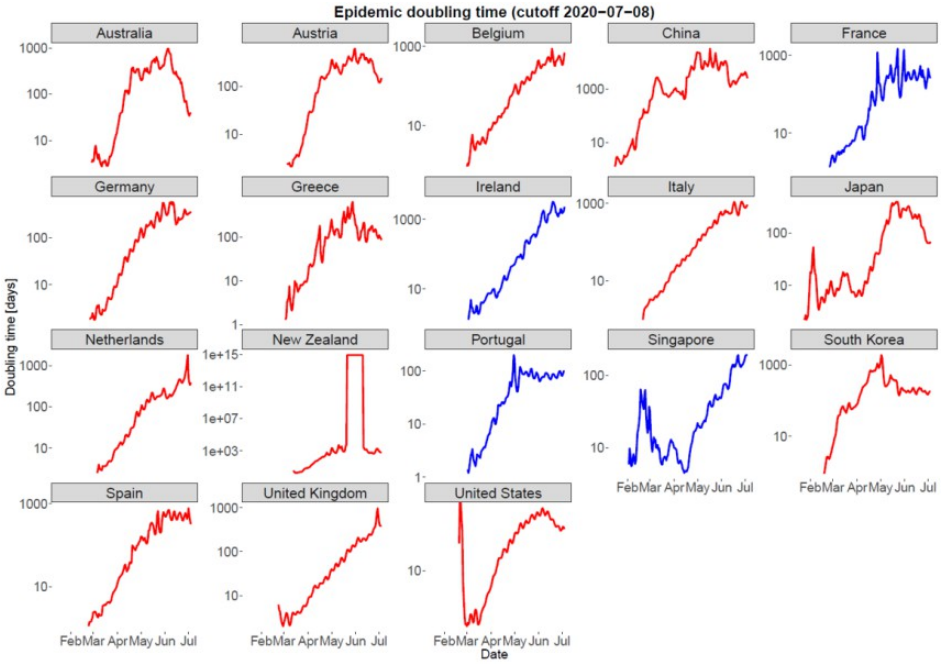
Exhibit 38: Time-varying effective reproduction number.



Source: Morgan Stanley Research, JHU CSSE, NY Times Github.

Epidemic doubling time: Countries shown in red represent countries wherein the doubling time has a decreasing trend (i.e. rate of increase in cases is raising) over the past 10 days. We note that the doubling time is highly variable and, therefore, should be used in combination with other metrics.

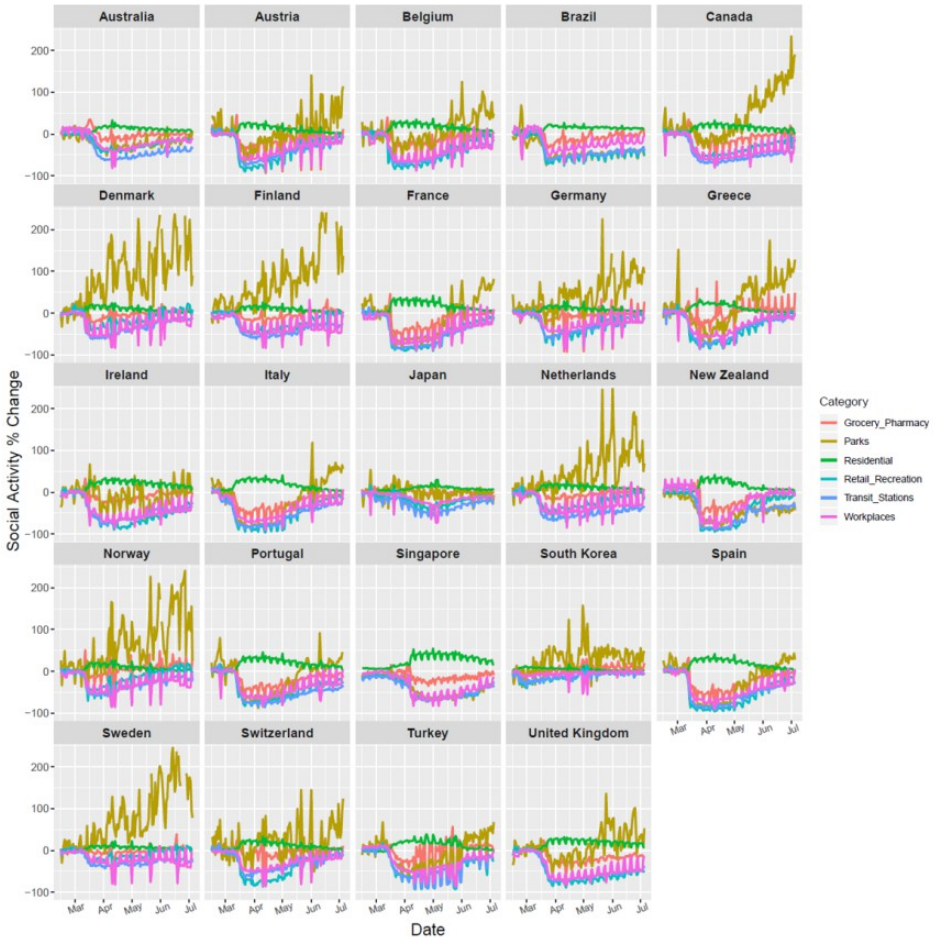
Exhibit 39: Epidemic doubling time for various countries.



Source: Morgan Stanley, The COVID Tracking Project, Johns Hopkins CSSE.

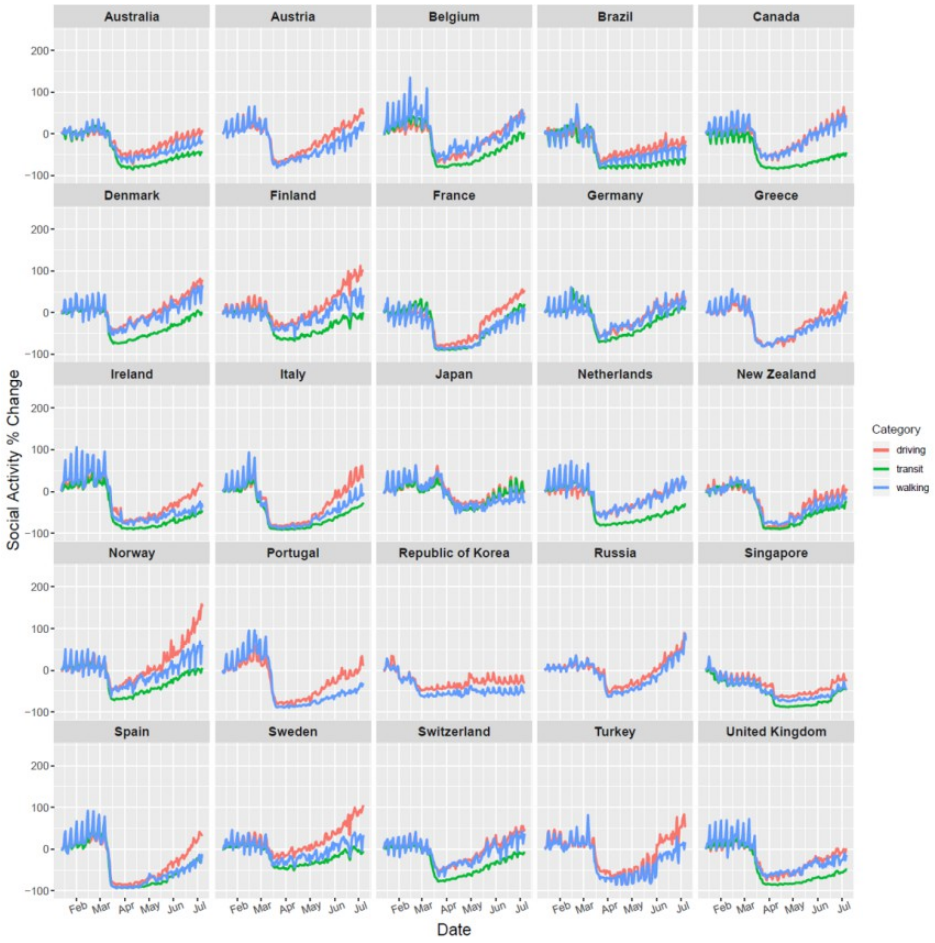
Apple and Google Mobility Data

Exhibit 40: Google mobility data for other countries



Source: Morgan Stanley Research, https://www.google.com/covid19/mobility/.

Exhibit 41: Apple mobility data for other countries

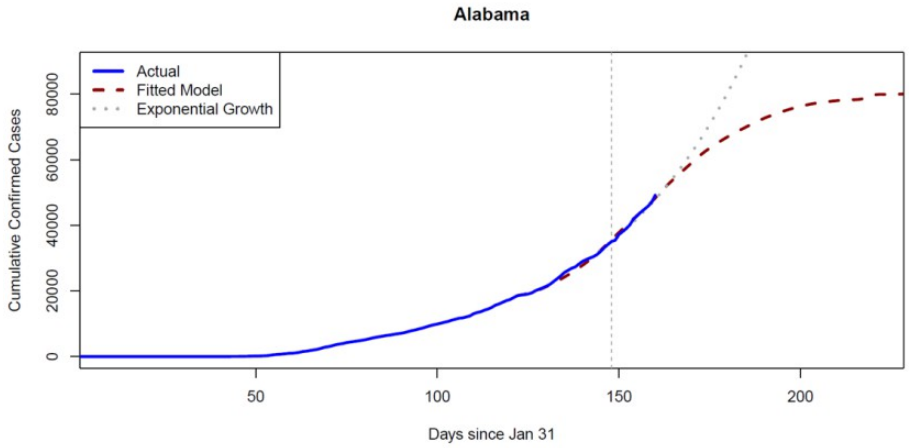


Source: Morgan Stanley Research, https://www.apple.com/covid19/mobility.

Tracking models for all states in the US

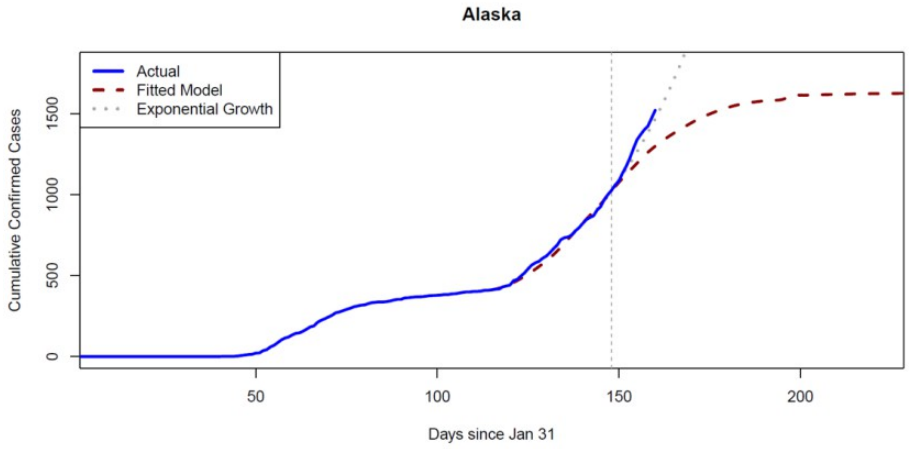
Our prediction on total confirmed infections stands at 3.8M (as of 6/27). We provide static models to track the dynamics in each states against our prediction during the past a couple of weeks. The dashed grey vertical line indicates when the models were built. We add an exponential growth curve (dotted grey) as a reference based on data 7 days before 6/27. The incremental actual data are plotted against the static models starting from 6/28 to inform if and when the trends are broken.

Exhibit 42:



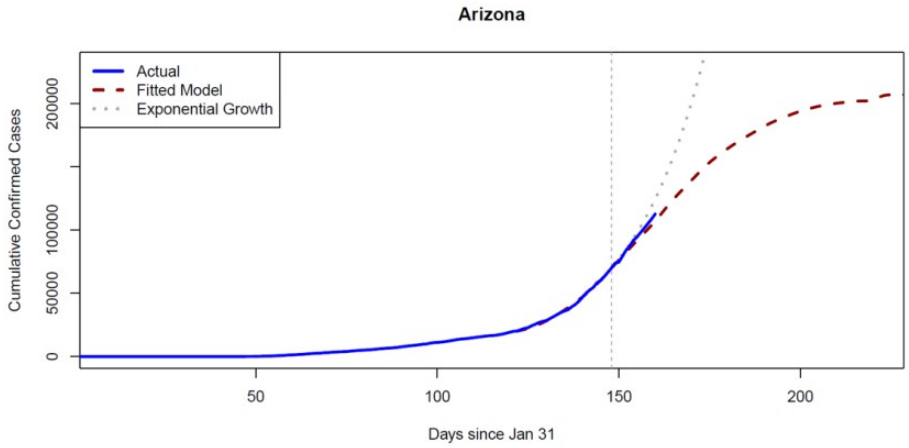
Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

Exhibit 43:



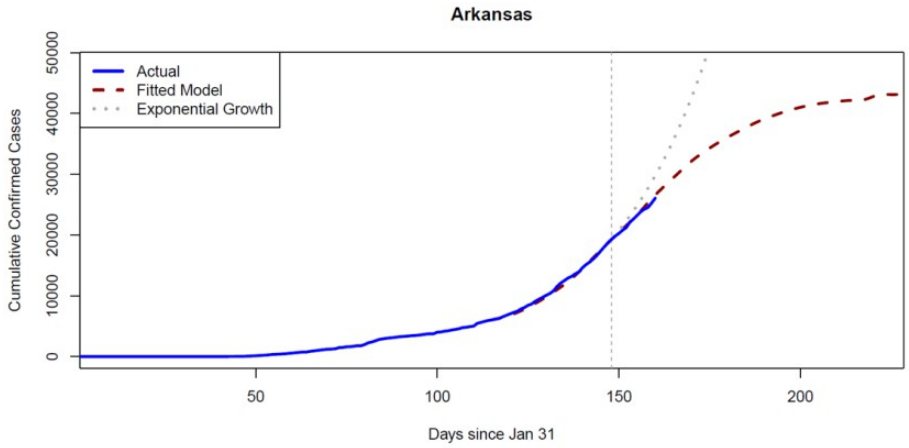
Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

Exhibit 44:



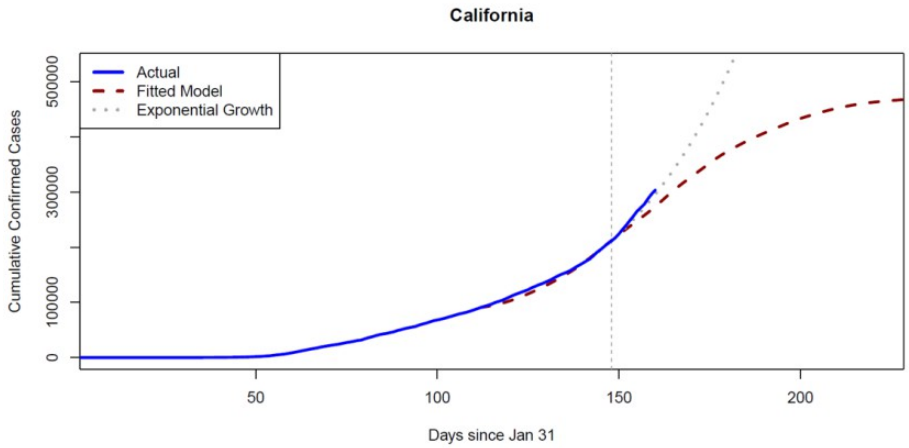
Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

Exhibit 45:



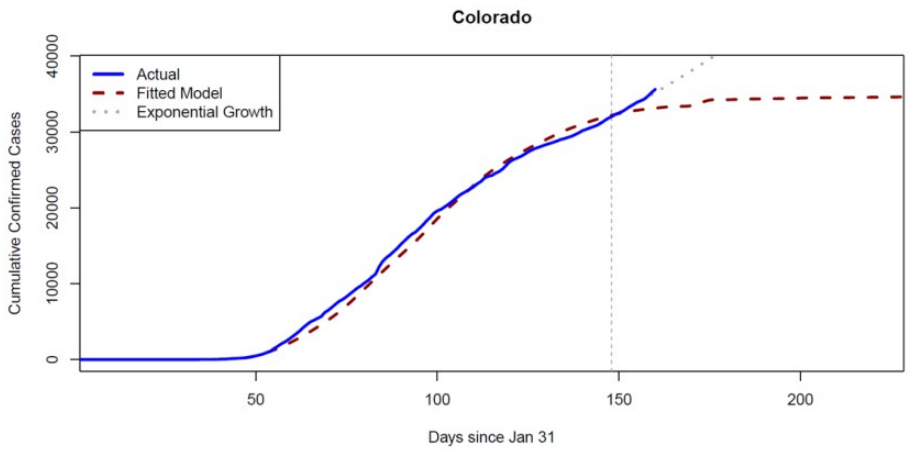
Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

Exhibit 46:



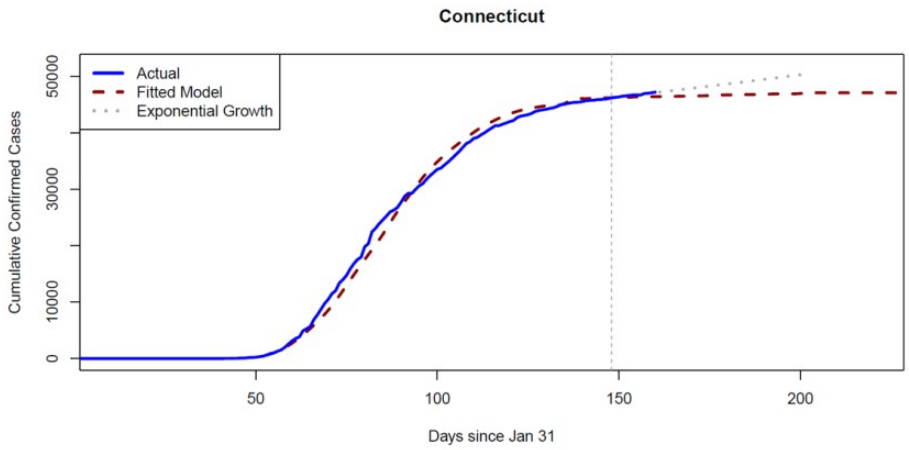
Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

Exhibit 47:



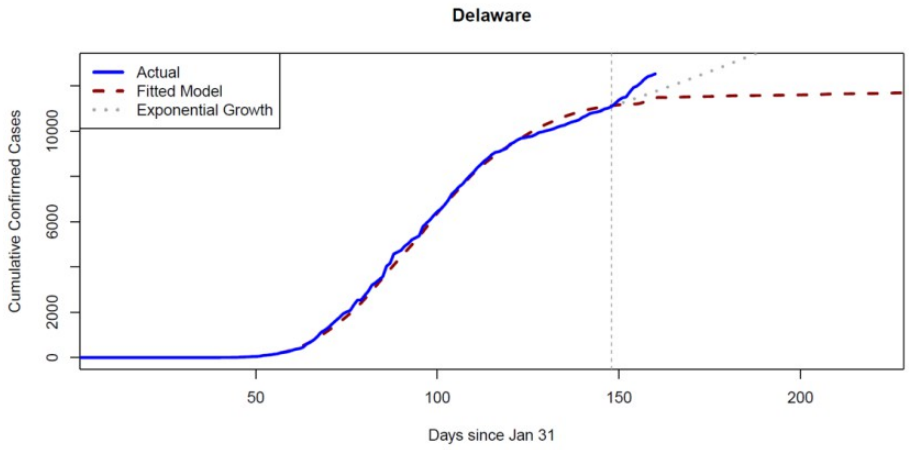
Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

Exhibit 48:



Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

Exhibit 49:



Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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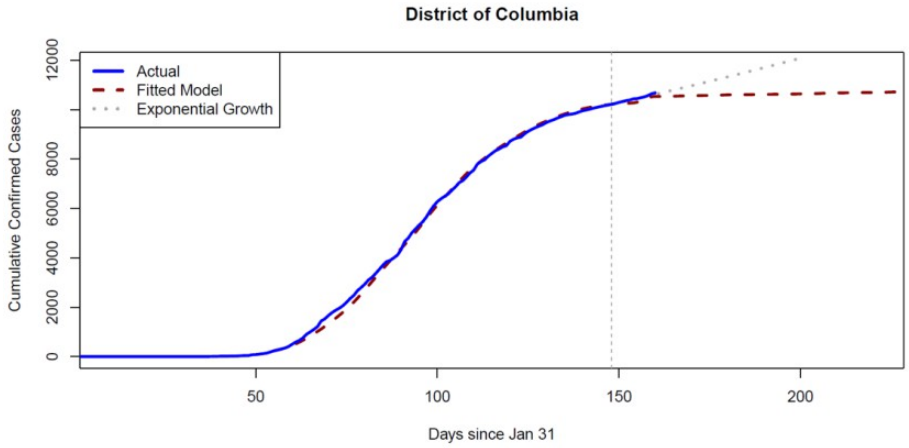

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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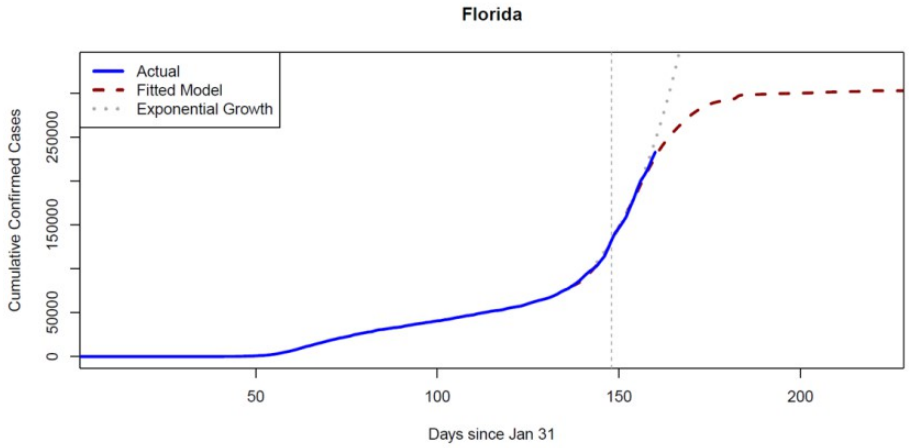

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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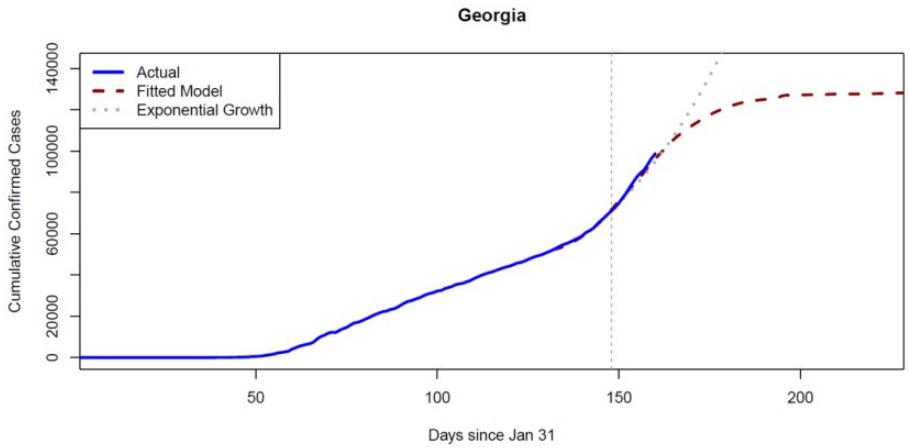

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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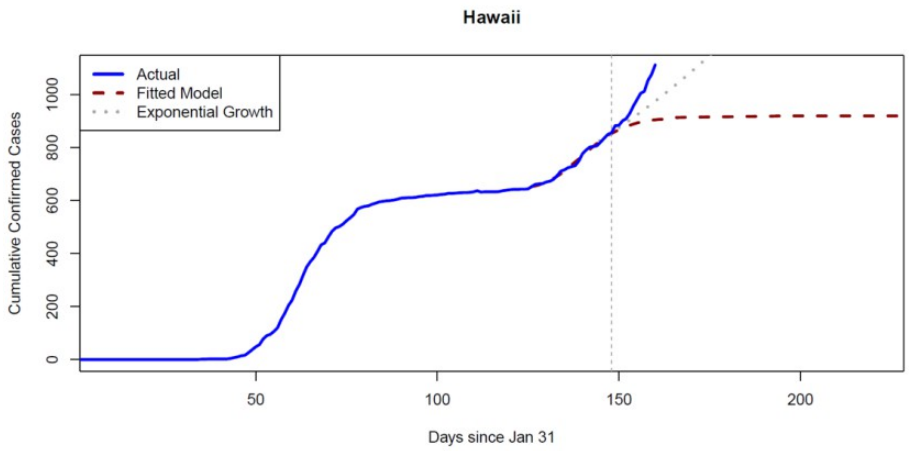

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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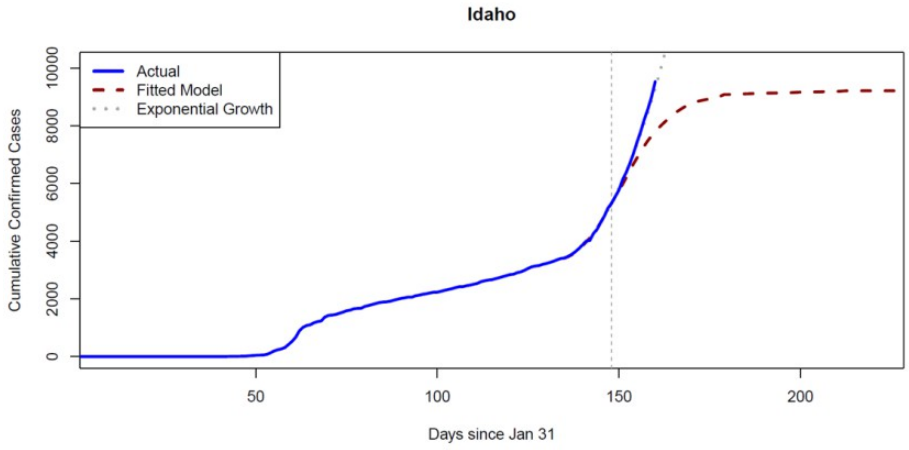

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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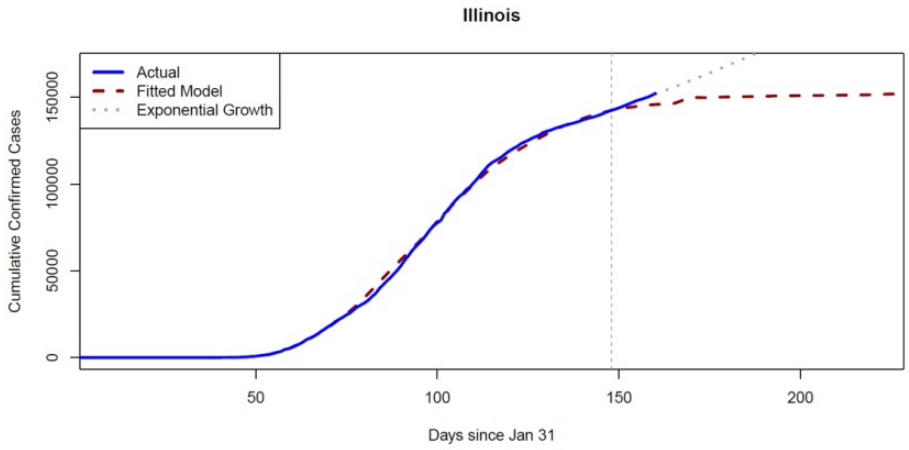

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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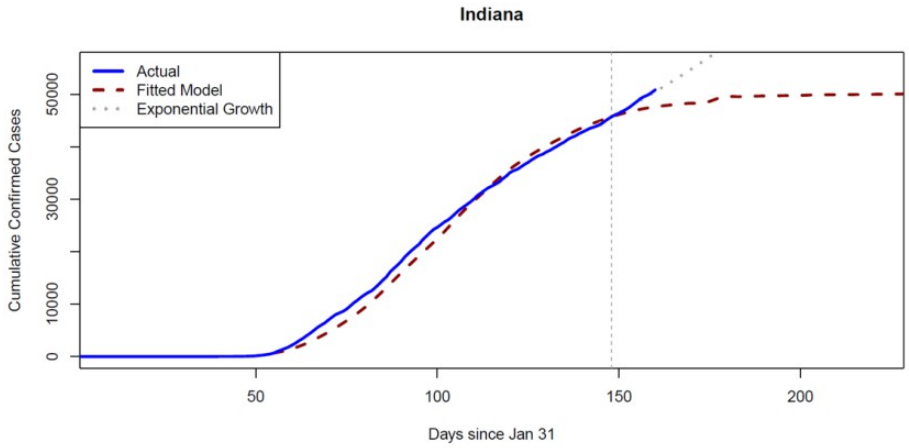

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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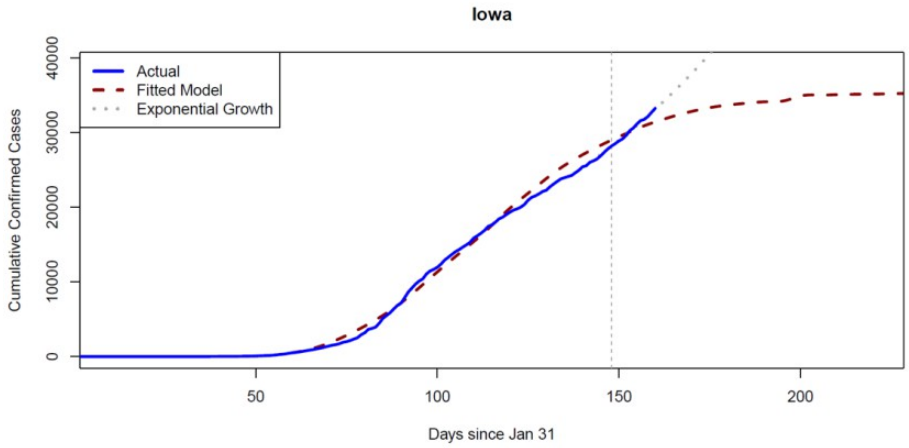

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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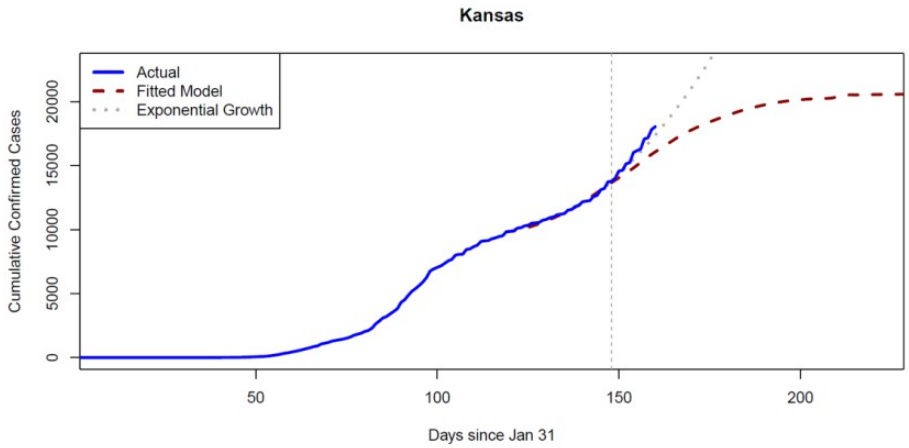

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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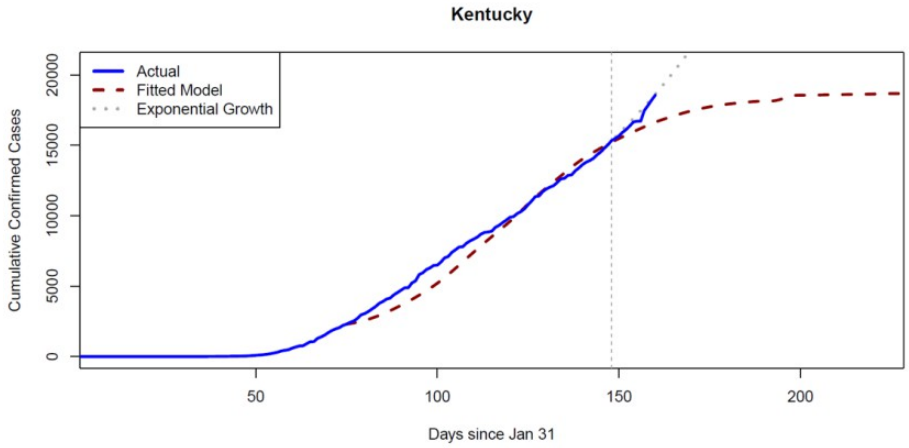

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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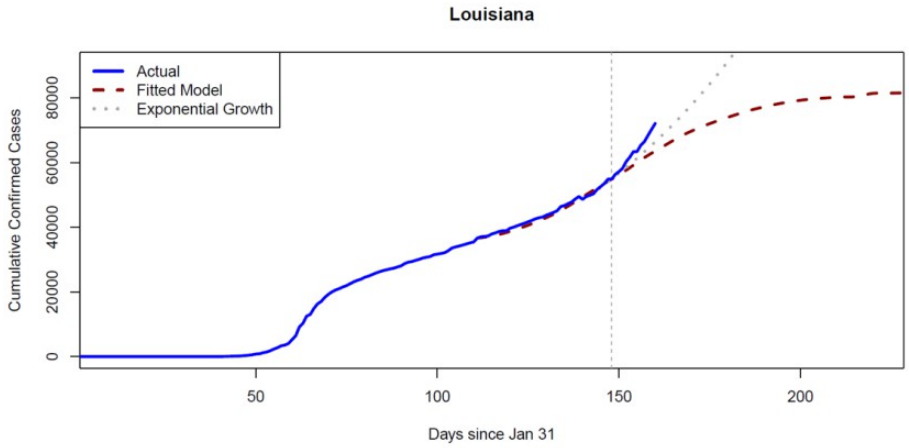

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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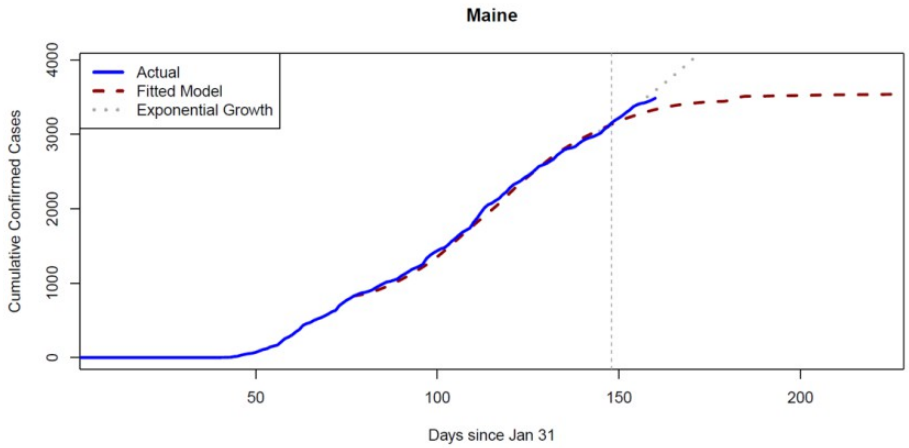

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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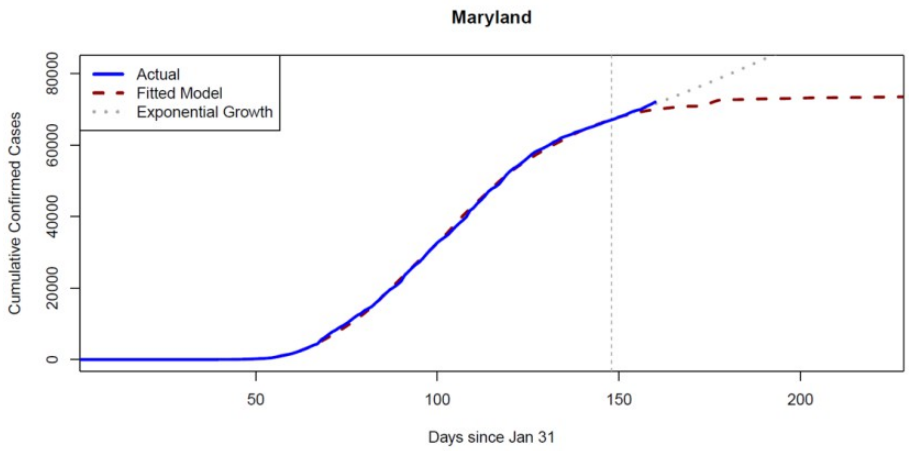

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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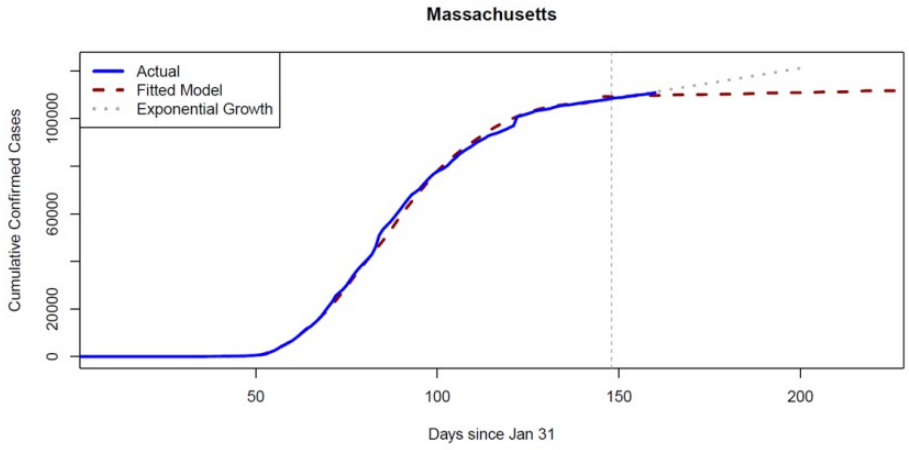

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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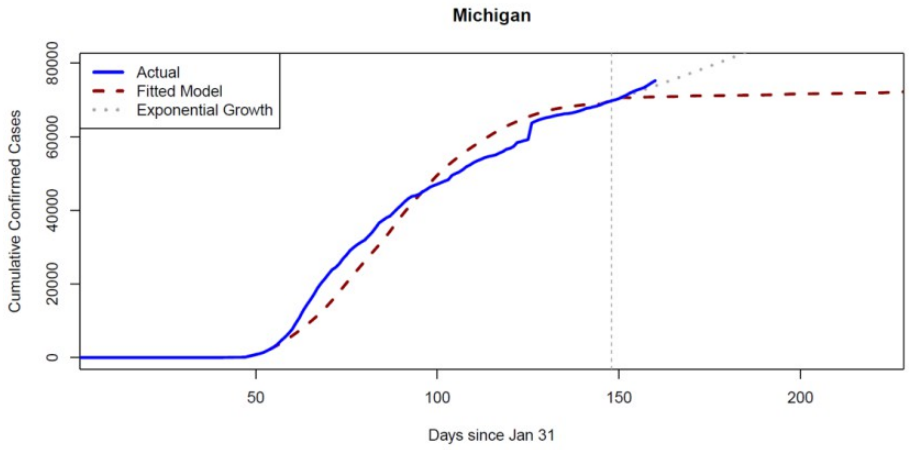

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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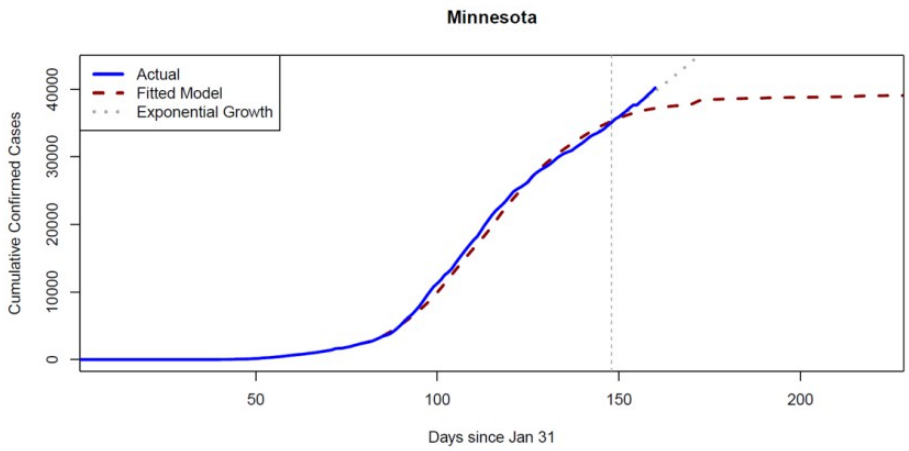

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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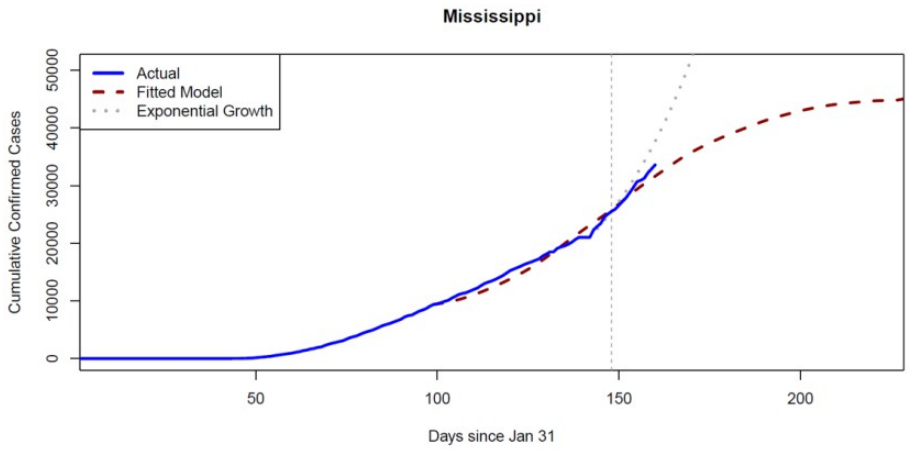

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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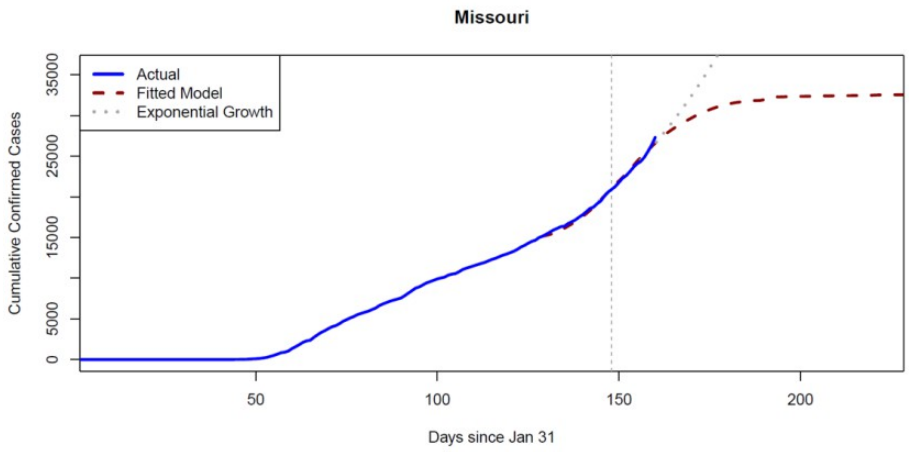

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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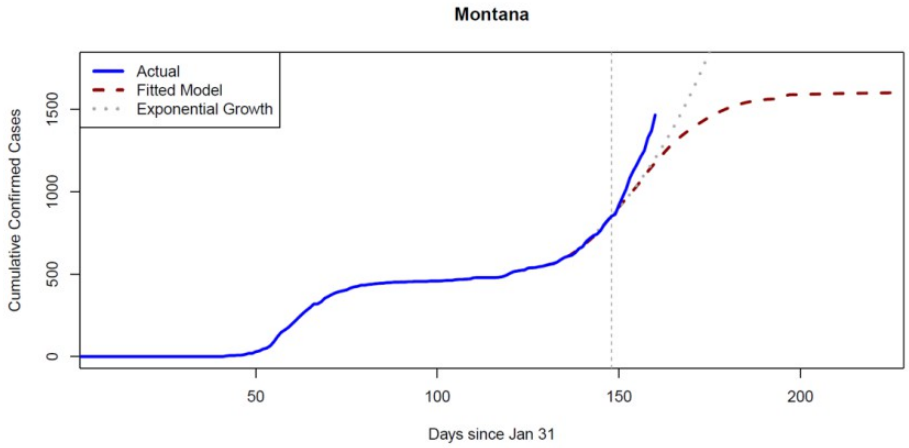

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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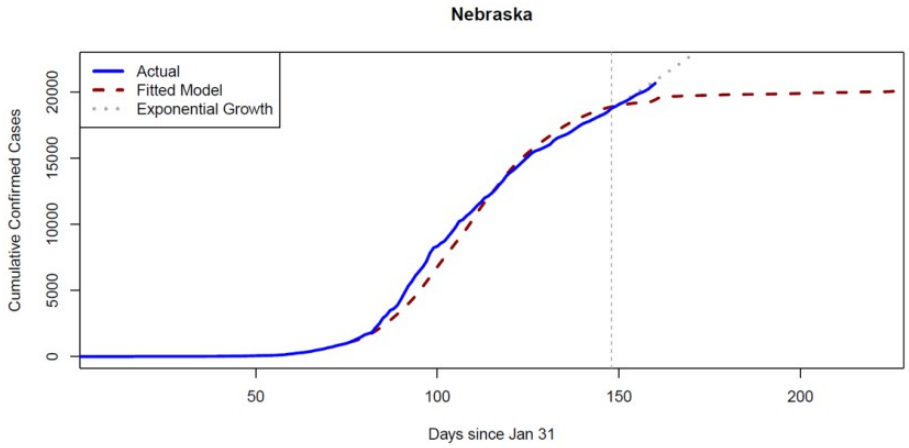

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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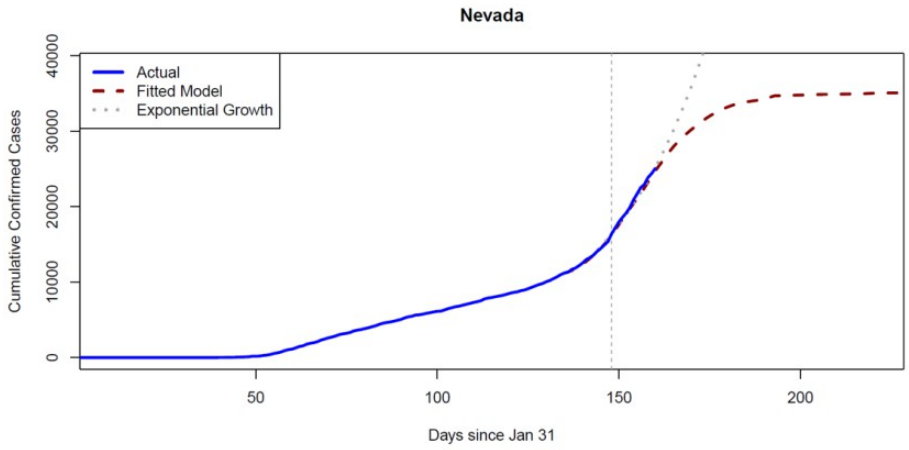

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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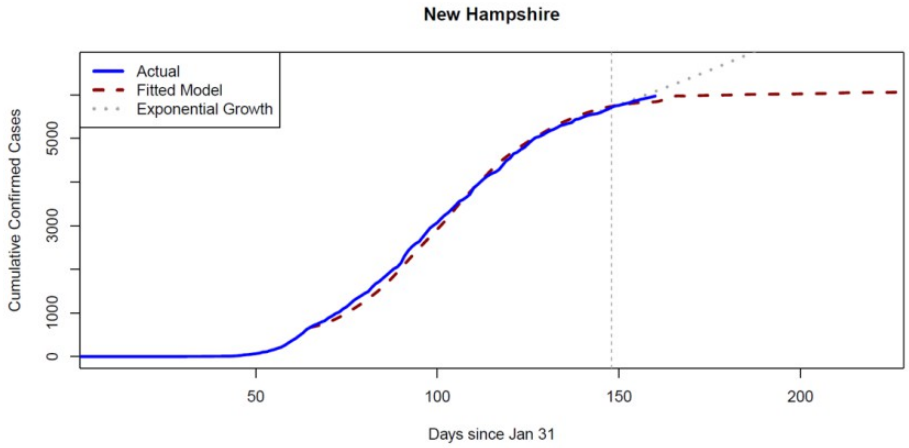

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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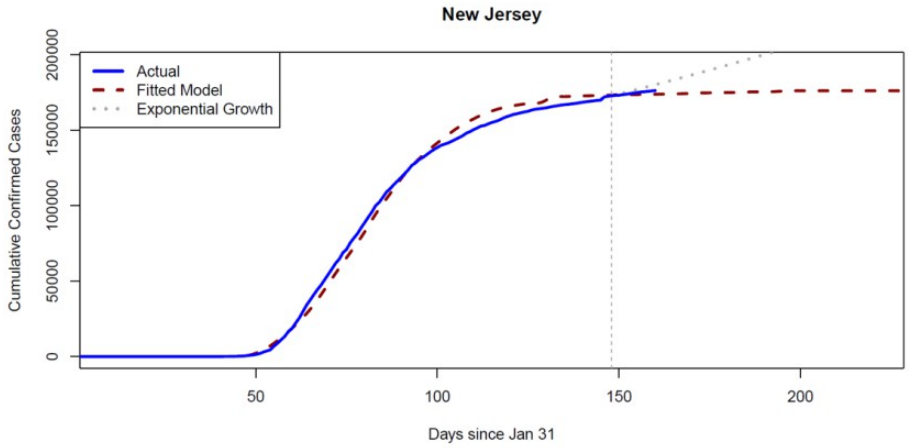

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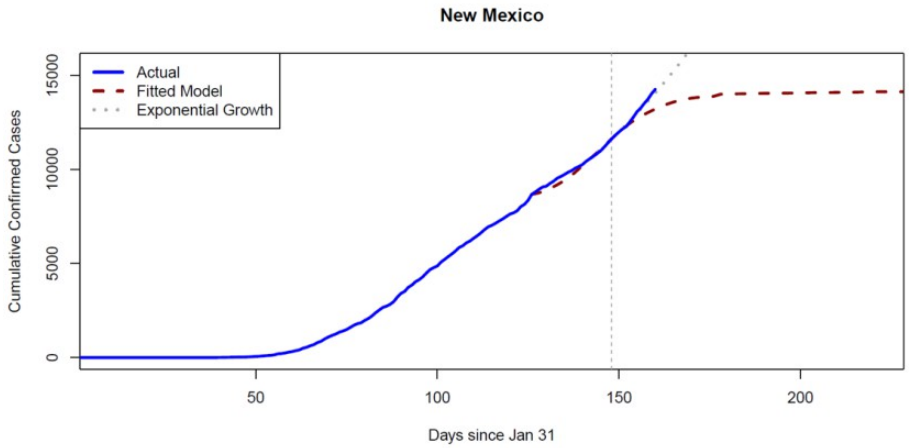

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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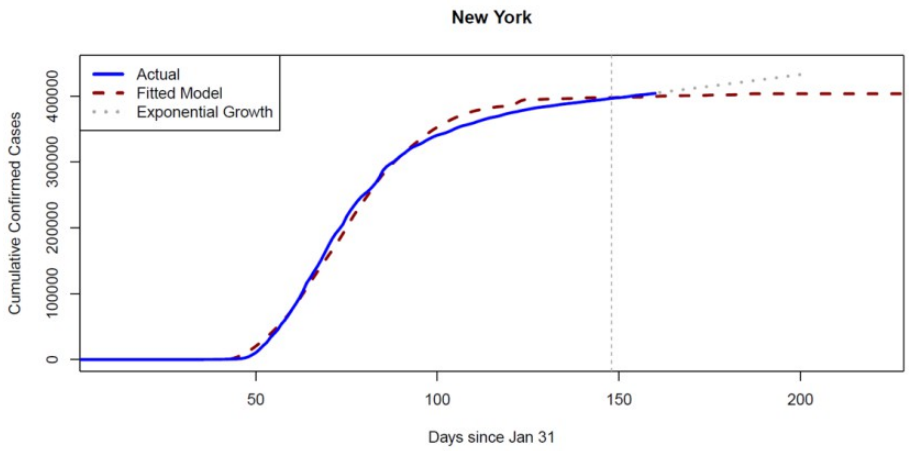

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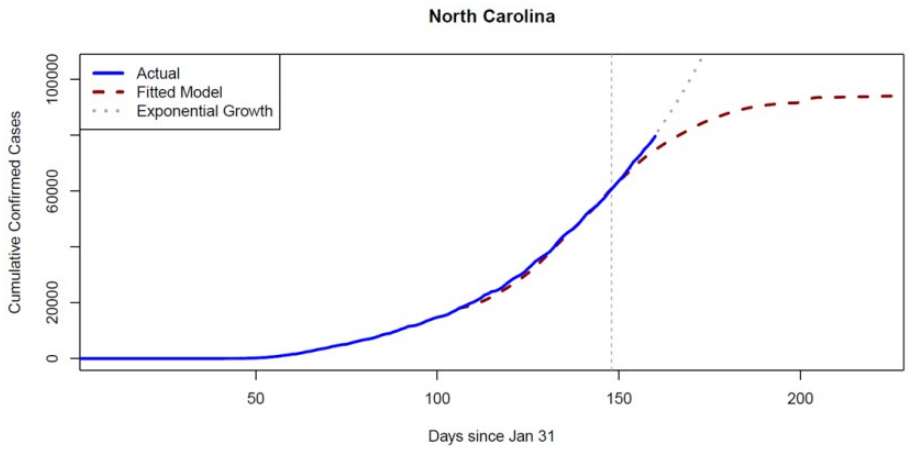

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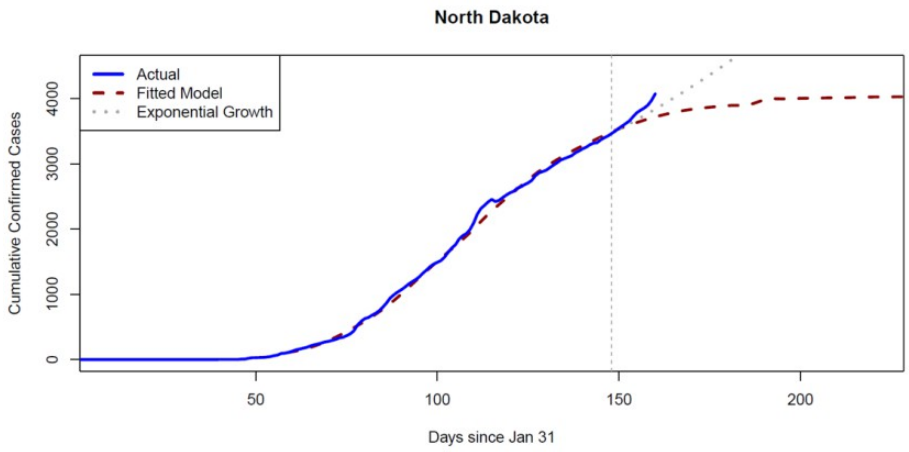

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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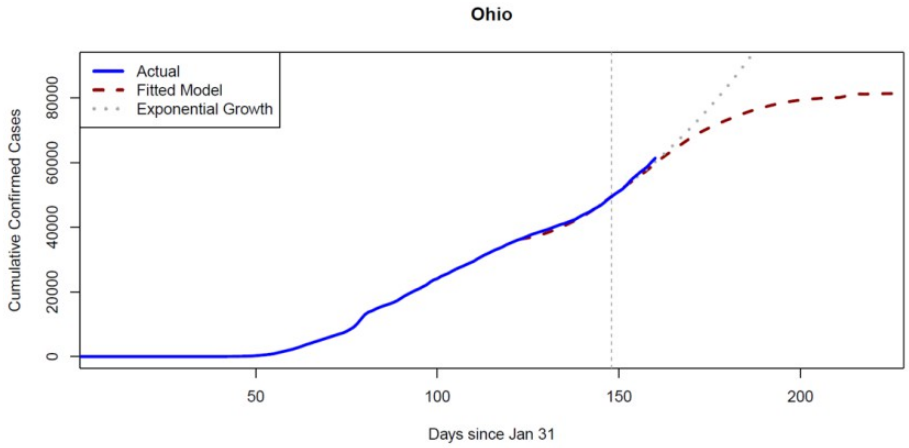

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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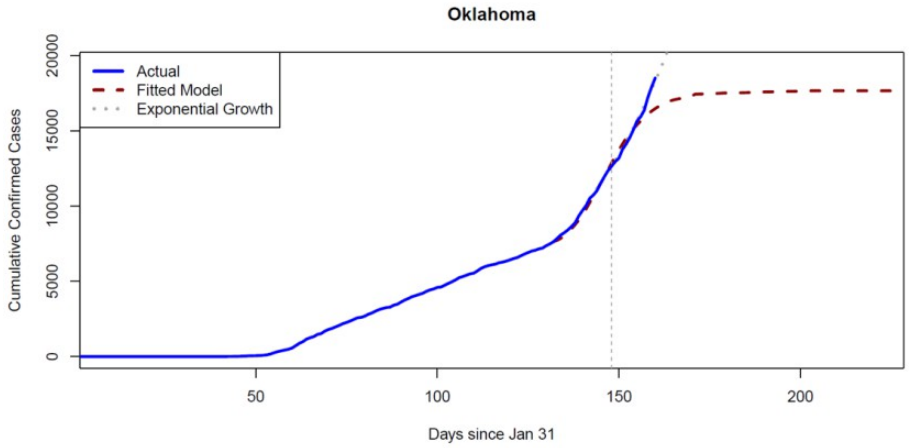

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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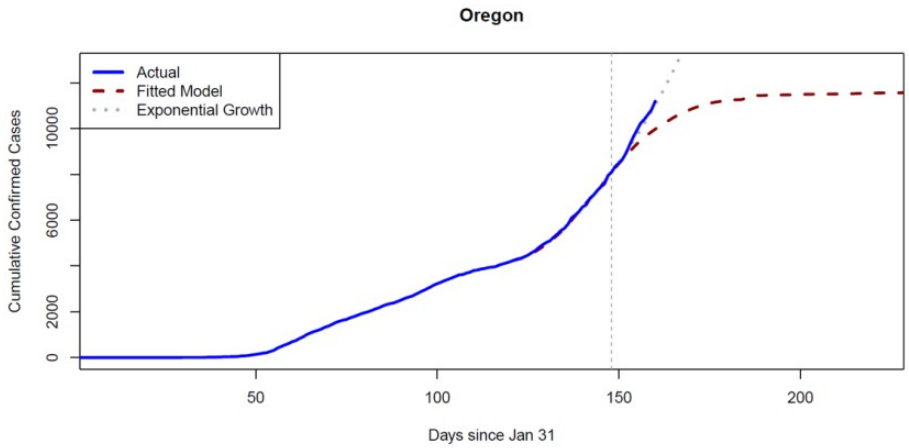

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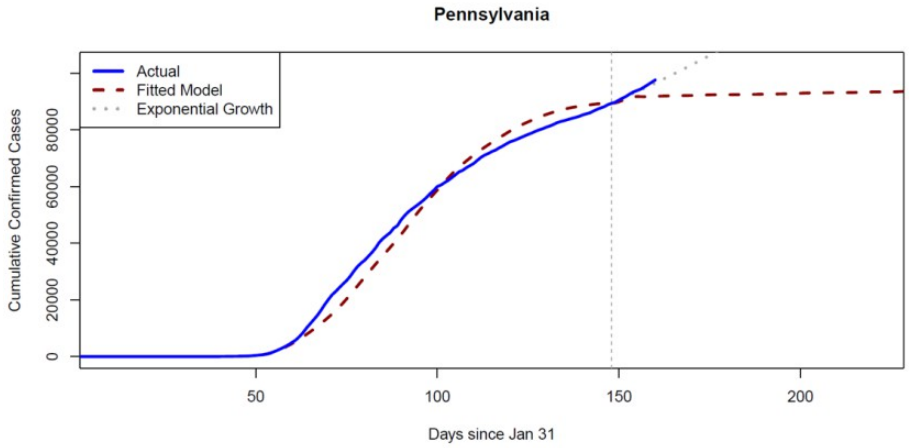

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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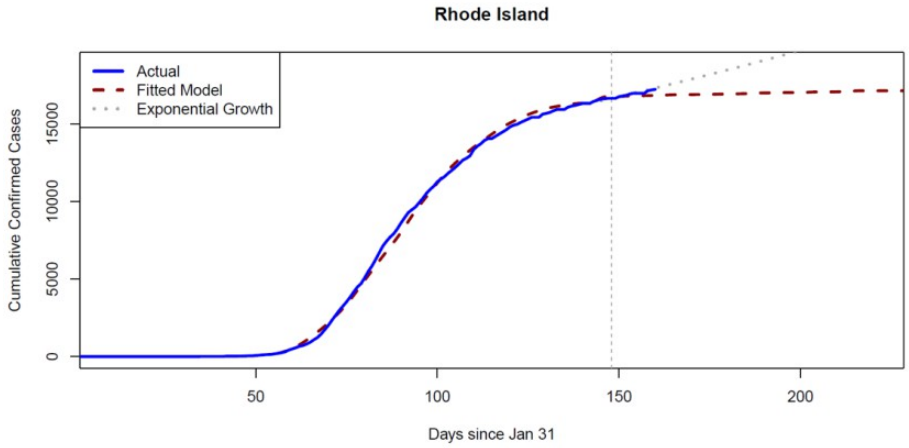

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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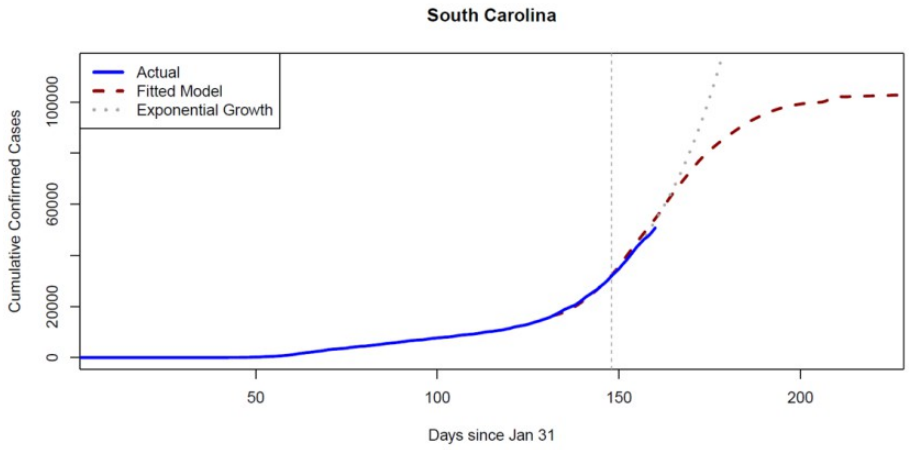

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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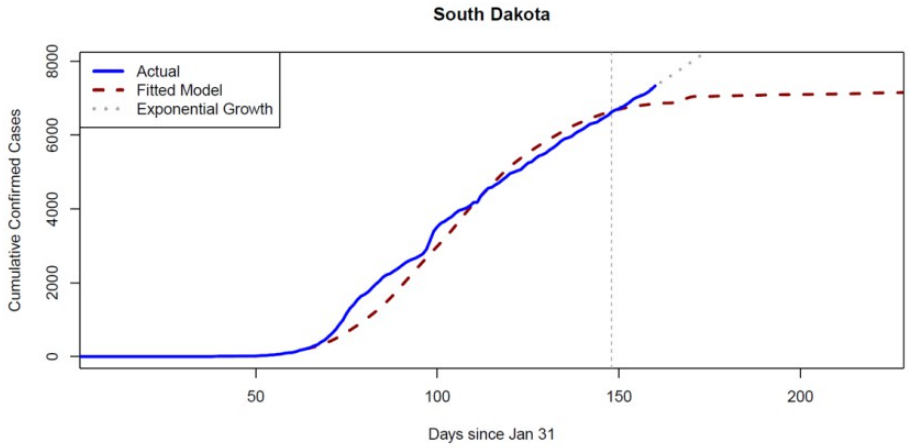

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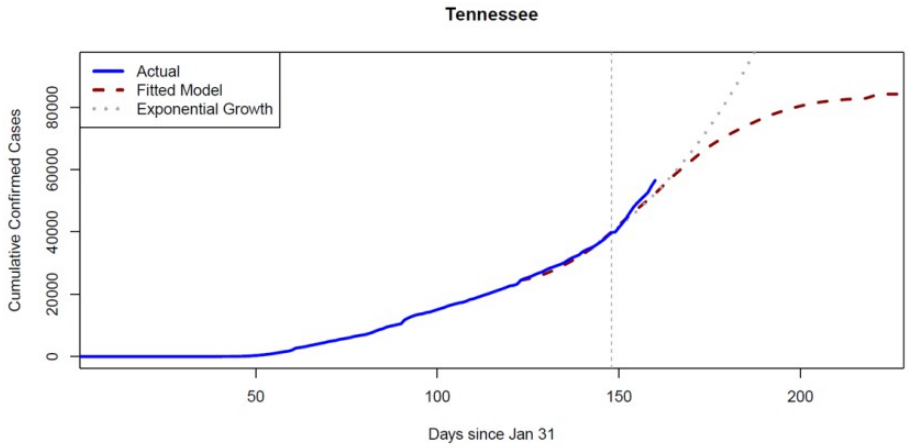

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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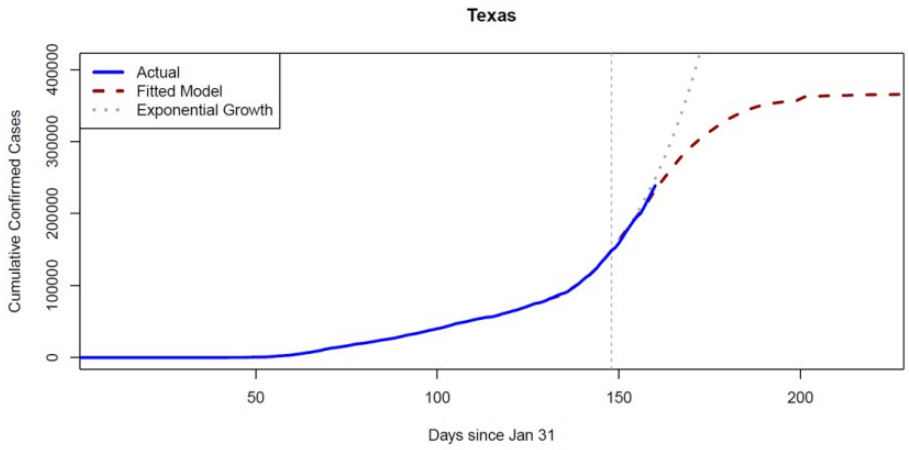

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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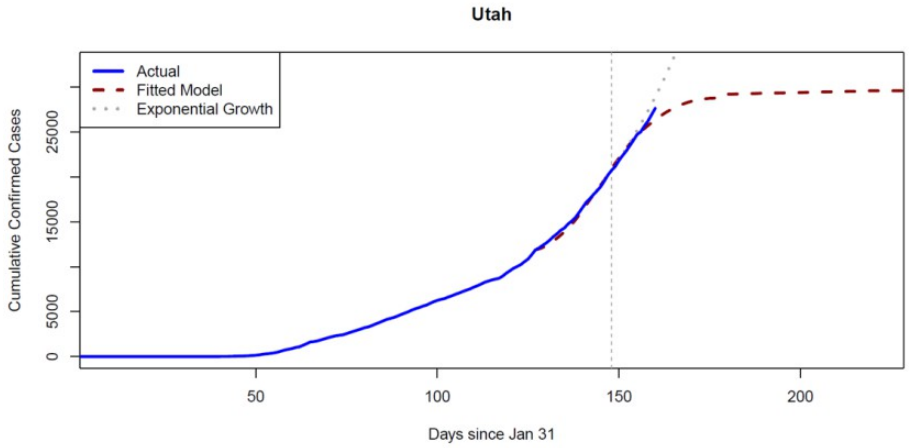

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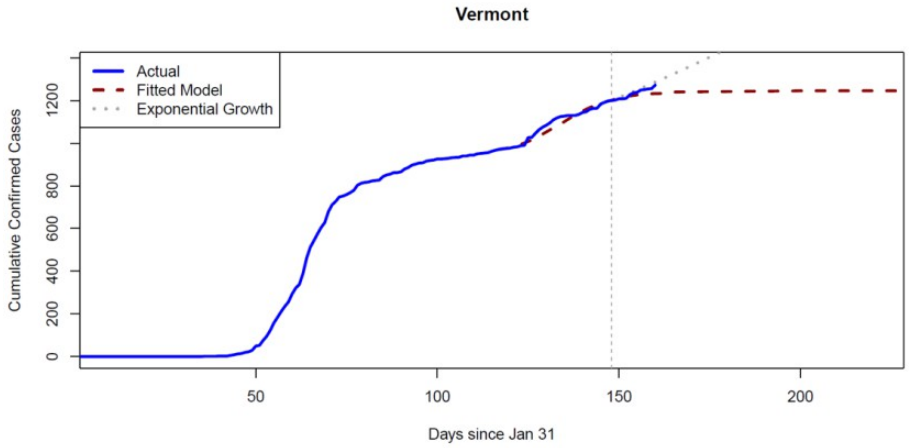

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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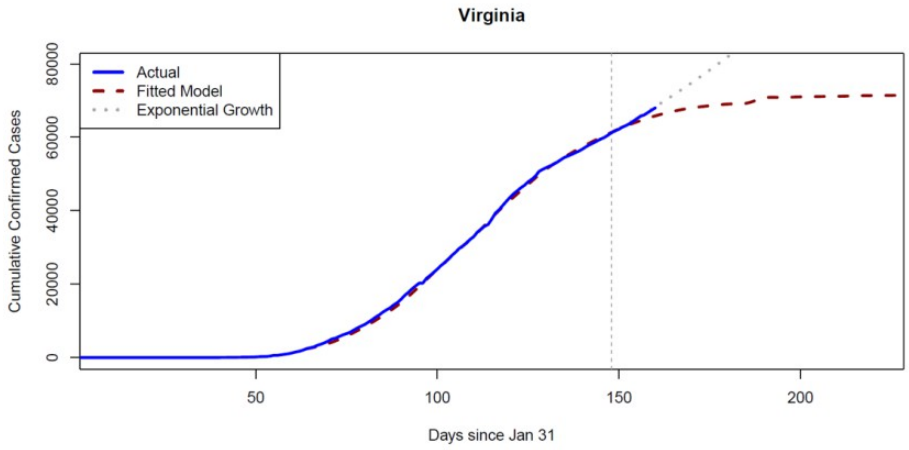

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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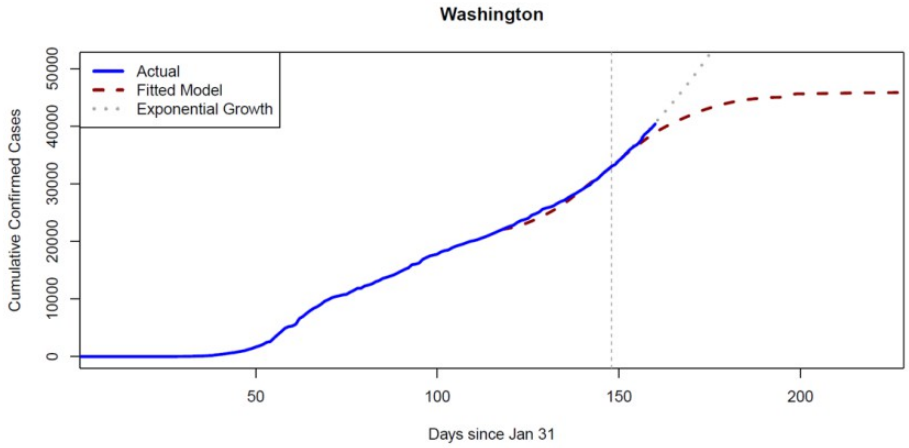

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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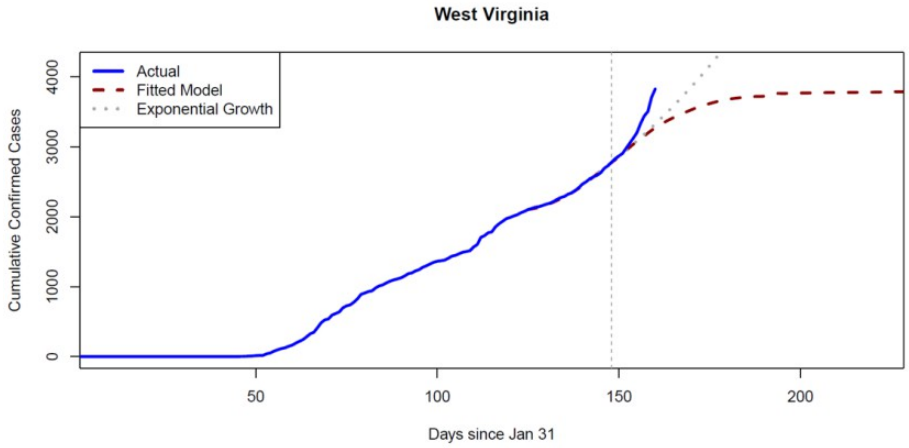

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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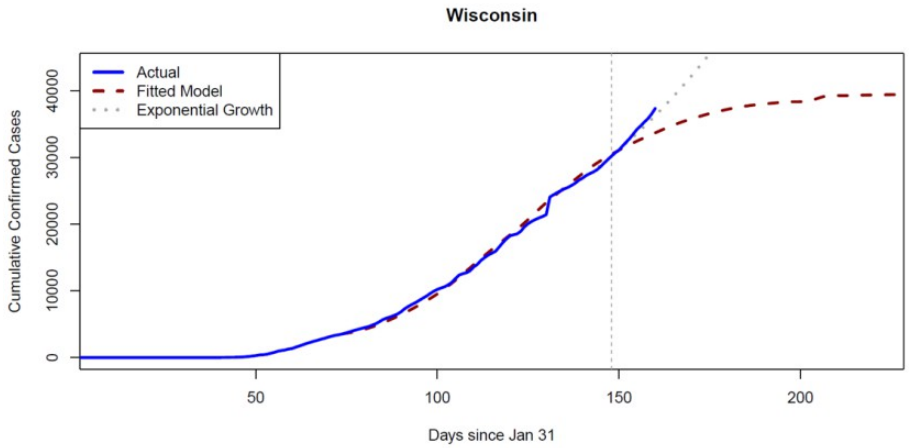

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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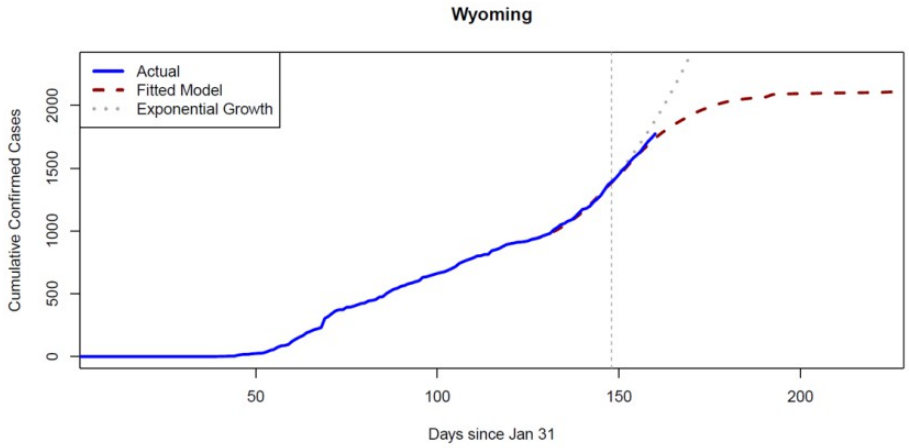

Source: Morgan Stanley, NY Times, The COVID Tracking Project, Johns Hopkins CSSE.

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In the next 3 months, Morgan Stanley expects to receive or intends to seek compensation for investment banking services from Acceleron Pharma Inc, ADC Therapeutics SA, Akebia Therapeutics Inc, Alector Inc, Alexion Pharmaceuticals, Alnylam Pharmaceuticals Inc, Amgen Inc., Aprea Therapeutics Inc, argenx SE, Ascendis Pharma A/S, AVROBIO Inc, BeiGene Ltd, Biogen Inc, Biohaven Pharmaceutical Holding Company, Biomarin Pharmaceutical Inc, Bluebird Bio Inc, Blueprint Medicines Corporation, Cabaletta Bio Inc, Cytokinetics Inc, DBV Technologies SA, Denali Therapeutics Inc, Editas Medicine, Epizyme Inc, Evelo Biosciences Inc, Exelixis Inc., Fulcrum Therapeutics Inc, Galapagos NV, Genmab A/S, Gilead Sciences Inc., Global Blood Therapeutics Inc, Imara Inc, Immunomedics Inc, Incyte Corp, Innoviva Inc, Insmed Inc, Ionis Pharmaceuticals Inc, Ironwood Pharmaceuticals, Inc., Kaleido Biosciences Inc., Karyopharm Therapeutics Inc, Kodiak Sciences Inc, Legend Biotech Corp, Moderna Inc, MyoKardia Inc, Nabriva Therapeutics PLC, Neurocrine Biosciences Inc, NextCure Inc., Prevail Therapeutics Inc, Radius Health Inc, Regeneron Pharmaceuticals Inc., Regenxbio Inc, Rhythm Pharmaceuticals Inc, Rubius Therapeutics Inc., SAGE Therapeutics Inc, Sarepta Therapeutics Inc, Schrodinger Inc., Seattle Genetics Inc., Syndax Pharmaceuticals Inc, Theravance Biopharma Inc, Ultragenyx Pharmaceutical Inc, Unity Biotechnology Inc., Vertex Pharmaceuticals, Viela Bio, Voyager Therapeutics Inc, Y-mABs Therapeutics Inc., Zealand Pharma A/S, Zentalis Pharmaceuticals Inc.

Within the last 12 months, Morgan Stanley has received compensation for products and services other than investment banking services from Amgen Inc., Biogen Inc, Galapagos NV, Gilead Sciences Inc., Vertex Pharmaceuticals.

Within the last 12 months, Morgan Stanley has provided or is providing investment banking services to, or has an investment banking client relationship with, the following company: Acceleron Pharma Inc, ADC Therapeutics SA, Akebia Therapeutics Inc, Alector Inc, Alexion Pharmaceuticals, Alnylam Pharmaceuticals Inc, Amgen Inc., Aprea Therapeutics Inc, argenx SE, Ascendis Pharma A/S, AVROBIO Inc, BeiGene Ltd, Biogen Inc, Biohaven Pharmaceutical Holding Company, Biomarin Pharmaceutical Inc, Bluebird Bio Inc, Blueprint Medicines Corporation, Cabaletta Bio Inc, Cytokinetics Inc, DBV Technologies SA, Denali Therapeutics Inc, Editas Medicine, Epizyme Inc, Evelo Biosciences Inc, Exelixis Inc., Fulcrum Therapeutics Inc, Galapagos NV, Genmab A/S, Gilead Sciences Inc., Global Blood Therapeutics Inc, Imara Inc, Immunomedics Inc, Incyte Corp, Innoviva Inc, Insmed Inc, Ionis Pharmaceuticals Inc, Ironwood Pharmaceuticals, Inc., Kaleido Biosciences Inc., Karyopharm Therapeutics Inc, Kodiak Sciences Inc, Legend Biotech Corp, Moderna Inc, MyoKardia Inc, Nabriva Therapeutics PLC, Neurocrine Biosciences Inc, NextCure Inc., Prevail Therapeutics Inc, Radius Health Inc, Regeneron Pharmaceuticals Inc., Regenxbio Inc, Rhythm Pharmaceuticals Inc, Rubius Therapeutics Inc., SAGE Therapeutics Inc, Sarepta Therapeutics Inc, Schrodinger Inc., Seattle Genetics Inc., Syndax Pharmaceuticals Inc, Theravance Biopharma Inc, Ultragenyx Pharmaceutical Inc, Unity Biotechnology Inc., Vertex Pharmaceuticals, Viela Bio, Voyager Therapeutics Inc, Y-mABs Therapeutics Inc., Zealand Pharma A/S, Zentalis Pharmaceuticals Inc.

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Morgan Stanley & Co. LLC makes a market in the securities of Acceleron Pharma Inc, Akebia Therapeutics Inc, Alector Inc, Alexion Pharmaceuticals, Alnylam Pharmaceuticals Inc, Amgen Inc., AVROBIO Inc, Biogen Inc, Biomarin Pharmaceutical Inc, Bluebird Bio Inc, Blueprint Medicines Corporation, Cabaletta Bio Inc, Cytokinetics Inc, Epizyme Inc, Evelo Biosciences Inc, Exelixis Inc., Fulcrum Therapeutics Inc, Gilead Sciences Inc., Global Blood Therapeutics Inc, Imara Inc, Immunomedics Inc, Incyte Corp, Innoviva Inc, Insmed Inc, Ionis Pharmaceuticals Inc, Ironwood Pharmaceuticals, Inc., Karyopharm Therapeutics Inc, Kodiak Sciences Inc, Legend Biotech Corp, MacroGenics Inc, Moderna Inc, Neurocrine Biosciences Inc, NextCure Inc., Prevail Therapeutics Inc, Radius Health Inc, Regeneron Pharmaceuticals Inc., Rhythm Pharmaceuticals Inc, Schrodinger Inc., Seattle Genetics Inc., Theravance Biopharma Inc, Ultragenyx Pharmaceutical Inc, Vertex Pharmaceuticals, Zealand Pharma A/S, Zentalis Pharmaceuticals Inc.

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Global Stock Ratings Distribution

(as of June 30, 2020)
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	COVERAGE UNIVERSE		INVESTMENT BANKING CLIENTS (IBC)			OTHER MATERIAL INVESTMENT SERVICES CLIENTS (MISC)	
STOCK RATING CATEGORY	COUNT	% OF TOTAL	COUNT	% OF TOTAL IBC	% OF RATING CATEGORY	COUNT	% OF TOTAL OTHER MISC
Overweight/Buy	**1252**	**39%**	**323**	**43%**	**26%**	**565**	**38%**
Equal-weight/Hold	**1430**	**44%**	**336**	**45%**	**23%**	**690**	**47%**
Not-Rated/Hold	**5**	**0%**	**0**	**0%**	**0%**	**3**	**0%**
Underweight/Sell	**553**	**17%**	**84**	**11%**	**15%**	**225**	**15%**
TOTAL	**3,240**		**743**			**1483**	

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months. Due to rounding off of decimals, the percentages provided in the "% of total" column may not add up to exactly 100 percent.

Analyst Stock Ratings

Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.
Equal-weight (E). The stock's total return is expected to be in line with the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.
Not-Rated (NR). Currently the analyst does not have adequate conviction about the stock's total return relative to the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.
Underweight (U). The stock's total return is expected to be below the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.
Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

Analyst Industry Views

Attractive (A): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be attractive vs. the relevant broad market benchmark, as indicated below.
In-Line (I): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be in line with the relevant broad market benchmark, as indicated below.
Cautious (C): The analyst views the performance of his or her industry coverage universe over the next 12-18 months with caution vs. the relevant broad market benchmark, as indicated below.
Benchmarks for each region are as follows: North America - S&P 500; Latin America - relevant MSCI country index or MSCI Latin America Index; Europe - MSCI Europe; Japan - TOPIX; Asia - relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

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INDUSTRY COVERAGE: Biotechnology

COMPANY (TICKER)	RATING (AS OF)	PRICE* (07/09/2020)
David N Lebowitz, CFA, MPH		
Akebia Therapeutics Inc (AKBA.O)	E (09/07/2018)	$12.50
Alnylam Pharmaceuticals Inc (ALNY.O)	O (03/05/2019)	$159.03
Ascendis Pharma A/S (ASND.O)	O (10/11/2019)	$140.00
AVROBIO Inc (AVRO.O)	O (07/16/2018)	$17.51
Blueprint Medicines Corporation (BPMC.O)	O (04/03/2019)	$78.38
Epizyme Inc (EPZM.O)	O (12/05/2019)	$15.17
Ionis Pharmaceuticals Inc (IONS.O)	U (11/07/2019)	$60.44
Ironwood Pharmaceuticals, Inc. (IRWD.O)	E (03/27/2019)	$9.86
Karyopharm Therapeutics Inc (KPTI.O)	O (07/01/2020)	$18.85
MacroGenics Inc (MGNX.O)	U (11/21/2019)	$30.68
Nabriva Therapeutics PLC (NBRV.O)	E (03/17/2020)	$0.69
Rhythm Pharmaceuticals Inc (RYTM.O)	O (09/07/2018)	$21.90
Schrodinger Inc. (SDGR.O)	E (03/02/2020)	$93.46
Syndax Pharmaceuticals Inc (SNDX.O)	E (10/29/2018)	$15.41
Y-mABs Therapeutics Inc. (YMAB.O)	E (04/29/2020)	$40.41
Zealand Pharma A/S (ZEAL.O)	O (09/12/2018)	$36.60
Jeffrey Hung		
Acceleron Pharma Inc (XLRN.O)	O (02/03/2020)	$100.68
Aprea Therapeutics Inc (APRE.O)	E (10/28/2019)	$30.81
Cytokinetics Inc (CYTK.O)	O (04/09/2020)	$26.12
Exelixis Inc. (EXEL.O)	E (03/18/2019)	$24.18
MyoKardia Inc (MYOK.O)	O (09/10/2018)	$93.13
Neurocrine Biosciences Inc (NBIX.O)	O (09/10/2018)	$131.56
NextCure Inc. (NXTC.O)	O (06/03/2019)	$18.18
Prevail Therapeutics Inc (PRVL.O)	O (07/15/2019)	$15.40
Ultragenyx Pharmaceutical Inc (RARE.O)	O (03/27/2019)	$87.95
Viela Bio (VIE.O)	O (10/28/2019)	$42.39
Voyager Therapeutics Inc (VYGR.O)	E (09/10/2018)	$13.33
Matthew Harrison		

ADC Therapeutics SA (ADCT.N)	O (06/09/2020)	$44.32
Alector Inc (ALEC.O)	O (03/04/2019)	$24.05
Alexion Pharmaceuticals (ALXN.O)	E (12/17/2019)	$108.47
Amgen Inc. (AMGN.O)	O (12/17/2019)	$251.66
argenx SE (ARGX.O)	O (01/04/2019)	$253.13
BeiGene Ltd (6160.HK)	O (01/17/2020)	HK$119.30
BeiGene Ltd (BGNE.O)	O (01/17/2020)	$199.81
Biogen Inc (BIIB.O)	U (03/22/2019)	$278.70
Biohaven Pharmaceutical Holding Company (BHVN.N)	E (04/09/2019)	$75.89
Biomarin Pharmaceutical Inc (BMRN.O)	E (07/08/2020)	$126.81
Bluebird Bio Inc (BLUE.O)	E (11/03/2017)	$66.16
Cabaletta Bio Inc (CABA.O)	O (11/19/2019)	$11.45
Denali Therapeutics Inc (DNLI.O)	O (01/02/2018)	$26.82
Editas Medicine (EDIT.O)	E (02/29/2016)	$34.49
Evelo Biosciences Inc (EVLO.O)	E (05/21/2020)	$4.40
Fulcrum Therapeutics Inc (FULC.O)	O (08/12/2019)	$19.31
Galapagos NV (GLPG.O)	E (12/17/2019)	$201.07
Genmab A/S (GMAB.CO)	O (08/12/2019)	DKr 2,334.00
Genmab A/S (GMAB.O)	O (08/12/2019)	$35.59
Gilead Sciences Inc. (GILD.O)	E (10/01/2015)	$74.71
Global Blood Therapeutics Inc (GBT.O)	E (03/21/2018)	$69.34
Imara Inc (IMRA.O)	O (04/06/2020)	$23.03
Immunomedics Inc (IMMU.O)	E (01/22/2019)	$42.30
Innoviva Inc (INVA.O)	U (08/14/2014)	$13.58
Insmed Inc (INSM.O)	O (03/21/2018)	$27.97
Kaleido Biosciences Inc. (KLDO.O)	E (05/21/2020)	$7.03
Kodiak Sciences Inc (KOD.O)	O (10/29/2018)	$53.44
Legend Biotech Corp (LEGN.O)	O (06/30/2020)	$38.88
Moderna Inc (MRNA.O)	O (01/02/2019)	$64.97
Regeneron Pharmaceuticals Inc. (REGN.O)	E (10/01/2015)	$640.63
Regenxbio Inc (RGNX.O)	O (11/09/2017)	$38.36
Rubius Therapeutics Inc. (RUBY.O)	E (03/13/2020)	$6.18
SAGE Therapeutics Inc (SAGE.O)	O (02/26/2018)	$44.11
Sarepta Therapeutics Inc (SRPT.O)	O (08/01/2018)	$169.96
Seattle Genetics Inc. (SGEN.O)	E (12/10/2019)	$181.17
Unity Biotechnology Inc. (UBX.O)	O (05/29/2018)	$7.88
Vertex Pharmaceuticals (VRTX.O)	E (07/08/2020)	$295.40
Zentalis Pharmaceuticals Inc (ZNTL.O)	O (04/28/2020)	$41.13

Vikram Purohit

DBV Technologies SA (DBVT.O)	E (10/23/2017)	$4.30
Incyte Corp (INCY.O)	E (04/29/2020)	$107.87
Radius Health Inc (RDUS.O)	E (05/13/2020)	$13.27
Theravance Biopharma Inc (TBPH.O)	E (06/15/2020)	$21.42

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* Historical prices are not split adjusted.