dean&company

COVID-19 Impact on US Economy & Stock Market

May 8, 2020

Disclaimer

- *Dean & Company Strategy Consultants, LLC (Dean & Company) is a strategy consulting firm for Fortune 500 companies, private equity, family offices, and its affiliates and affiliated family offices.*
- *In its efforts to develop these materials, Dean & Company consulted and collaborated with and received analysis from certain of its affiliates, including DC Investments Management, LLC (DC Investments), which is a family office investment adviser, commodity pool operator and commodity trading advisor for family clients/affiliated hedge funds. These materials and the collaboration grew from work that Dean & Company provided to DC Investments as part of DC Investments' research of the impact of COVID-19 on the economy. These views reflect both the views of Dean & Company and its affiliate, DC Investments. Dean & Company and its affiliates, including DC Investments Management, share certain officers and a number of employees and there is direct and indirect compensation paid by DC Investments, its hedge funds and other affiliates to Dean & Company. References herein to Dean & Company and/or its affiliates include each of their affiliates, officers, owners, employees, and directors, as applicable.*
- *The DC Investments hedge funds have various short and long positions (including but not limited to options) in the securities/stock derivatives and commodities markets at this time, with the DC Investments hedge funds currently being net short to the market across numerous and various sectors of the market. The DC Investments hedge funds will profit if the trading prices of their short positions decline and will lose money if the trading prices increase.*
- *As further discussed on the next page, some of the other Dean & Company affiliates also have various short and long positions (including options) in the stock, derivatives and commodities markets at this time.*
- *Dean & Company and its affiliates are not soliciting commodity pool or hedge fund business or investors and are not providing any advice via these materials. These materials are not an advertisement for investors or prospective investors or to the public generally. The Dean & Company family office affiliates and their hedge funds, commodity pools and/or trading entities are not holding themselves out to the public and are not available to the public in any way.*
- *These materials are for general information and educational purposes only. The information included in these materials is not investment, trading or financial product advice or a recommendation, intent or solicitation to buy or sell any securities, derivatives, commodities, investments or investment strategies. These materials are not intended to be, and should not be, relied upon by the recipient or any other person in making decisions of a commercial, investment or other nature with respect to the issues discussed herein. Nothing herein should be taken as or is intended to be a solicitation or an offer to purchase or sell securities, derivatives, commodities, investments or investment strategies. The recipient should do its own independent investigation and analysis of the markets, business sectors and any other information mentioned herein or consult a qualified financial advisor before buying or selling any securities, derivatives or commodities. No one should use these materials as the basis for future investments or trades. Investing includes risks, including loss of principal, and are not guaranteed. Past performance is not indicative of future results.*

Disclaimers, continued

- *Some of Dean & Company's other affiliates also have various short and long positions (including options) in the stock, derivatives and commodities markets at this time, including but not limited to:*
  - *DC Energy Management, LP and DC Energy Holdings (DC Energy) which among other things, manage, operate and/or advise various affiliated trading entities and commodity pools that participate in the energy trading space and in the venture capital/private equity space and VECO, LLC which manages various affiliated energy trading entities. The positions of the DC Energy and VECO energy trading entities and/or commodity pools depend at least in part of on the level of the general economy and its various sectors, although their positions are generally a mix with some long, some short and many neutral the general economy.*
  - *DC Investment Partners, LLC which invests or is currently considering investing in various venture and/or private equity investments including but not limited to the biotech, cloud-based, telecom and security related sectors. The DC Investment Partners' investments in early and/or growth stage companies also depend at least in part on the general economy and its various sectors.*
- *The Dean & Company affiliates do not undertake to commit to take or refrain from taking any actions with respect to any sector or company. The Dean & Company affiliates may change their views and/or their trading/investment positions at any time, for any reason. They may buy, sell, cover or otherwise change the form or substance of their trades and/or investments and have no obligation to notify the market of such changes.*
- *The information and opinions expressed herein are based upon publicly available information. However, there may be material non-public information in the possession of the recipients of these materials or others that could lead the recipients or others to disagree with these materials and the statements, analysis, projections and opinions herein.*
- *These materials contain forward looking statements, projections, and statements of opinion. Although Dean & Company believes these materials are substantially accurate in all material respects and do not omit material facts necessary to make the statements not misleading, no representation or warranty, express or implied, is made regarding the accuracy, completeness or reliability of the forward looking statements, projections or opinions, or the assumptions on which such is based. All such information is, by its nature, subject to significant uncertainties and risks outside of the control of Dean & Company and its affiliates and also will become quickly outdated. Such statements, projections and opinions may prove to be substantially inaccurate. There is no plan or obligation to update, correct or revise these materials or provide any additional materials.*
- *To the maximum extent permitted by law, Dean & Company, its affiliates and each of their officers, owners, employees, directors and representatives do not accept any liability for any loss arising from the use of the information contained in these materials.*

Observations (Part 1 of 2)

- **It is not the lockdown, but the ensuing mitigation period that will most hurt the economy**
  - With lockdown only and a return to the previous trajectory, the stock market would be expected to drop only 12–15% from its peak
  - With longer term mitigation, expect -7.6% on GDP in 2020, -19% corporate earnings, and ~35–55% stock price drop from peak after accounting for expected fiscal and monetary stimulus

- **Only a vaccine will allow the economy to repair the damage and begin a full recovery**
  - The "casualty" rate, including both fatality and disability, is well over 1%, and we believe is too high to ignore
  - Therapeutic treatments do not appear to be a silver bullet. (Remdesivir reduces hospital time, not mortality rate)
  - Herd immunity will likely take 2 years
  - Vaccines will likely be available in 12 to 18 months at best

- **Mitigation period requires containment, which is as challenging as a vaccine**
  - Testing is easier said than done
    - Mega testing: in the millions per day, not 100k
    - Everywhere: not just where the labs are
    - Real time: 3-day delays make a viral test useless for containment
  - Contact tracing is like starting a new industry from scratch – 500,000 skilled employees needed
  - Social distancing required since the above items won't be perfect or immediate
  - Only S. Korea and Taiwan have successfully mitigated spread, but have per capita infection rates of 1/1000th of the US

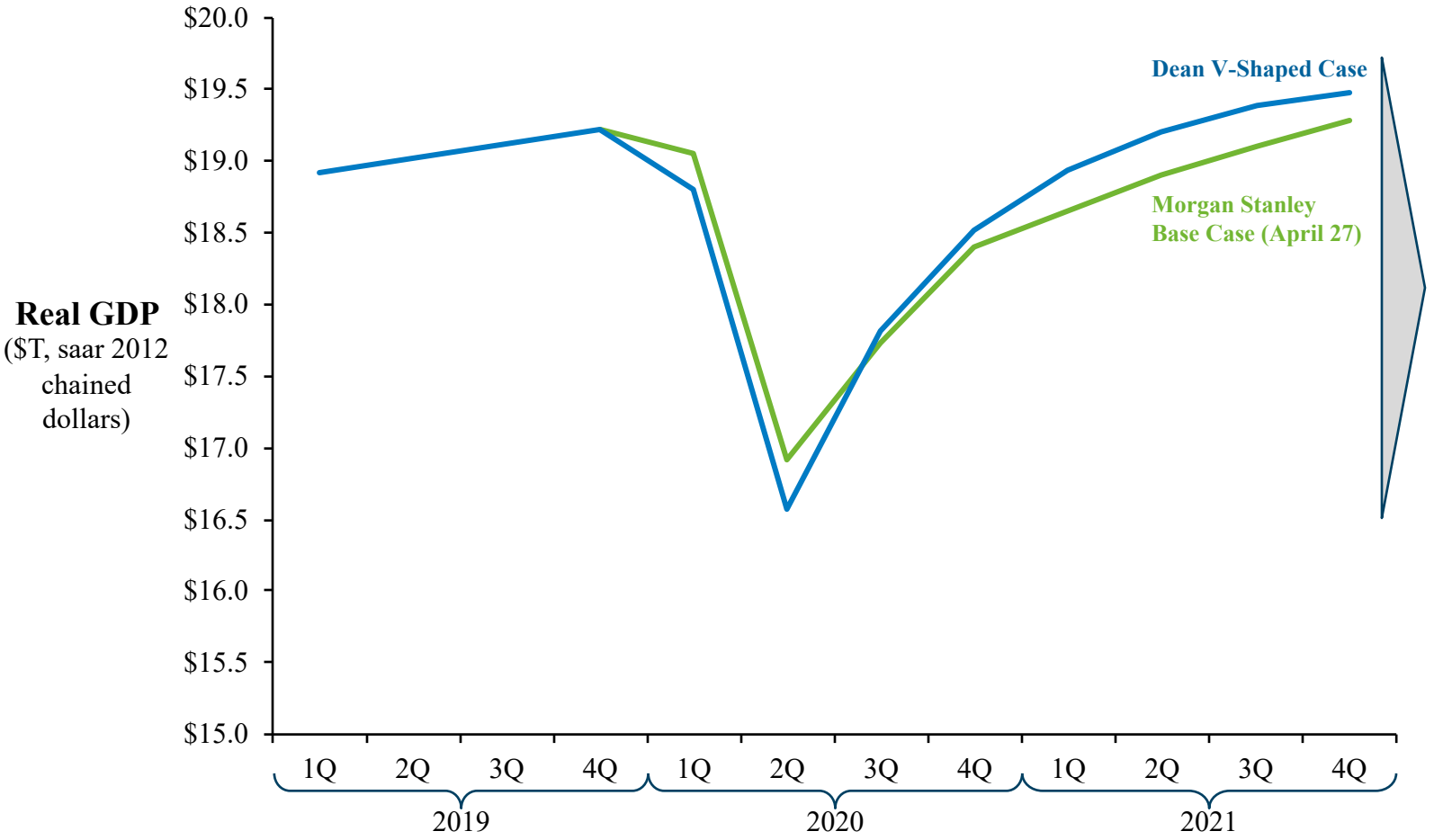
Observations (Part 2 of 2)

- **Under mitigation economies run slower**
  - Certain economic activities must be curtailed, and new costs are incurred
  - Empirical data from S Korea and Taiwan shows a significant slow down of economic activity of perhaps 3-8% of GDP (with only 1/1000th of the per capita active cases as in the US)
  - Supply chain disruptions and reduced global demand
  - Early U.S. indicators show suppressed activity even after lockdowns are lifted
- **Like terrorism (another hidden enemy), pandemic prevention will not go away**
  - Annual cost roughly 0.6% GDP
- **Several vectors can be used to estimate market impact of ~35 to 55% from peak**
  - Bottom-up GDP modelling with negative growth, earnings shrinkage, and higher equity risk premium
  - Top-down total unemployment losses of 20 to 23% point to a -16 to -19% GDP impact – with even deeper market impacts
  - Return on worst case scenarios suggest lowest apparent risk is being short – in this unusual situation the highest expected return has the lowest worst-case risk
- **None of the above is intended as a recommendation to buy or sell financial securities**

Summary Observations

- **It is not the lockdown, but the ensuing mitigation period that will most hurt the economy**
- **Only a vaccine will allow the economy to repair the damage and begin a full recovery**
- **Mitigation period requires containment, which is as challenging as a vaccine**
- **Under mitigation economies run slower**
- **Like terrorism (another hidden enemy), pandemic prevention is not expected to go away**
- **Several vectors can be used to estimate market impact of ~35 to 55% from peak**

If productivity falls under lockdown but recovers smoothly, we project full year GDP would be down 6.0% consistent with end of April stock market declines of 14%



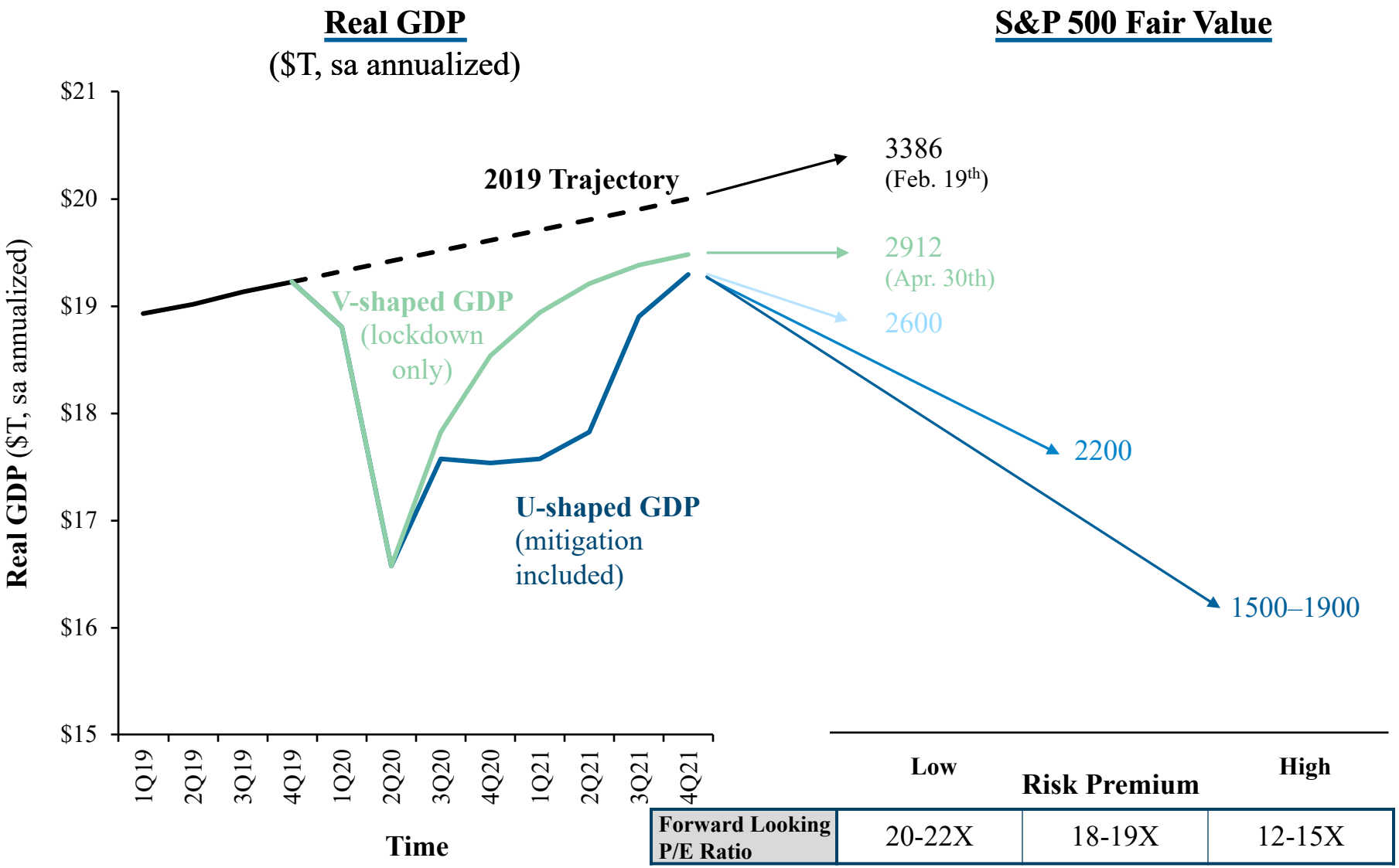
- **One time GDP hit**
- **No change in equity risk premium**
- **2900 S&P 500 reasonable today**

	1Q19	2Q19	3Q19	4Q19	1Q20	2Q20	3Q20	4Q20	1Q21	2Q21	3Q21	4Q21	FY19	FY20	FY21
• **Annualized GDP ($T)**	$18.93	$19.02	$19.12	$19.22	$18.80	$16.57	$17.81	$18.53	$18.94	$19.20	$19.38	$19.48	$19.07	$17.93	$19.25
• **GDP Growth YOY**	2.7%	2.3%	2.1%	2.3%	(0.7%)	(12.9%)	(6.9%)	(3.6%)	0.8%	15.9%	8.8%	5.1%	2.3%	(6.0%)	7.4%

Note: Dean V-Shaped scenario assumes some stimulus impact in 2Q20, a 2 week transition into an 8-week lockdown period from March 25 to May 19 followed by recovery in 3Q20 back to the trend GDP growth of 2%. Recovery is set at 7.5% QoQ growth in 3Q20 and growth is halved each quarter towards the trend GDP annual growth of 2% (0.5% QoQ), which is reached in 4Q21

Source: Morgan Stanley, US Bureau of Economic Analysis, Dean and Company Research

Since we expect the economy to fully recover only after a vaccine is available, we anticipate impacts will be larger with increased uncertainty – reducing stock prices by approximately 35 to 55% from the February peak



NOTE: 2019 trajectory is GDP at an annual growth rate of 2.0%, based on 4Q19's QoQ annualized growth rate

Source: Dean & Company

dean&company

Summary Observations

- It is not the lockdown, but the ensuing mitigation period that will most hurt the economy
- **Only a vaccine will allow the economy to repair the damage and begin a full recovery**
- Mitigation period requires containment, which is as challenging as a vaccine
- Under mitigation economies run slower
- Like terrorism (another hidden enemy), pandemic prevention is not expected to go away
- Several vectors can be used to estimate market impact of ~35 to 55% from peak

We believe that economic headwinds from mitigation cannot be avoided; the alternative is a huge uptick in fatalities and long-term health impacts – the casualty rate may be 1.6% or higher

- **If mitigation efforts ceased, total fatalities could increase by ~20X**
  - Even without a spike in fatality rates from overwhelmed hospital systems
- **While most people with COVID-19 manage through,**
- **Approximately 0.6% of those infected die[1],**
  - There is ambiguity/uncertainty on these numbers, but various studies (on next page) suggest a fatality rate of 0.6% or greater.
- **And an additional 1% of COVID-19 infections likely cause long-term health effects[2]**
  - 3% of COVID infections are severe[3]
  - Of severe infections, likely a third will have permanent lung damage and/or depression/anxiety (one third of severe SARS patients had permanent damage)

Given these risks, a significant portion of the population will continue to social distance regardless of official policy

[1] See next page for detailed estimates
[2] Science Magazine Estimates ~1/3rd of severe infections will have permanent lung damage and/or depression/anxiety based on long term health of SARS Patients
[3] This is the number implied by South Korean fatality rates by age (7.6% hospitalization rate), and the estimates from Verity et al. on ICU admittances and likelihood of dying after ICU admittance (37.5% of hospitalizations going to ICU)
Source: Science News, South Korean CDC, Verity et al. Epidemic Forecasting.org, Dean & Company analysis

An analysis of over two dozen studies indicates COVID-19 fatality rates are ≥ 0.6%; studies suggesting much lower rates are likely incorrect or not applicable to the U.S.

Study Details	Fatality Rate	Sources
• **NYC: Serology testing implies 0.8% fatality rate** — On April 27, serology testing in NYC implied 24.7% of the city had been infected and developed antibodies, and on that same day there were 17,215 confirmed and probable deaths — It's likely that time from infection to death is longer than time from infection to antibody presence, so this 0.8% estimate is biased downward (not all deaths among the 24.7% infected had been counted yet).	**0.8%**	NBC, NYC Gov
• **South Korea: currently reporting a fatality rate of 2.2%** — Extensive testing (only 2% of tests come back positive) with virus very well controlled — Would need to be undercounting cases by a factor of ~7 for there to be a fatality rate of 0.3%	**2.2%**	Korean CDC
• **Bergamo Province, Italy: using excess deaths statistics, fatality rate is 0.4% if everyone in the province had been infected and 2.7% if 15% of the people have been infected** — We see 4,500 excess deaths in a population of 1.1 million	**0.4–2.7%**	WSJ
• **Diamond Princess: projecting fatality rates by age to US demographics yields a 0.6% fatality rate** — Likely underestimates the real fatality rate, because 80-year-olds on cruises are likely to be much healthier than 80-year-olds not on cruises (they're much less likely to be bedridden) — Small sample size but it may bias estimates downward because it implies no one under 60 dies because no-one on the Diamond Princess did	**0.6%**	UN, Russel et. al
• **Austria: random sample of 1,544 people implies fatality rate probably not below 0.5%** — The sample showed 0.33% of the population was currently infected — If you think the number of people who have ever been infected is 3x that number currently infected, then you get a fatality rate of 0.5%, and that's before the current cases have resolved	**≥ 0.5%**	SORA Institute. Ogris et. al
• **Streeck study in Gangelt, Germany indicating a 0.37% fatality rate is likely not reflective of the U.S. risk given higher obesity rates in the U.S.** — Tests likely impacted to some degree by false positives, which incorrectly lowers computed fatality rate — Obesity increases risks of Covid-19 death; U.S. obesity rates are higher than in Germany, so US fatality is likely higher	**≥ 0.37%**	Institut für Virologie, BC. Courier
• **CDC study of medical workers suggesting a 0.3% fatality rate in fact suggests a fatality rate of 0.6% if resolved cases are used as the denominator** — A fatality rate of 0.6% would be computed using resolved cases as the denominator rather than all cases — Study fatality rate likely biased down because healthcare workers are healthier than the general population	**0.6%**	US CDC

Near term treatment options are unlikely to change the risk calculus

- **Treatments that are sufficiently safe and effective to fundamentally change the risk calculus are likely to require lengthy development and testing cycle**
  - Existing drugs may be helpful, but impacts likely to be marginal
- **Remdesivir test results suggest at best a modest improvement**
  - In NIAID study Remdesivir was associated with a reduced recovery time from 15 to 11 days w/ no statistically significant impact on mortality
  - A Chinese study found no benefit in mortality or recovery time (study was halted early due to falling case counts)
  - Potential for serious side effects
- **A number of other drugs are in development; all will require extensive testing and time to scale up production to millions of doses**
  - Likely not sooner than the fall or winter with availability limited to high risk groups initially
- **This doesn't deny that there will be continued improvements in the standard of care as the medical community learns more about the virus**

Source: Y. Wang, D. Zhang, G. Du, R. Du et. al., The Lancet April 29, 2020, NIAID April 29, 2020

Herd immunity will require 50-67% of the population to be infected and take ~2 years to achieve at current infection rates

- **~50–67% of the population would need to be immune to achieve herd immunity**
  - Based on R0 estimates of 2–3
  - WHO estimates R0 at 1.4–2.5
  - HK School of Public Health estimates R0 at 3.3–5.5
  - Lancaster University estimates R0 at 2.5–3.1

R0 Estimate	Percent Immune Required for Herd Immunity
5.5	82%
3.0	67%
2.5	60%
2.0	50%
1.4	29%

- **Assuming current infection rates are ~10X the reported level of ~28.6K per day it would take ~1.5–2 years to achieve herd immunity in the U.S.**
  - Not clear whether immunity even lasts two years
  - Process can't be significantly accelerated without overwhelming the hospital system

- **Huge increases in fatalities would likely be required to achieve herd immunity without a vaccine**

Vaccine availability should allow a return to normal economic activity, but it is likely to take at least 12-18 months before a vaccine is available and additional time to deploy

- **Consensus estimates suggests 12–18 months to develop, test, and scale a new vaccine**
  - This would be a record; previous record was 4 years for mumps
  - No existing human vaccines available for any coronavirus
  - Vaccine testing cycles are typically long because long-term side effects and the duration of immunity must be understood
- **Billions of doses will be required globally to achieve the necessary levels of immunity**
  - At least ~50–67% of the population would require inoculation, likely 2022 timeframe
- **Significant uncertainty around how long Covid-19 immunity will last which may make achieving herd immunity through vaccination programs more challenging**
  - A Columbia study found immunity for common coronaviruses waned in less than a year

Source: A. Fauci public statements; N. Akpan, National Geographic; April 10, 2020; Regalado, Technology Review; April 27 2020

Summary Observations

- It is not the lockdown, but the ensuing mitigation period that will most hurt the economy
- Only a vaccine will allow the economy to repair the damage and begin a full recovery
- **Mitigation period requires containment, which is as challenging as a vaccine**
- Under mitigation economies run slower
- Like terrorism (another hidden enemy), pandemic prevention is not expected to go away
- Several vectors can be used to estimate market impact of ~35 to 55% from peak

Successful containment models have involved 5 related elements that will be challenging to replicate quickly in the US particularly given current case counts

Element	Taiwan	S. Korea	China	United States
Daily Cases per MM, 5/1/20	0.000	0.078	0.003	82.58
1) Testing / Surveillance				
Testing Capacity (per day)	3,800	140,000	Not published	~250,000
Testing[1,2] (per day per million)	22	91		699
% Positive[2] (cumulative)	0.7%	1.7%		16.6%
Testing Turnaround	Likely <24 Hours	<24 Hours		1-2 Days
Other Surveillance Techniques	• Temperature checks, thermal cameras in metros, broad testing criteria	• Temperature checks, thermal cameras, broad testing criteria. CCTV, credit transactions, location tracking	• Some thermal cameras, temperature checks, health questionnaires	• Minimal
2) Contact Tracing	• Yes, technology supported	• Yes, app supported	• Yes, app supported	• No, overwhelmed with no current app support
3) Enforced Isolation / Quarantine	• Monitored, phone tracked, twice daily status check, 14 day quarantine for contacts and international travelers	• Includes delivery of food/water, discussing adding electronic wrist monitors	• 14 day quarantine for close contacts, risky travel history. Enforced via social credit system	• Limited enforcement / support, varies by state
4) General Controls / Social Distancing	• Mass gatherings recommended to cancel, no enforcement, • Schools open, • Mask wearing prevalent, enforced in some public spaces • Disinfection of public spaces	• Mass gatherings restricted • Schools closed, • Mask wearing prevalent • Free testing, treatment • Disinfection of public spaces	• Internal movement controls (health pass app), • Restrictions vary by prefecture, • Some school closures, • Local curfew, lockdown orders,	• State by state restrictions of mass gatherings • Some stay at home orders, mask advisories. • All schools closed • Some non-essential closures
5) Strong Border Controls	• Foreigners Require "Granted Entry" • 14 day monitored quarantine at home (w/ food delivery) or in public facilities (non-residents)	• 14 day quarantine (short term visitors in government facility)	• Closed to non-diplomatic foreigners, 14 day quarantine	• Europe, China, Iran travelers banned. US Citizens from restricted countries undergo screening, some 14 day quarantines

In the US, political polarization, distrust of institutions, emphasis on individual rights, and an inconsistent federal response are likely to make successful containment challenging to achieve

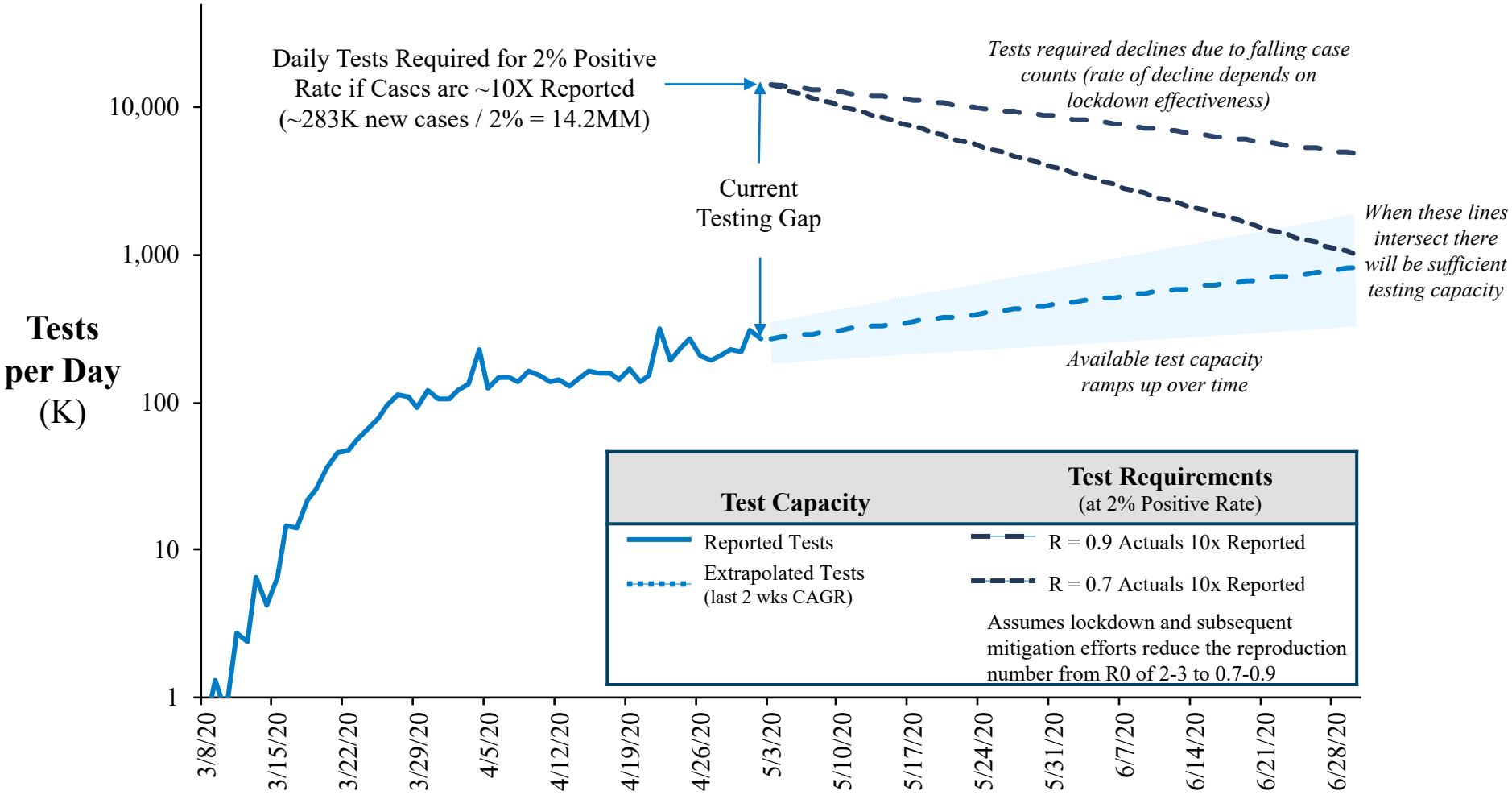
1 Trailing 7 day average

2 Data as of 2020-05-03

Source: Dean & Company, Our World in Data, Countries, Time

US is unlikely to have sufficient testing capacity to achieve adequate testing (S. Korean levels, 2% positive rate) until late June or July

U.S. Testing Gap

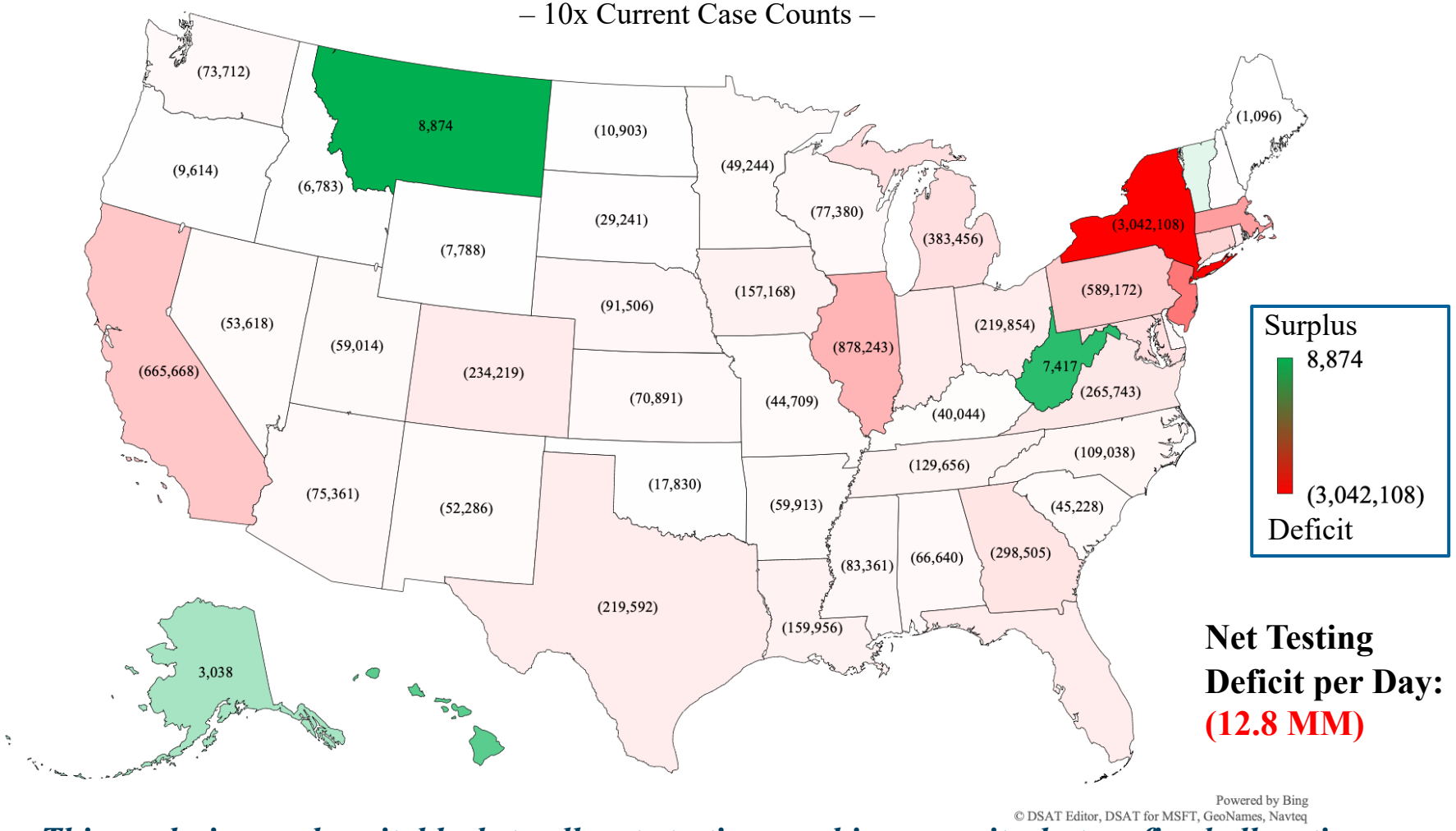


Source: JHU, Our World in Data, Various PCR Texting Machine manufacturers, Dean and Company research and analysis

The distribution of machine test capacity will further limit the effective testing capacity since rapid results are critical. Properly allocating testing machines will not be any easier than allocating ventilators

Available Machine Deficit

– 10x Current Case Counts –



Net Testing Deficit per Day: (12.8 MM)

This analysis uses hospital beds to allocate testing machine capacity, but no fixed allocation can precisely match evolving testing needs; it will be a complex logistical challenge

Note: Deficit shows each state's machine testing capacity testing relative to testing required to reach 2% daily positive rate. Machine testing capacity assumes total machine testing capacity of ~1.8 MM per day distributed to states proportional to the number of hospital beds

Source: COVID Tracking Project, US Census

Contact tracing efforts will need to be dramatically scaled up to leverage test results to achieve more targeted isolation, with ~500K new contact tracers needed at current infection rates

Driver	Value
Number of Close Contacts per Case	10[1]
Contacts/Epidemiologist/Day	10[1]
Contact Tracing Epidemiologist Days per Case	1.0
Patient Interview & Contact Compilation Epidemiologist Days per Case (assumption)	0.25
Percent of Days Worked (5-day workweek)	71%
Confirmed New Cases (New Cases/Day)	28.3K
Actual Case Counts, ~10x Higher (New Cases/Day)	283K
Number of Contact Tracers Needed (FTEs)	396K
Number of Case Investigators (FTEs)	99K
Total Employees Needed at Current New Case Levels (FTEs)	495K
Current Number of Epidemiologists	2.2K[2]
New Employees Needed (FTEs)	**493K**
Expert Views on Needed Number of New Employees	30-300K[2,3]

Note: Current new case levels taken as a 7-day average of new cases (4/25-5/1). No data found on time needed to interview a patient and compile a list of close contacts. Assumption is calculated using time needed per patient: 2 hours for base case. Employees assumed to work 5 days a week, 8-hour work shift

Source: [1] NYTimes, "An Army of Virus Tracers Take Shape in Massachusetts" (4/16/20).
[2] Association of State and Territorial Health Officials Memo to Congress (4/10/20)
[3] STAT News, "We Need an Army: Hiring of coronavirus trackers seen as key to curbing disease spread" (4/13/20).

Summary Observations

- **It is not the lockdown, but the ensuing mitigation period that will most hurt the economy**
- **Only a vaccine will allow the economy to repair the damage and begin a full recovery**
- **Mitigation period requires containment, which is as challenging as a vaccine**
- **Under mitigation economies run slower**
- **Like terrorism (another hidden enemy), pandemic prevention is not expected to go away**
- **Several vectors can be used to estimate market impact of ~35 to 55% from peak**

Economies in containment are expected to run slower

- **Basic mitigation efforts will likely impact supply for all industries by a few percentage points**
  - Additional costs for cleaning, testing, social distancing, physical controls etc.
- **Some high-risk activities will be dramatically scaled back to limit risk of undetected transmission**
  - Air travel, bars/restaurants, stadium events, tourism, etc.
- **This will likely result in significant net job loses and shifts in the nature of employment and skills required**
- **Consumer confidence will likely be hit as a result, likely further reducing demand**
- **Few countries have successfully controlled the outbreak, so exports may be suppressed, and supply chains disrupted**
- **Without successful containment the likely alternative is another round of lockdown which would be worse**

In South Korea, mitigation has led to a significant recession with retail sales down ~9%

South Korea

– Impact under Mitigation –

Current Impact	Impact Under Mitigation	Baseline
Retail Sales Index (sa) (Feb. & March)	↓ 9%	December 2019
Manufacturing Production (sa) (Feb & March)	↓ 4%	December 2019
Index of Services (March)	↓ 4%	March 2019 (YoY)
Accommodation and Food Service Activities (March)	↓ 32%	March 2019 (YoY)
Arts, Sports and Recreation Related Activities (March)	↓ 46%	March 2019 (YoY)
Daily NO2 Levels (average of March and April data)	↓ 21%	2017-2019 data, aligned by weekday
Google Mobility – Workplaces (Apr. 26)	↓ 8%	Jan 3– Feb 6 data, median value for day of the week
Google Mobility – Retail & Recreation (Apr. 26)	↓ 6%	Jan 3– Feb 6 data, median value for day of the week
Composite Consumer Sentiment Index (April)	↓ 32%	January 2020 (peak)
Current Mitigation Policies	Schools taught online; social distancing at restaurants, zoos and aquariums; sports stadiums open but physical contact discouraged; mandatory quarantining and monitoring of travelers; mask wearing prevalent	

Sources: Statistics Korea, AQICN, Bank of Korea, Google, News Reports

Taiwan has also experienced a decline in economic output, despite controlling COVID-19 through contact tracing and mitigation policies

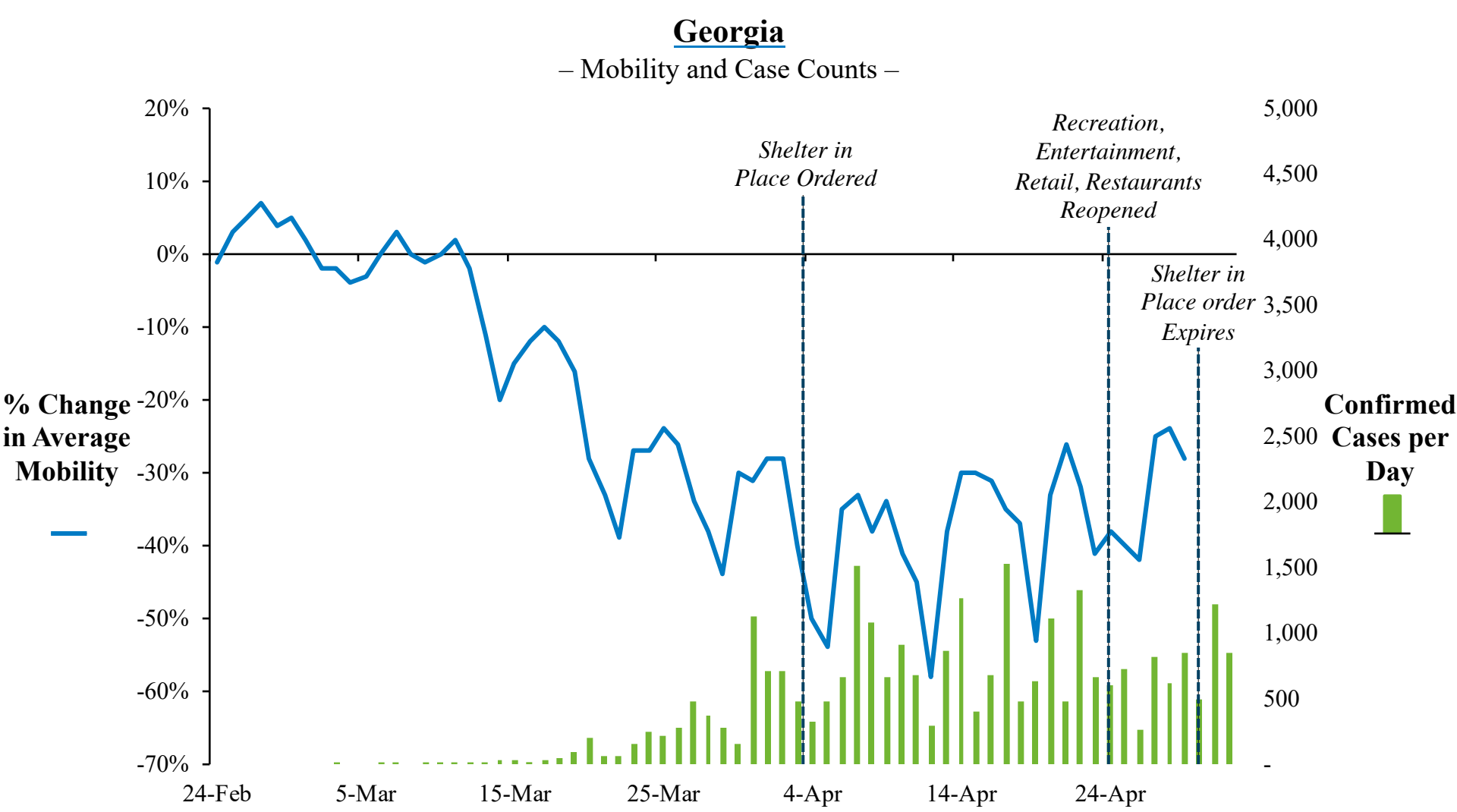
Taiwan

– Impact under Mitigation –

Current Impact	Impact Under Mitigation	Baseline
Monthly Retail Sales	↓ 3%	March 2019 (YoY)
Monthly Sales at Department Stores	↓ 22%	March 2019 (YoY)
Monthly Sales at Restaurants	↓ 22%	March 2019 (YoY)
Daily NO2 Levels	↓ 36%	2017-2019 data, aligned by weekday
Google Mobility – Workplaces (Apr. 26)	↓ 5%	Jan 3– Feb 6 data, median value for day of the week
Google Mobility – Retail & Recreation (Apr. 26)	↓ 14%	Jan 3– Feb 6 data, median value for day of the week
Consumer Confidence Index (April)	↓ 14%	January (peak)
Mitigation Policies	Schools open; mandatory quarantining and monitoring of travelers; mask wearing prevalent	

Sources: National Statistics of Republic of China, National Central University (NCU), AQICN, Google, News Reports

Lifting restrictions will not restore economic activity if consumers do not feel safe - Georgians only increased weekday mobility by ~7% in the week since the reopening began

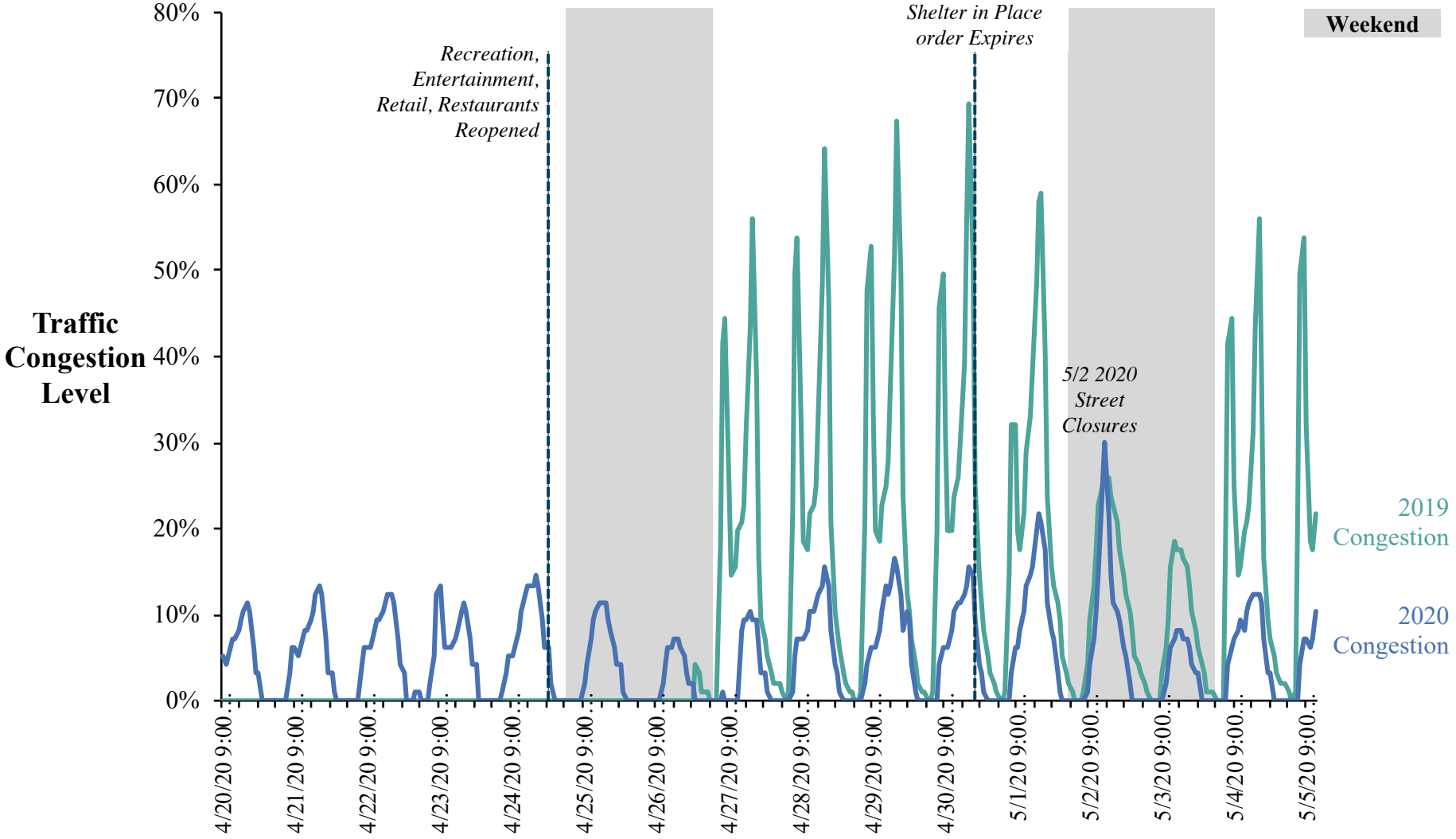


Note: Change in mobility is based on distance traveled. Businesses allowed to reopen assuming they follow strict social distancing guidelines set out by state

Source: Unacast, State of Georgia

Atlanta weekday traffic has increased little since businesses have reopened

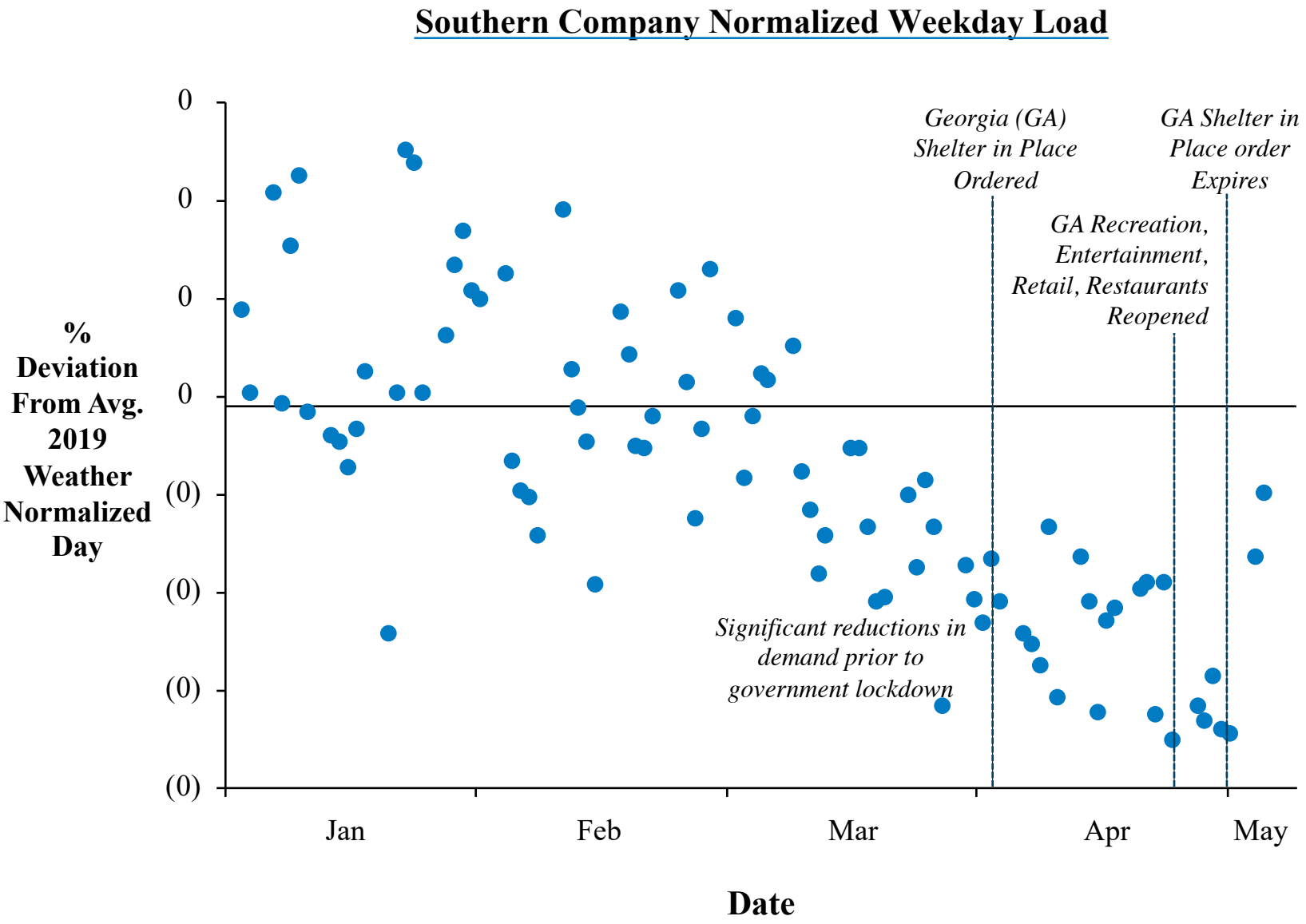
Atlanta Congestion



Note: Historical data is defined as traffic congestion the previous year on the same day of the week. Traffic congestion is defined as additional time required to reach a destination. 100% congestion implies 2x commute time

Source: TomTom

Weather normalized electricity demand remains suppressed in Georgia despite the reopening of some sectors

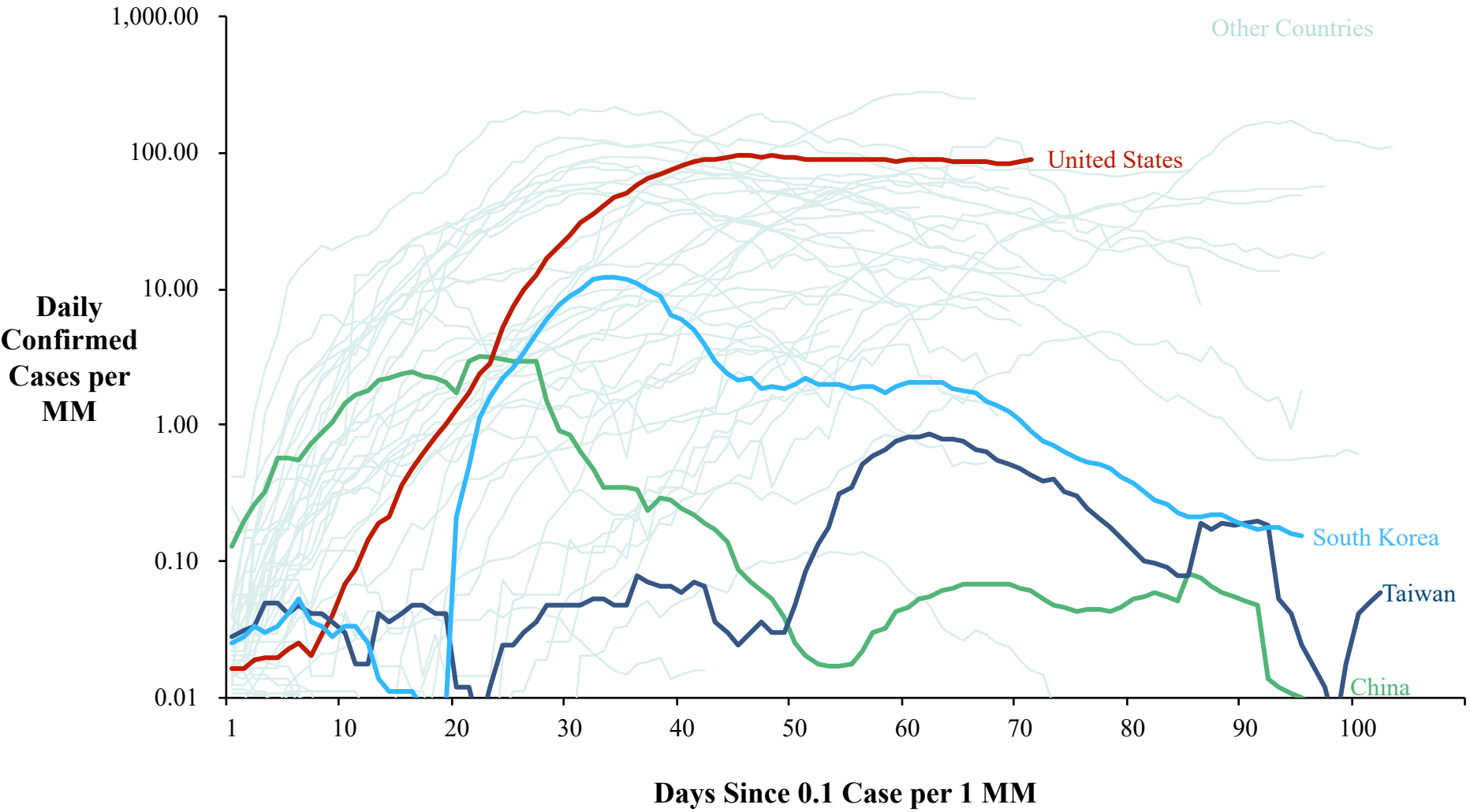


Note: Regional load service territory includes Georgia, Alabama, and Mississippi, Data shown is weather normalized electricity usage as a % of 2019 daily average weather normalized electricity

Source: Southern Company

The performance of Asian economies that have successfully controlled the spread is likely a best-case scenario for the US since per capita case counts are >1000x higher in the US

Case Growth per Capita



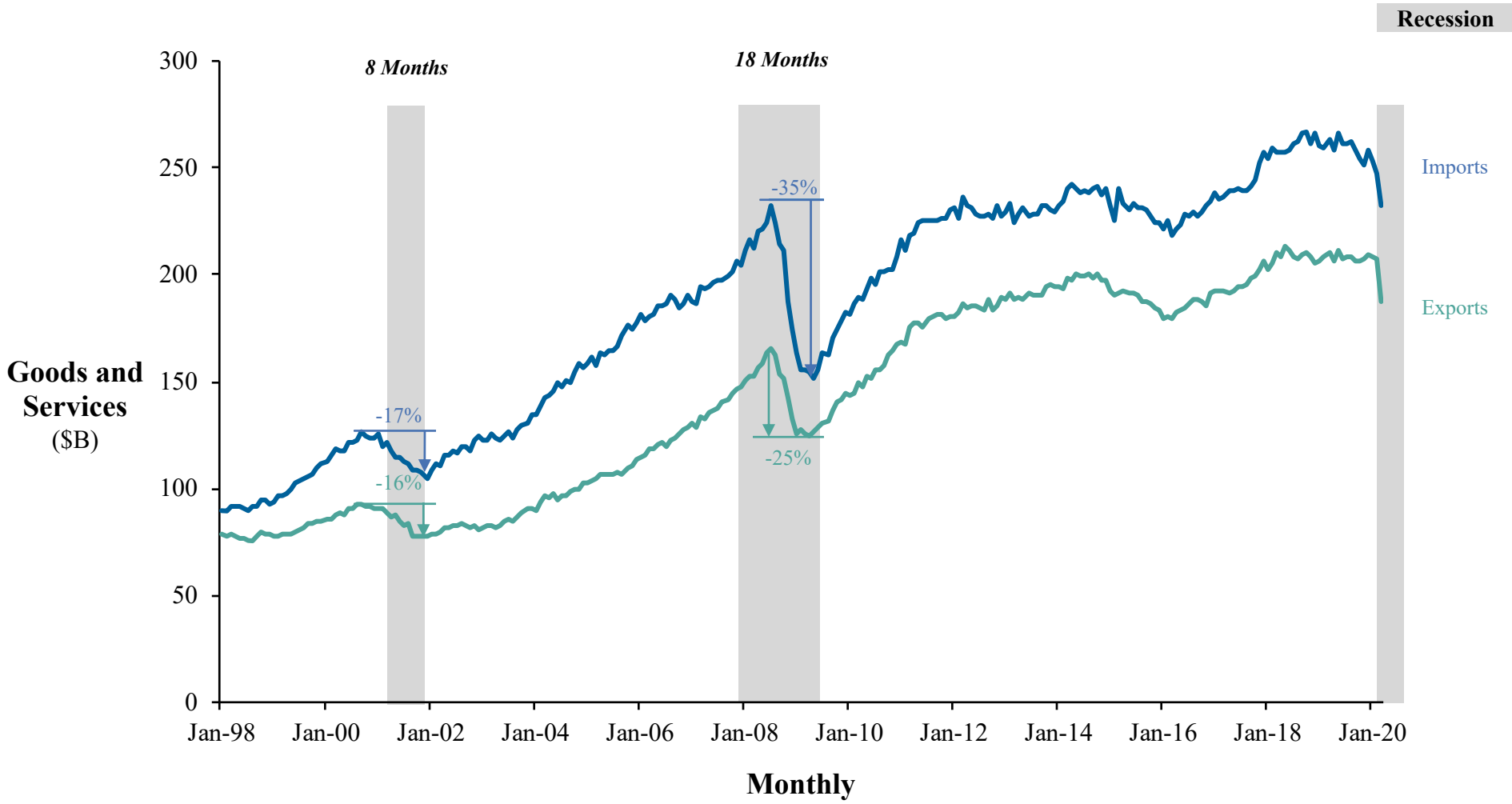
Note: Daily Confirmed cases are shown as a past 7 day rolling average, by number of days since 1 case per 10 MM first recorded. Updated 5/03. China Listed as Days since 0.38 Case per MM due to lack of data prior to 1/22/2020. First 7 days of China listed as average of day 1 to that day (insufficient data for complete 7 day rolling average)

Source: CEIC, US Census

Since all economies are facing the simultaneous pandemic headwinds, we expect a significant drop in global trade as in previous recessions

Effects on Foreign Trade

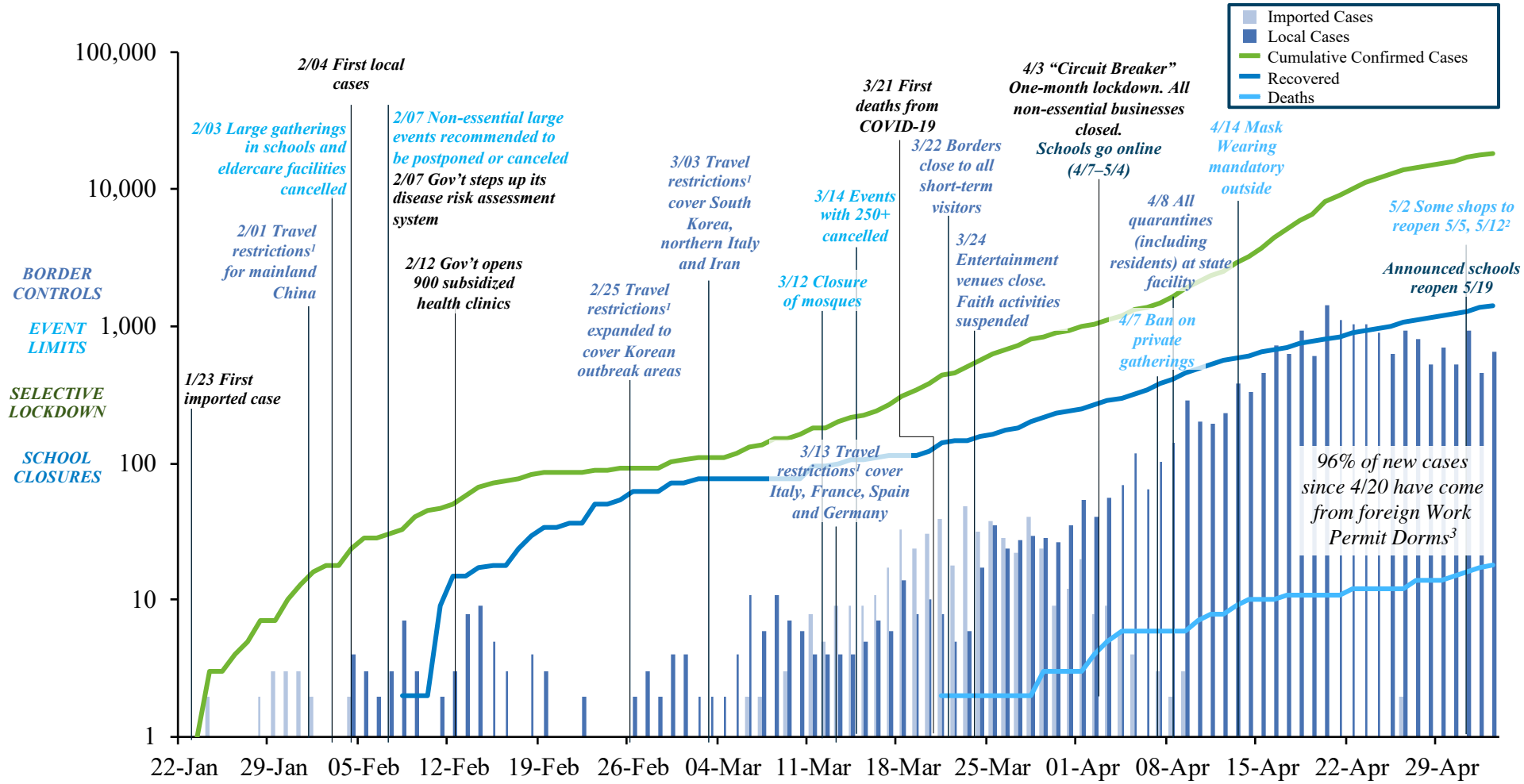
– Nominal Imports, Exports Through March 2020 –



Note: Nominal imports and exports of goods and services are shown in on a Balance of Payments Basis, Monthly, Seasonally Adjusted
Source: FRED, NBER

Singapore demonstrates the need for rigorous continuous mitigation; despite initial success, Singapore imposed a 4-week lockdown on April 7th when containment failed

Singapore Case Progression



1 Travel restrictions: No short-term visitors allowed to enter or transit through Singapore with recent travel history (last 14 days) to the country; residents required to stay at home for 14 days after arrival

2 May 5 – TCM and essential condo activities open; May 12 – home-based bakeries, some food shops, barbers, manufacturing of confectionary, laundry open; May 19 – schools open to smaller class sizes

3 Workers who are well and work in critical services have been moved to new housing facilities. Several work dormitories with high infection rates have isolated

Source: JHU, MOH, University of Oxford

dean&company

Summary Observations

- **It is not the lockdown, but the ensuing mitigation period that will most hurt the economy**
- **Only a vaccine will allow the economy to repair the damage and begin a full recovery**
- **Mitigation period requires containment, which is as challenging as a vaccine**
- **Under mitigation economies run slower**
- **Like terrorism (another hidden enemy), pandemic prevention is not expected to go away**
- **Several vectors can be used to estimate market impact of ~35 to 55% from peak**

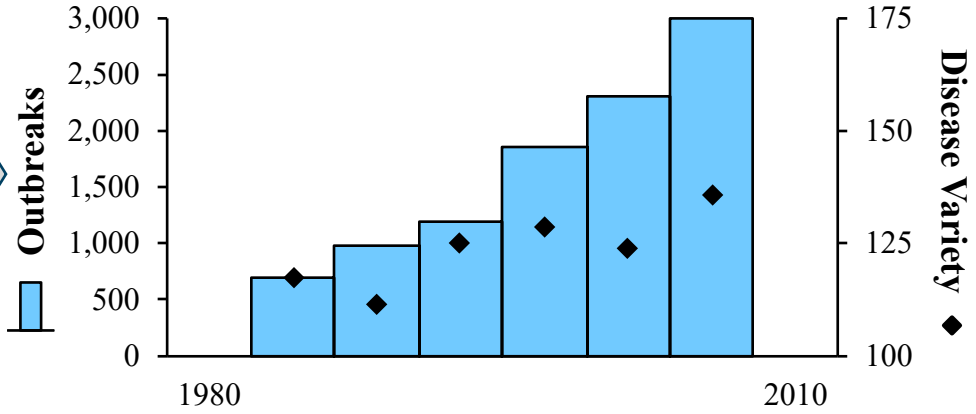
Prompted by COVID-19, the U.S. is expected to spend $100 to $200 billion to mitigate future pandemics (0.6% of annual GDP)

1. **With increased social mobility, large gathering spaces, more dense living, and increased travel, disease outbreaks have risen significantly over the past few decades**

2. **COVID-19 will likely be the forcing-function for the U.S. government to mitigate risks of future pandemics**

3. **As a recent analog – terrorism**
   - The 9/11 attacks killed just over 3,000 U.S. citizens and initiated $3T in counter-terrorism spending over the next two decades (not including overseas wars)
   - COVID-19 has already claimed 70,000 U.S. lives, and will likely increase to 100,000 or more, so we should expect at least as much spending
   - The expense will be justified by value-of-life statistics

Outbreaks Rise and Change[1]



Since 1980 the global number of disease outbreaks has risen, while the variety of diseases has also increased

Value of Pandemic Mitigation Within the U.S.?

Say COVID-19 truncates 10 years of human life (COVID disproportionately kills older population), Value-of-life is $130,000/year/life, and pandemic risk is 100,000 additional pre-mature deaths per year

100,000 x 130,000 x 10 = $130B/year *($2.6T in 20 years)*

0.6% of annual GDP

[1] Global Rise in Human Infectious Disease Outbreaks, *Journal of the Royal Society Interface, 2014, JHU Covid 19 Dashboard as of May 5th 2020*

Source: Dean & Company

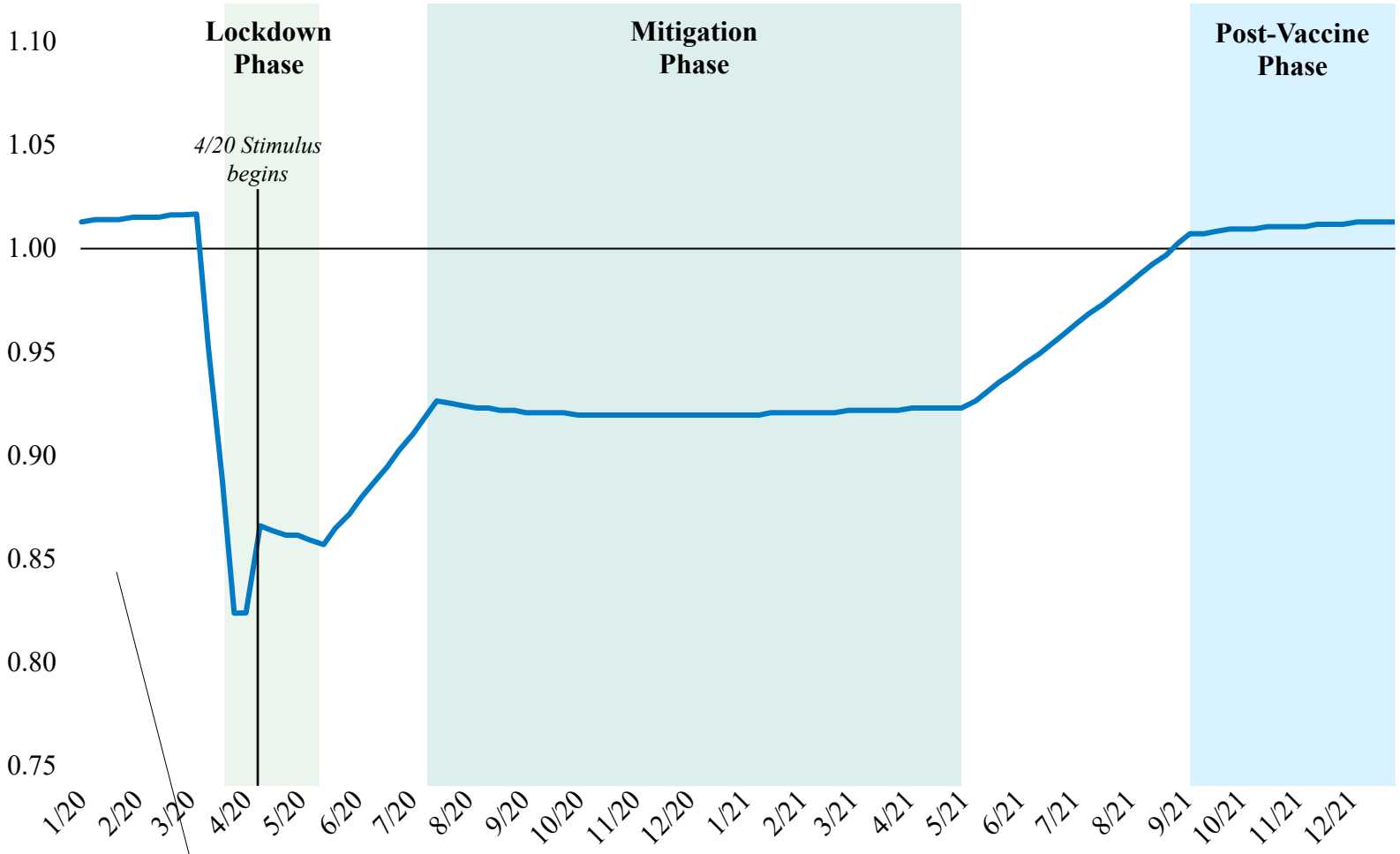
Summary Observations

- **It is not the lockdown, but the ensuing mitigation period that will most hurt the economy**
- **Only a vaccine will allow the economy to repair the damage and begin a full recovery**
- **Mitigation period requires containment, which is as challenging as a vaccine**
- **Under mitigation economies run slower**
- **Like terrorism (another hidden enemy), pandemic prevention is not expected to go away**
- **Several vectors can be used to estimate market impact of ~35 to 55% from peak**

The GDP estimates are based on estimating sector performance at three stages of the pandemic with transition periods between each and adding stimulus and trade effects

Weekly GDP Run Rate

– Compared to 2019 Values –



Note: Certain stimulus segments (direct payments to households, grants to distressed sectors, and transfer payments for FEMA, local schools and transit system) are addressed explicitly in model. Direct payments to households are assumed to have a flat impact for 4 weeks, and then a slowly decreasing impact. Grants and transfer payments assumed to have a flat impact for 12 months then a slowly decreasing impact

Sector impacts from Covid-19 – lockdown phase estimates

Sector	% of GDP	Impact	Rationale
Agriculture, Forestry, Fishing and Hunting	1.3%	(5%)	News reports referencing distribution & end customer impacts. TSN says food service decline > retail growth.
Mining, Quarrying, and Oil and Gas Extraction	2.8%	(31%)	MS China indicators: Feb. activity coal down 20-50%, steel down 30-50%. Wuhan NO2 levels down 52%. O&G based on consuming sector declines; HAL, SLB, KMI, BKR, NOV 1Q reports indicate15-50% declines.
Utilities	1.5%	(7%)	MS indicators: US electrical output down 5-10%. CMS reports 7% electricity decline in Apr.
Construction	3.4%	(40%)	Mar. AGC survey of US contractors: 28% report halted/delayed projects, only 14% reported no material or worker disruptions. CAT sales down 27% in 1Q20. MS reports Feb. China property construction down 70-80%
Manufacturing	11.3%	(27%)	Wuhan NO2 levels down 52%. MS China indicators: Feb. manufacturing down 40-50%. Sub-sectors scaled up based on degree to which likely to be deemed essential
Wholesale Trade	5.9%	(21%)	Tied to retail trade in mitigation, but impact softened initially to assumed increases in target inventory levels
Retail Trade	6.0%	(26%)	DFS reports Apr. total spend volume down 29%, AXP non-travel and expense spend volumes down 25%
Motor Vehicle and Parts Dealers	1.4%	(50%)	JD Power reports auto sales down 55%. KMX comparable store sales down 50%. ORLY parts sales down 13%. PPG US body shop customers at <50% of capacity
Food and Beverage Stores	0.7%	15%	DFS cardholder spending volumes on groceries up 16% in April
General Merchandise Stores	0.8%	(10%)	DFS non-grocery everyday down 10% April
Other Retail	3.2%	(29%)	Assumed to be a more heavily impacted retail sector; DFX reports total retail down 29% April
Transportation and Warehousing	2.9%	(44%)	TSA air traffic down 96%, DFS reports Apr. travel spend down 99%; DAL near-term demand near 0; CSX & UNP rail volumes down 20-25%; JHBT & ODFL truck volumes down ~20%. News reports: transit down 75%.
Information[1]	6.4%	(8%)	Box office down 100%, home theatre unaffected/up. No live music. Reports of publishing impacts from lockdown. Internet traffic up 18%. Earnings call commentary: VZ & T revenue hit by declines in digital media, marketing, and roaming. XLNX sees demand weakness from broadcast business
Finance and Insurance	6.3%	(9%)	Assumed peak-to-trough similar impact last recession (down 31%), but lagged
Real Estate and Rental and Leasing	12.5%	(11%)	Earnings call commentary: BXP Apr. retail rent collection at 40%, office rent at 95%. SLG Apr. retail rent at 64%, office rent at 92%. ARE office rent 98%. WSJ reports apartment rent down 15% YoY. Rental of non-real estate (e.g. cars, clothes) expected to be down 40% from lack of mobility
Professional and Business Services	13.3%	(10%)	Earnings call commentary on tech and scientific companies: computer software (FFIV, CDNS, IBM) at normal levels, healthcare-related ABT "sharp decline", DGX down 50%. Assume drop similar to mitigation
Educational Services	1.1%	(11%)	Assumed impact similar to professional services, GS estimates down 15%
Health Care and Social Assistance	7.6%	(42%)	UHS end of Mar. admissions down 25-29%. HCA Apr. inpatient admissions down 30%, ER admissions down 50%, outpatient surgeries down 70%. DGX non-COVID tests down 50-60%. Dentistry practices closed.
Arts, Entertainment, and Recreation	1.0%	(91%)	Assume almost all in person activities closed
Accommodation and Food Services	2.7%	(63%)	DFS Apr. restaurant spending down 60%; MS has daily US restaurant transactions down ~80%. Hotel occupancy rate down ~70% in news reports
Other Services (except Government)	1.9%	(27%)	Assumed high mix of in person services; US Services PMI down to 40
Government	11.5%	2%	Assumed similar impact to previous recession
TOTAL IMPACT (Change vs. Prior Trend[2])		**(20%)**	

[1] Includes publishing, motion picture & sound, telco, broadcasting, data processing, internet, info services
[2] Prior trend growth assumed to be 2% CAGR

Sector impacts from Covid-19 – mitigation phase estimates

Sector	% of GDP	Impact	Rationale
Agriculture, Forestry, Fishing and Hunting	1.3%	(2%)	Improvement from lockdown but still slight decline from restaurants
Mining, Quarrying, and Oil and Gas Extraction	2.8%	(21%)	MS China indicators: mid-Mar activity coal normal, steel down 30%, S. Korean NO2 down 25%, O&G based on consuming sector estimated declines
Utilities	1.5%	(2%)	Expect some recovery from lockdown
Construction	3.4%	(23%)	MS China indicators: mid-Mar. property construction down 30%. 33% peak-to-trough drop last recession
Manufacturing	11.3%	(11%)	Closed factories restart. Expected 10-15% demand shocks for durable and intermediate. APH suggests mitigation efforts likely to have 2% productivity drag. MS China indicators: mid-Mar. mfg. down 10-30%.
Wholesale Trade	5.9%	(14%)	Tied to retail
Retail Trade	6.0%	(14%)	See subsectors. South Korea Feb.-Mar. retail down 9%. CH Mar. retail sales down 16% YoY.
Motor Vehicle and Parts Dealers	1.4%	(20%)	CH Mar. auto sales down 18% YoY. News reports: South Korea down 10% across Feb.-Mar. Sweden's Mar. passenger vehicle registrations down 37% YoY.
Food and Beverage Stores	0.7%	4%	Boost from decreased restaurant attendance remains, but at a lower level
General Merchandise Stores	0.8%	(8%)	Taiwan Feb.-Mar. department store sales down 20-25% YoY, other general merchandise stores flat to 9% decline YoY
Other Retail	3.2%	(17%)	MS China indicators: mall demand down 30-40%.
Transportation and Warehousing	2.9%	(14%)	Some subsectors improve from lockdown. Flightradar24: CH # of flights down 50%. Google transit station mobility data for Singapore, Taiwan and South Korea down 15-25%
Information[1]	6.4%	(5%)	Improvements from lockdown but significant social distancing impacts for mass events. News reports: WSJ expects demand shock hit to information technology spending, down 4-8%
Finance and Insurance	6.3%	(30%)	Assumed peak-to-trough similar impact last recession (down 31%), but lagged from lockdown
Real Estate and Rental and Leasing	12.5%	(7%)	Real estate similar to suppression period behavior due to decreased demand, increased unemployment. Rental and leasing (of non-real estate e.g. cars, clothes) assumed to improve
Professional and Business Services	13.3%	(10%)	Consistent with overall mitigation drags, except software which is unaffected
Educational Services	1.1%	(3%)	Improvement from suppression period
Health Care and Social Assistance	7.6%	(10%)	DGX expects lower post lockdown volumes, ABT expect slower recovery than decline, ISRG China procedures fell 90% initially, down 70% by end of Mar., continued deferral of some elective healthcare
Arts, Entertainment, and Recreation	1.0%	(50%)	Improvement from suppression. Surveys on people's willingness to attend events pre-vaccine (28% willing to attend sporting events). LVS expects casinos to recover quickly
Accommodation and Food Services	2.7%	(29%)	Restaurant volumes expected to improve to 70% normal w/ social distancing; MS indicators: CH hotel occupancy rates up to 52% from 25% between mid-Feb. and end of Mar.
Other Services (except Government)	1.9%	(10%)	Assumed similar to overall mitigation drag
Government	11.5%	2%	Assumed similar impact to previous recession
TOTAL IMPACT (Change vs. Prior Trend[2])		**(11%)**	

[1] Includes publishing, motion picture & sound, telco, broadcasting, data processing, internet, info services
[2] Prior trend growth assumed to be 2% CAGR

Sector impacts from Covid-19 – post-vaccine phase estimates

Sector	% of GDP	Impact	Rationale
Agriculture, Forestry, Fishing and Hunting	1.3%	(2%)	Slight residual demand shock
Mining, Quarrying, and Oil and Gas Extraction	2.8%	(7%)	Residual demand/price shock. Earnings call expectations of 2 years of recovery for O&G sector
Utilities	1.5%	(2%)	Slight residual demand shock
Construction	3.4%	(14%)	Assumed 5-10% increase from mitigation (residual demand shock impact)
Manufacturing	11.3%	(2%)	Slight residual demand shock to subsectors, although otherwise recovered
Wholesale Trade	5.9%	(2%)	Tied to retail
Retail Trade	6.0%	(2%)	See subsectors
Motor Vehicle and Parts Dealers	1.4%	0%	Full return to normal
Food and Beverage Stores	0.7%	0%	Full return to normal
General Merchandise Stores	0.8%	0%	Full return to normal
Other Retail	3.2%	(5%)	Assume residual demand shock and bankruptcies of smaller retailers
Transportation and Warehousing	2.9%	0%	Full return to normal
Information[1]	6.4%	(2%)	Slight residual demand shock to some subsectors
Finance and Insurance	6.3%	(20%)	Assumed peak-to-trough similar to last recession (down 31%), but lagged from mitigation & lockdown phases
Real Estate and Rental and Leasing	12.5%	(6%)	Assumed residual demand shock, long recovery
Professional and Business Services	13.3%	(2%)	Assume small residual demand shock
Educational Services	1.1%	0%	Full return to normal
Health Care and Social Assistance	7.6%	3%	Assumed pent-up demand from mitigation period
Arts, Entertainment, and Recreation	1.0%	(3%)	Assumed residual impact from demand shock and bankruptcies
Accommodation and Food Services	2.7%	(3%)	Assume some restaurants bankrupt and unable to reopen after mitigation
Other Services (except Government)	1.9%	(2%)	Assumed modest decline from prior trend
Government	11.5%	(2%)	Assumed modest decline after significant deficit spending
TOTAL IMPACT (Change vs. Prior Trend[2])		**(4%)**	

[1] Includes publishing, motion picture & sound, telco, broadcasting, data processing, internet, info services
[2] Prior trend growth assumed to be 2% CAGR

The stimulus is included in the GDP model, most elements are included in the sector estimates, the remainder are added back in aggregate. This assumes stimulus goes where intended, in the correct amounts, and on time which suggests we may have overstated the benefits

2020 Stimulus Component	GDP Impact[1]	Included in Sector Estimates	Aggregate GDP Additions	Reasoning	Sectors Affected	Timing
Direct Payments to Households	$338 B	Partially	$236 B	• Assumes 80MM people receive stimulus, 70% of recipients use as explicit stimulus remainder use to offset lost income	Retail, Mfg, Whls, by GDP	After 1 mo. exp. decay at 7%/week
Unemployment Insurance expansion	$319 B	Yes	-	• Analogs driving sector estimates either include stimulative effects or are from countries w/ a less severe demand shock	-	
Transfers to State and Local Governments	$193 B	Yes	-	• 2009 state/local up initially then dropped ~4% despite $205B in aid; model up 1% suppression & mitigation, down 2% post vaccine	-	
Loans/grants to small businesses	$946 B	Yes	-	• Decreases second/third order effects; we assume entire industries do not need to be rebuilt and allow restart	-	
Grants to Distressed Sectors	$40 B	No	$40 B	• Direct subsidy to airlines and some manufacturing, not included in model which is based on traffic estimates	Air Transportation	After 12 mo. exp. decays at 5%/wk
Loans to Businesses, States, Cities	$525 B	Yes	-	• Assume liquidity necessary to allow smooth restart in mitigation & post vaccine phases	-	
Tax Cuts / Deferrals to Businesses	$294 B	Yes	-	• Arguably stimulative, but benefits predominately the very wealthy so likely to have minimal spill over effects	-	
Payments & Credits Support Expanded Sick and Family Leave	$131 B	Yes	-	• Assumed to offset drag from additional absenteeism due to mitigation/lockdown		
Payments to hospitals/health care providers	$383 B	Yes	-	• Model is based on aggregate activity levels that should include stimulus effects. Assumed to maintain solvency of healthcare and allow smooth restart post suppression and mitigation	-	
Transfer to Support Virus Prevention, Preparation, & Testing	$10 B	Yes	-	• Same rationale as above hospital/healthcare payments	-	
Transfers to Medicare, Medicaid, and Uninsured	$68 B	Yes	-	• Same rationale as above hospital/healthcare payments	-	
Transfer payment to FEMA's Disaster Relief Fund	$59 B	No	$59 B	• Additional funding to be used for major disasters and "all purpose" fund	Federal	After 12 mo. exp. decays at 5%/wk
Transfer payment to support local schools and colleges	$34 B	No	$34 B	• Additional unbudgeted spending for support of COVID response activities	Educational Services	After 12 mo. exp. decays at 5%/wk
Transfer payment to support nation's transit system	$28 B	No	$28 B	• Additional unbudgeted funds for transit infrastructure grants	Transit	After 12 mo. exp. decays at 5%/wk
Transfer payment to food stamps	$31 B	Yes	-	• Offsets decrease in food spending associated with job losses	-	
Total	**$3.46 T**		**~$400 B**			
% of 2019 GDP	**13.0%**		**2.1%**			

[1] All sectors include a GDP multiplier based on their estimated effect for GDP. Full stimulus is $2.9T, with an average multiplier of 1.2

Aside from business lockdowns and slowdowns, we will experience a structural employment loss of ~3.6% to manage virus containment

Driver	Value
Daily Cases (10X confirmed)	283,000
Contacts/Case (lower bound)	10
Isolation Time	
Infected (days)	28
Contact (days)	14
Share that can Work from Home	50%
% Isolated to Achieve R = 1	60%
Person Days Lost per Case	35
Total Lost Potential Work Days Each Day	11,886,000
Population (= Potential Work Days Each Day)	328,000,000
Share of Potential Labor Lost (Structural Containment Impact)	**3.6%**

Notes:

- *Calculations assume the reproduction number is managed to near 1 via contact tracing alone*
- *% Isolated is the % of cases that are isolated before generating additional contacts*
- *Transmission must be managed so that the reproduction number is near 1 even if herd immunity is the target to avoid overwhelming hospitals and significantly increasing fatality rates*

Source: JHU, Dean and Company

Employment losses and historical analogs suggests a GDP decline of an even larger magnitude even before accounting for the masking effects of the SBA payroll protection plan

Significant Prior Recessions					
Recession	**Dates**	**Employment Decline**		**Actual GDP Decline**	**Ratio** (GDP / Employment)
		(sa)	**(%)**		
1969	4Q69 – 1Q71	1.0MM	1.5%	0.7%	0.47
1973	4Q73 – 2Q75	2.2MM	2.8%	3.1%	1.11
1981	3Q81 – 4Q82	2.8MM	3.1%	2.6%	0.84
1990	3Q90 – 1Q91	1.6MM	1.5%	1.4%	0.93
2008	1Q08 – 3Q09	8.7MM	6.3%	4.0%	0.63
			Mean Ratio from Past Recessions		**0.80**
2020	1Q20 - ?	32.2 MM (Reported[1])	20.5% (Reported)	0.80 (mean ratio from past recessions)	
		36.5 MM (w/o PPP impact[2])	23.2% (w/o PPP impact)		
		5.7 MM (structural containment impact alone[3])	3.6% (structural containment impact alone[3])		

Implied GDP Decline
16.4%
18.6%
+2.9%

[1] As of 5/8/2020

[2] Assumes total SBA Paycheck Protection Plan (PPP) saves 8.7 MM jobs on average over a 3 month period, 50% of employees covered by PPP likely also included in new claims and so are not counted here

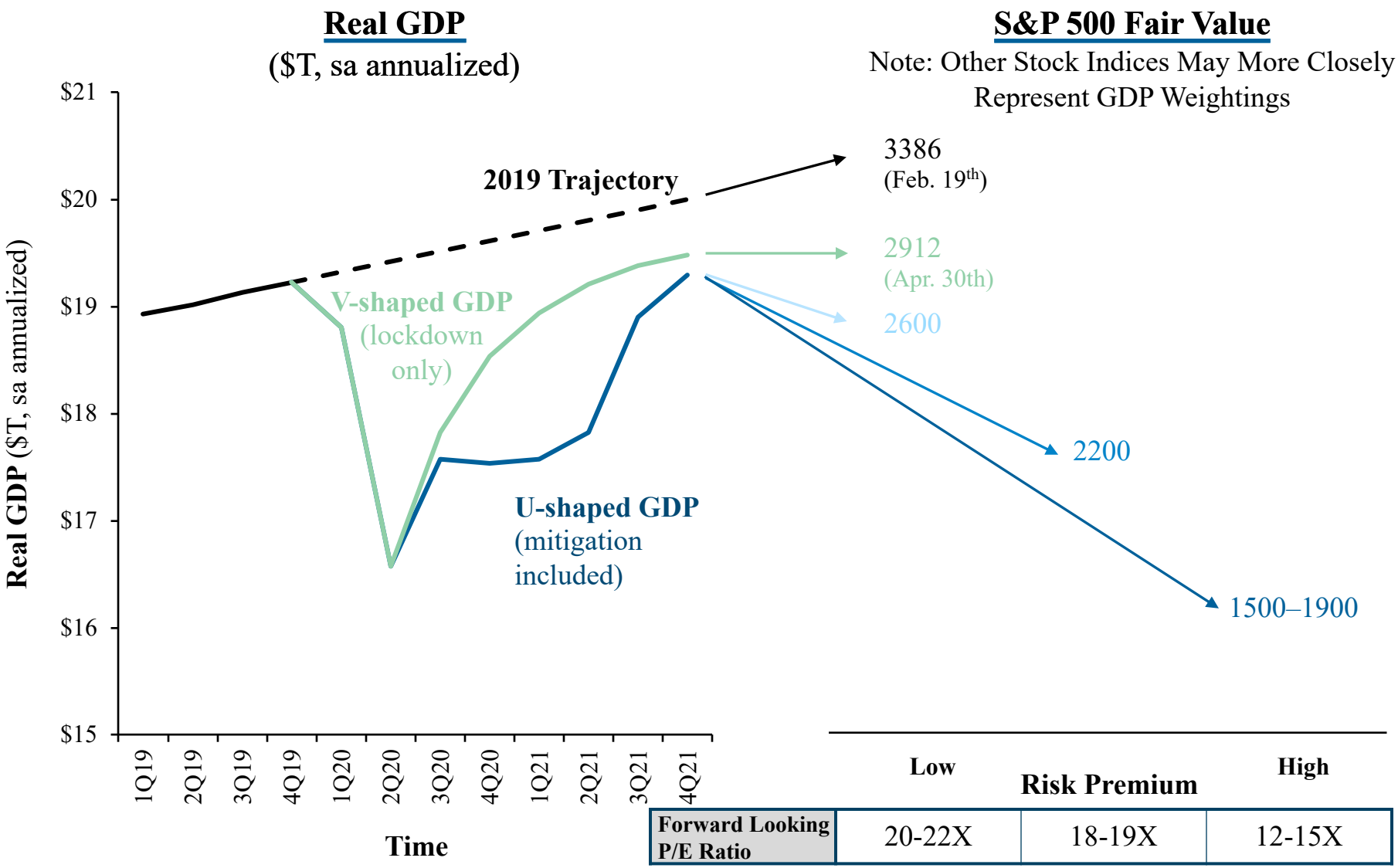
[3] Containment impact denotes the structural unemployment likely if the US maintains ~280k cases per day due purely to required isolation time of patients and their contacts. ~3.6% of population per day

Notes: Declines for previous recessions are peak-to-trough.

Current unemployment drop calculated using total new weekly unemployment claims from 3/08 to 4/04 , excluding the usual claim levels. Continuing claims were not used due to reports of significant processing lags due to increased volumes. Analysis includes the $599 B of PPP funding, no additional funding used for "PPP Impacts" assumed.

Source: FRED, BLS, DOL, Inquirer

Since we expect the economy to fully recover only after a vaccine is available, we anticipate impacts will be larger with increased uncertainty – reducing stock prices by approximately 35 to 55% from the February peak



	Low Risk Premium		High Risk Premium
Forward Looking P/E Ratio	20-22X	18-19X	12-15X

Typical of recent recessions

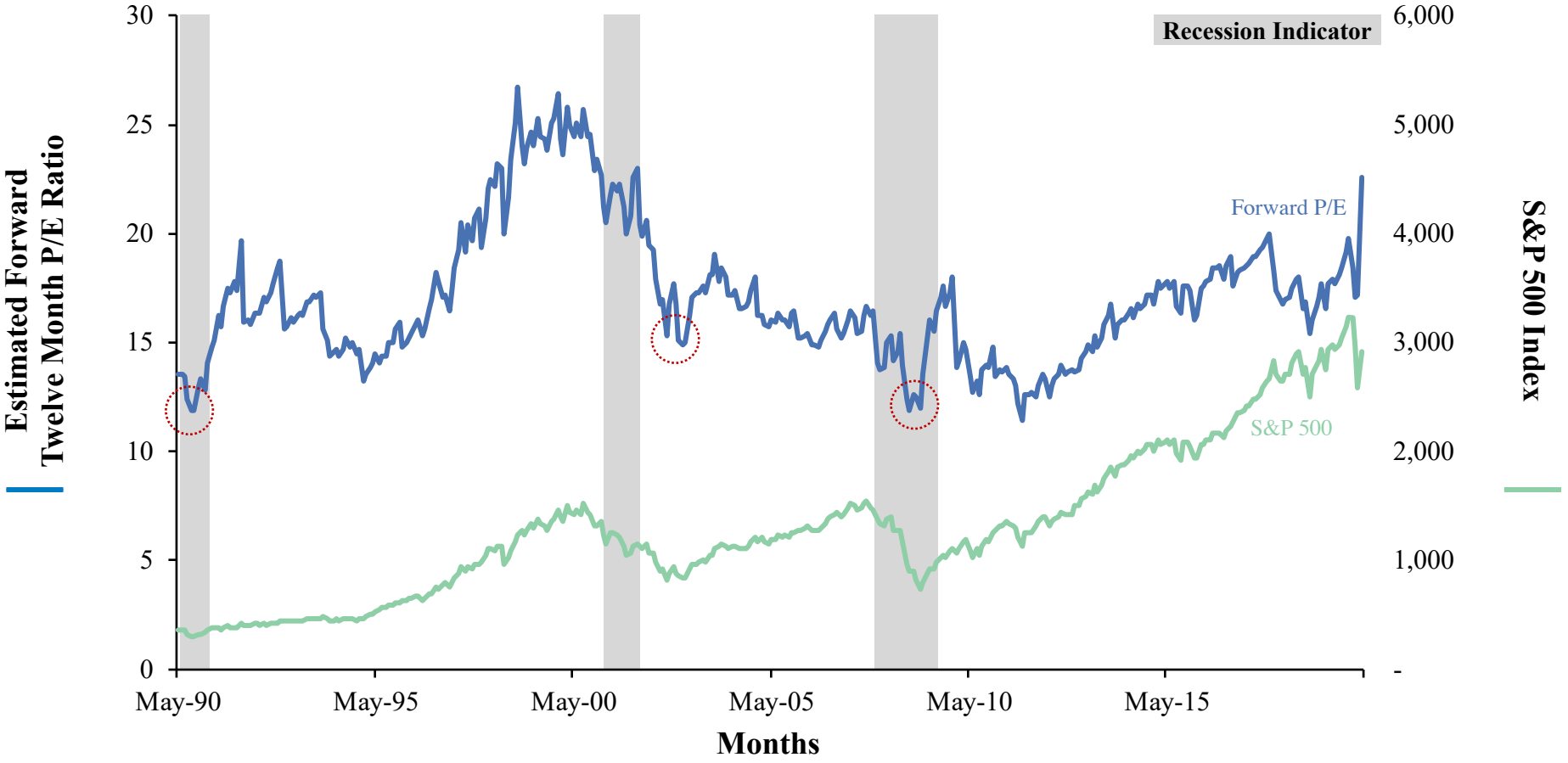
NOTE: 2019 trajectory is GDP at an annual growth rate of 2.0%, based on 4Q19's QoQ annualized growth rate

Source: Dean & Company

dean&company

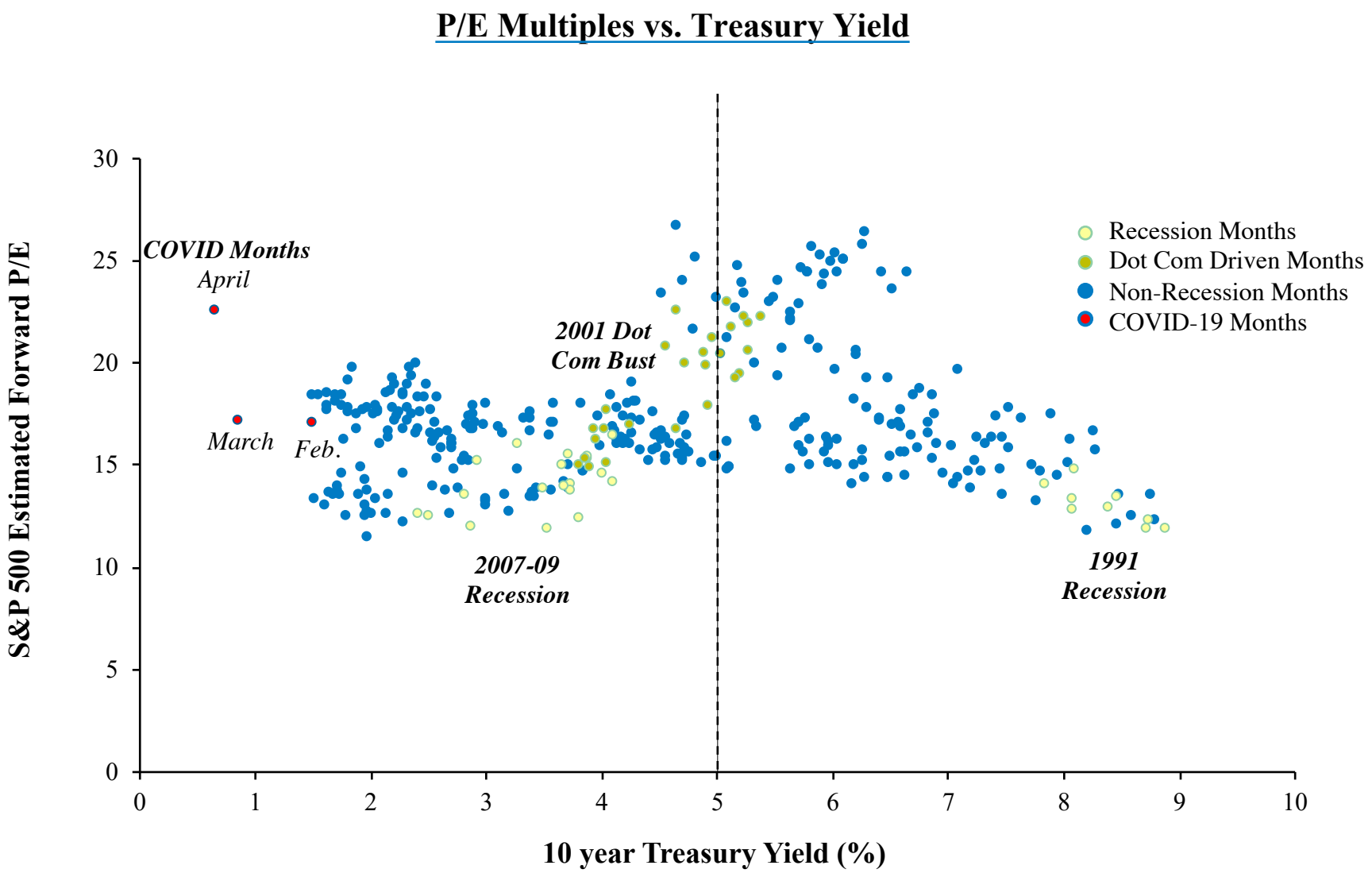
Recessions tend to lead to lower Price to Earnings ratios of 12-15 reflecting a higher equity risk premium

S&P 500 Price to Earnings Ratio over Time



Source: Bloomberg S&P 500 Index

We assume interested rates will stay low in part due to Fed actions; however, even in a low interest rate environment a 12-15 Price to Earnings ratio is typical



Note: Monthly data for 1/1990-12/2019, Recession Months includes all month where the economy was in recession; Dot Com Driven Months include recession months and those months after the end of the recession until 4/2003

Source: Credit Suisse

Potential downside risks exceed potential upside risks

Potential Downside Risks

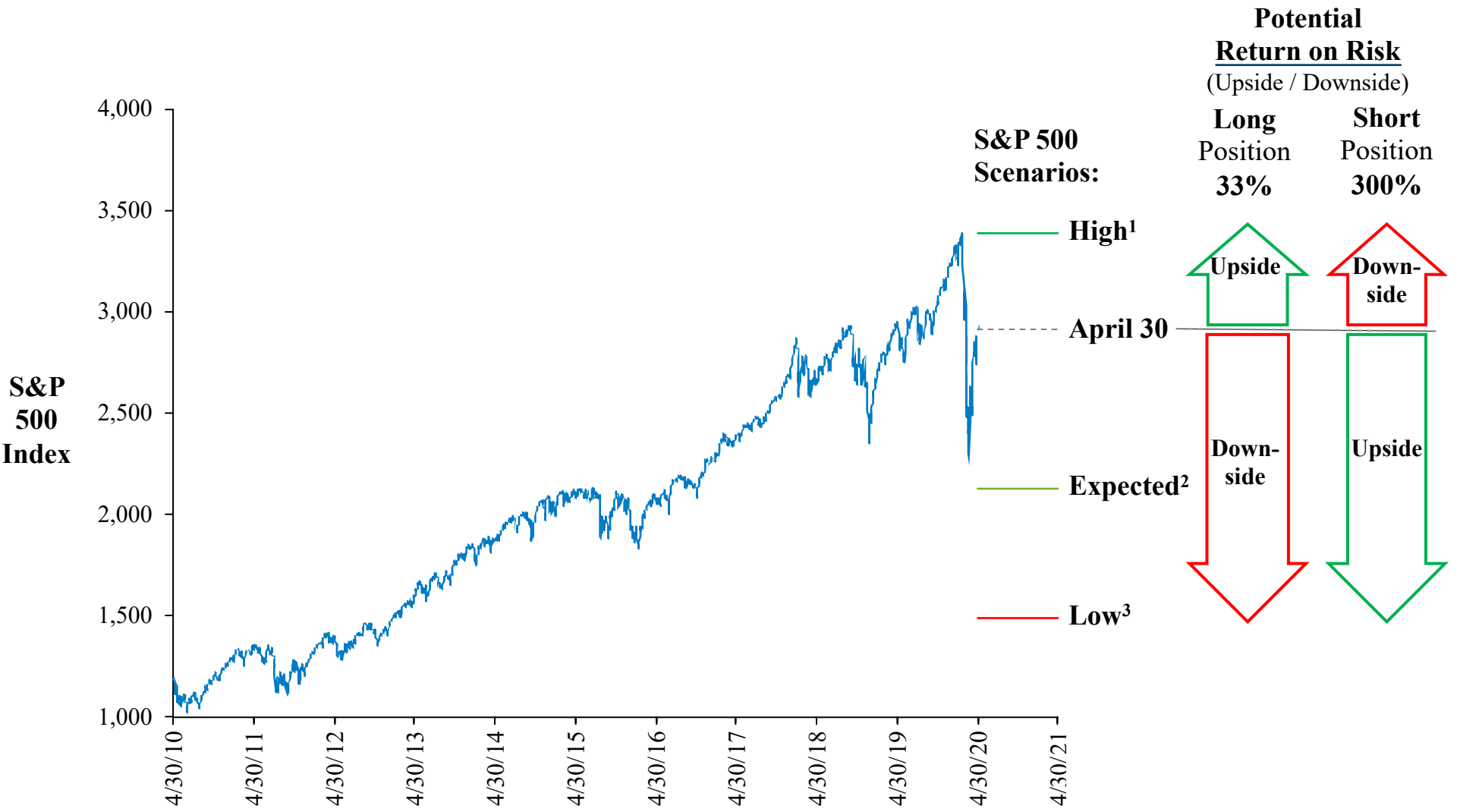
- Vaccine takes longer to develop than expected
  - Previous record was 4 years for mumps
- Risk that opening triggers runaway case growth & a return to lockdown
  - Previous 10 pandemics all had a 2nd wave
  - US trying to open economy with per capita cases >1000X Chinese levels at reopening
  - Excluding the NY metro area case counts are continuing to grow in the US[1]
- North/South EU debt tensions limit fiscal stimulus and slow recovery
- Long term trend growth rate reduced due to near term disruption
  - Schools closed – extent of damage to children unclear
  - Record unemployment causes skills of unemployed atrophy
  - High debt burdens constrain future productivity enhancing investments
  - Social distancing reduces innovation
- Some high contact industries may have to be rebuilt nearly from scratch
  - Hospitality industries, air travel, etc.
- Supply chain disruption likely to impede recovery
- Stimulus is not limitless or perfect; significant risks managing this level of disruption
  - Printing money has potential to lead to dangerous levels of inflation or another recession to combat inflationary pressures
  - Current models assume stimulus largely works as intended; limited unintended consequences
- There will be ongoing costs to prevent the next pandemic
  - 9/11 attacks led to significant investment in national security, preparedness

Potential Upside Risks

- Breakthrough treatment / vaccine at scale
- Virus mutates into less virulent forms
  - Likely to occur, but over several years
- New ”cloud” based sectors grow more than expected which disproportionately benefits the US
- Effort to reduce Covid-19 transmission reduces burden from other infectious diseases like influenza

[1] New York Times, May 5th 2020

At the April 30th 2020 S&P level, a short equity position has significantly better expected return with less downside risk than a long position



1 "High" refers to the S&P returning to its 2/19/20 peak;
2 "Expected" refers to the average S&P fair value under our expected "U-shaped" GDP recovery and a range of earnings multiples (discount rates),
3 "Low" refers to our expected "U-shaped" GDP recovery under our lowest recession earnings multiple scenario of12x forward P/E.
Source: Bloomberg, Dean & Company Analysis

Contact Information:

Dean and Company Strategy Consultants

info@dean.com

1600 Tysons Boulevard, Fifth Floor
McLean, VA 22102