March 1st, 2020

Public Note 2:

Analysis of COVID-19 Contagion & Outlook

This report focuses on the epidemiological trajectory of the coronavirus COVID-19 disease, what measures are likely to shift that trajectory, and the economic impact of those measures.

In addition to data analysis of the trajectory of infections by jurisdiction, the clinical and contagion characteristics of COVID-19 are covered in the second half of this report.

SUMMARY

The dramatic equity market selloff since Feb. 20th, though spurred by coronavirus developments, should be understood as a confluence of multiple factors:

- **a shift in the perception of the epidemiology and trajectory of the virus**:
  - contagion that had previously seemed to be on a positive trajectory of control in China and relatively contained elsewhere evolved into the rapid development of large clusters of infection in advanced and other global economies (notably Italy, Japan, South Korea, and Iran – and to a much lesser extent the US)
- concern that government- and self-imposed **measures to thwart further contagion are likely to grow in significance and negatively impact economic activity** thus reducing earnings below previous expectations
- a growing appreciation that beyond the immediate macroeconomic impact of the virus there is **a significant potential financial impact** as cash flows evaporate in multiple sectors in China and elsewhere, within a context of economies that currently carry high levels of debt

This evolution and the exceptional strength of the recent selloff should be understood especially in terms of how they represent **a major shift in the dynamics we highlighted in our 2020 Macroeconomic Outlook**. That report highlighted that:

- within a context of significant bearish long-term pressures, a short-term cyclical bullish trend emerged in Q4 2019 and gained considerable strength leading into 2020 (as indicated in market trends prior to the COVID-19 disruption)

The Feb. 20 - Feb 28 equity market selloff is best understood not as a "the end is near and hundreds of millions will die in a pandemic" panic. It reflects **a sharp reversal in sentiment driven by concerns that the short-term cyclical bullish support which generated substantial Q4 2019-Q1 2020 equity gains is disappearing** thanks to coronavirus headwinds.

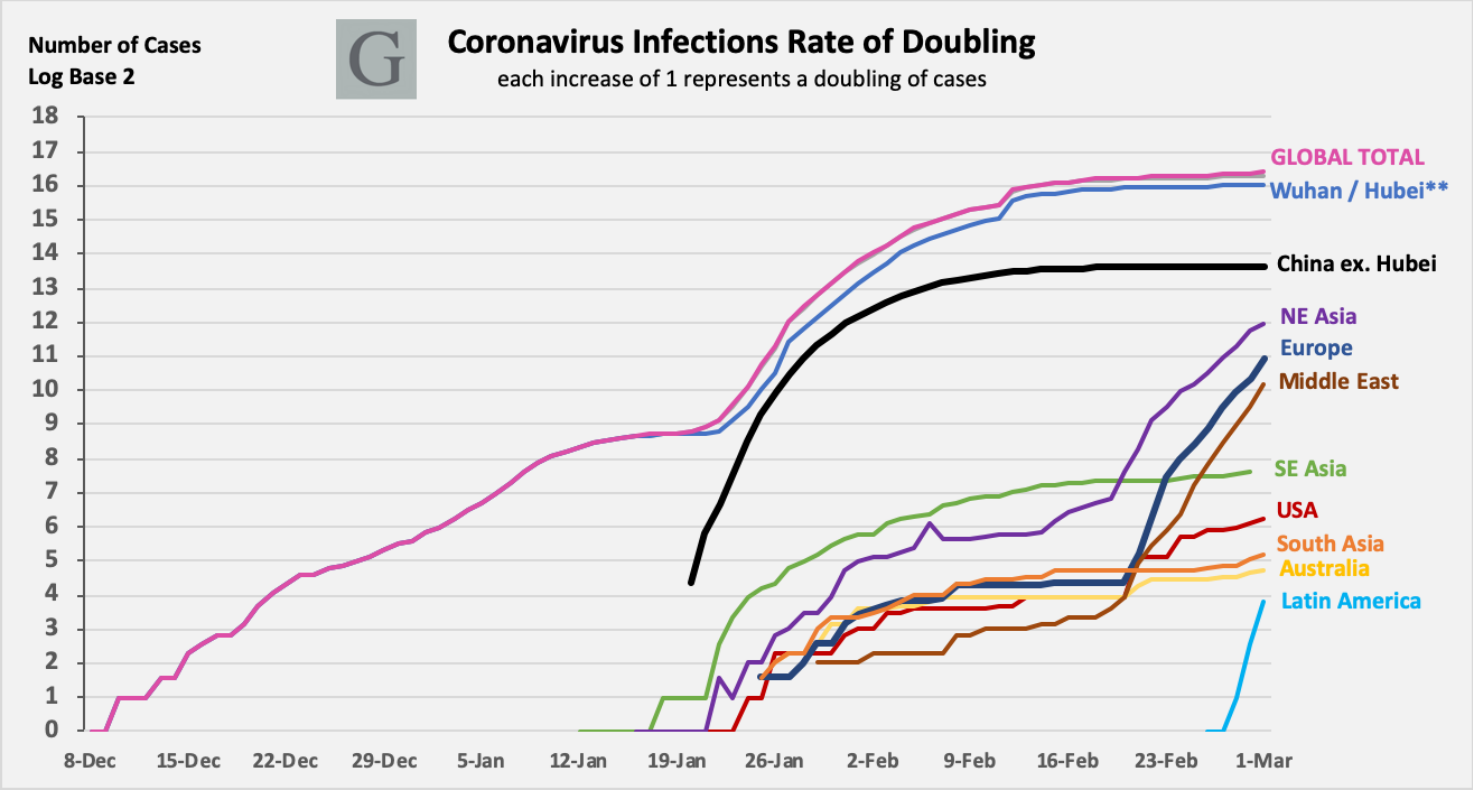
The focus of this report is the strength and likely evolution of COVID-19 headwinds.

This report is part of the analysis and advisory service we provide clients on COVID-19 dynamics. That service and access to all of our data is available to private sector clients for $375, and to government and public health entities for free. Bespoke research tailored to client interests and portfolios is also available on contract. Contact us at client.relations@greygcapital.com for further details.

Is the Market Response an Overreaction?

The chart below tracks the epidemiological trajectory of COVID-19 infections using logarithmic analysis that measures the speed at which the number of cases is doubling.

It demonstrates clearly that **beginning Feb. 20th (concurrent with the market's sharp negative trend), the rate of new infections accelerated rapidly in NE Asia and Europe, and more recently in Latin America.**



Despite this dramatic recent epidemiological trend after what had appeared to be a plateauing of cases in China and elsewhere in the world, the speed of the market's decline (S&P 500 down 15.5% from Feb 19 to Feb 28) has driven **assertions that negative sentiment is rapidly outpacing any real shift in fundamentals, i.e. that "panic" has set in.**

There are multiple factors driving this market "correction," as noted above. Unjustified panic is, however, in our assessment not one of them. **A sense that the threat of COVID-19 is overstated nonetheless continues to influence market sentiment.**

US DATA NOT THAT BAD

Sentiment that the market is overreacting is in part spurred by a recognition that the **trajectory of infections in the US continues to be modest and current US case numbers are slightly misleading**:

- individuals returning from a diagnosed infection abroad and immediately quarantined upon arrival in the US represent the majority of US cases as of March 1st

US Coronavirus Cases

March 1st	Date of First Case	Current Number of Cases
King County, WA	21-Jan	9
Chicago, IL	24-Jan	3
Tempe, AZ	26-Jan	1
Orange, CA	26-Jan	1
Los Angeles, CA	26-Jan	1
Santa Clara, CA	31-Jan	3
Boston, MA	1-Feb	1
San Benito, CA	3-Feb	2
Madison, WI	5-Feb	1
San Diego County, CA	11-Feb	2
San Antonio, TX	13-Feb	1
Omaha, NE (From Diamond Princess)	21-Feb	0
Travis, CA (From Diamond Princess)	21-Feb	0
Lackland, TX (From Diamond Princess)	21-Feb	0
Humboldt County, CA	21-Feb	1
Sacramento County, CA	21-Feb	2
Unassigned Location (From Diamond Princess)	24-Feb	**44**
Portland, OR	29-Feb	1
Snohomish County, WA	1-Mar	2
Providence, RI	1-Mar	1
Total US	21-Jan	76

Source: Georgetown Capital Research; Johns Hopkins data

From a purely US epidemiological standpoint, the spread of COVID-19 in the United States as of March 1st does not merit the market's reaction.

However, **we do not believe US epidemiological factors are the primary driver of recent market dynamics**.

In this context, should the US epidemiological trajectory deteriorate, significant further deterioration in equity markets can be expected.

We anticipate **the development of a cyclical pattern:**

- **equity market deterioration** in tandem with any further epidemiological deterioration in the US and globally,
- **counterbalanced cyclically** by policy expectations of economic stimulus and the implementation of aggressive policy to stabilize the epidemiological trajectory.

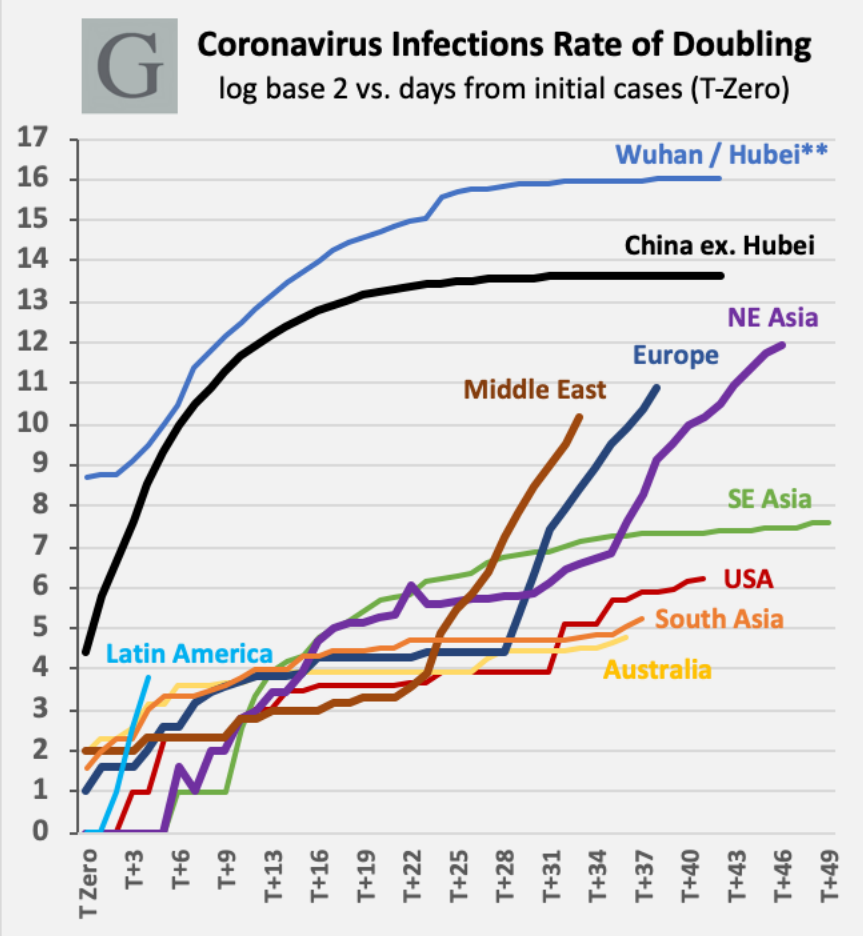
AT A CRITICAL CROSSROADS

Though the trajectory of overall US infections is currently modest, the **recent emergence in the US of infections that originate from local community contagion** – as opposed to travel to or known intimate contact with a person who has traveled to an infected region - **represents a dangerous epidemiological shift**.

Furthermore, the rapid development of large clusters of contagion in multiple nations beyond China is leading to **a significantly increased risk of clusters of infection developing in the US through inbound international travel.**

These two factors – inbound travel of infected travelers, and the development of clusters of community contagion – have been **the precursors of rapid infection outbreaks in multiple other regions.**

The following graph demonstrates how quickly domestic clusters of COVID-19 infection can develop. It tracks the evolution of COVID-19 cases in terms of their rate of doubling after the diagnosis of initial cases.



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Per the above chart:

- Not only have **infections in the last 10 days of February doubled on a nearly daily basis in multiple regions**: NE Asia (Japan and Korea), Europe (Italy in particular), and the Middle East (primarily Iran).
- **The speed with which this trajectory is reached has been increasing as COVID-19 is spread through travel** (note the number of days from initial cases until outbreak in Latin America and Middle East vs. Europe and NE Asia).

TRAVEL IS THE CRITICAL DYNAMIC

The black line on the graph above tracks the exceptional exponential growth of infections in China outside the initial Wuhan epicenter. Its early trajectory highlights what in our assessment is the critical factor which investors should be prepared to see addressed by further policy action:

- **travel of infected persons from one jurisdiction to another is the primary vector by which local disease clusters are developing**

- **China's initial explosion of cases was driven by travel of individuals infected in Wuhan** to other areas of the country, sparking secondary local infection clusters across China that subsequently required severe travel restrictions and quarantines (not only restricting travel from Wuhan but also internally across China)
- **Travel from China to other nations sparked secondary infection clusters** at a rate that also required severe internal quarantine measures (Japan, Korea, Italy, Iran, etc.)
- **Travel from nations with secondary infection clusters threatens now to establish tertiary infection clusters** not only in the US but globally (the recent explosion of cases in Latin America has been tied to travel from Italy)

Our assessment is that significant international travel controls and monitoring will likely be required to thwart this cycle of contagion.

How Dangerous is COVID-19?

Minimization of the COVID-19 threat has limited pressure thus far for aggressive international travel monitoring and restrictions and reflected a common perspective that "fear" represents a greater threat than the virus itself.

From a short-term economic perspective, this may be accurate: the greatest immediate economic impact of COVID-19 is from measures taken by governments and individuals to reduce the risk of exposure. This represents a major potential hit to the travel and service sectors, in particular. However, **the long-term cost of inaction that allows COVID-19 infections to become established in a jurisdiction is far greater than the pain and cost to that jurisdiction of aggressive short-term action.**

The Scale of the Public Health Threat

The assessment that COVID-19 risk sentiment exceeds the actual threat has been driven in part by clinical data that indicates **the risk of severe complications from COVID-19 to average healthy adults is low**.

A further key statistic cited to indicate fear is disproportionate to the fundamental threat is the **relatively limited number of deaths attributed to COVID-19 vs. common seasonal influenza**: less than 3,000 globally vs. 61,000 deaths from the common flu in the US alone during the 2017-2018 flu season (source: US CDC estimates).

Comparing the absolute mortality rate of COVID-19 thus far with common influenza is misplaced and significantly underappreciates the scale of the COVID-19 public health threat.

<u>Any sense of complacency generated from the relatively mild symptoms in healthy adults should be put aside by a realization of the broader dynamics of the disease:</u>

- Healthy adults who show minor symptoms but are nonetheless contagious represent an optimal vector for COVID-19* to spread to individuals who are far more susceptible to severe complications.
- This combination has the capacity to rapidly overwhelm health systems, as ease of contagion leads to exponential growth in cases and the growing number of those cases that need treatment for severe COVID-19 complications overwhelms health care systems.

<u>The primary threat of COVID-19 is its capacity to overwhelm health systems.</u>

* 'COVID-19' technically refers to the disease that is generated by the novel coronavirus which has the clinical name 'SARS-CoV2'. For simplicity, in this report we use COVID-19 when discussing both virus and disease contagion.

Healthy Individuals: COVID-19's Trojan Horse

Though this coronavirus has a low likelihood of killing the average person, it is devastating to at-risk populations. Furthermore, **the overwhelming of health systems has the potential to lead not only to a far greater economic impact and mortality** of severe COVID-19 cases. In health systems that have been overwhelmed, significant increases in mortality can be expected from illnesses that are not COVID-19-related.

It is imperative to recognize that:

- though approx. 80% of COVID-19 cases have only mild-to-moderate symptoms and the virus's overall mortality rate has been estimated at approx. 2%
- **mortality is dramatically higher in elderly individuals and others whose systems are already weakened** (as well as the occasional otherwise healthy human who proves vulnerable to COVID-19 for genetic and undiagnosed reasons)

Clinical observations indicate that, at the low end of estimates, 16% of persons infected by COVID-19 develop severe symptoms.

- **a 2% overall mortality rate means 2 out of those 16 severe cases die**
- **this represents a 1/8 or greater than 12% mortality rate for severe cases** - significantly higher than influenza (as is COVID-19's 2% overall mortality rate)

Because nearly one fifth of COVID-19 infections result in severe respiratory distress, **as the total number of infected grows and severe-case patient loads multiply, the treatment protocols and cost of limiting mortality threaten to overwhelm health systems** in any jurisdiction where COVID-19 is prevalent.

This combination of extreme contagiousness of the virus via vectors that show only mild-to-moderate symptoms or are asymptomatic (80% of total cases) plus the high mortality of targeted populations, means a decision has to be made:

- **fight the virus very aggressively**
- **or surrender the targeted population and see the health system overwhelmed**

The Lesson from China

Global cases are currently nowhere near the level of infection seen in Wuhan and the rest of China, but **China's experience highlights not only the risk of initial inaction in restricting travel**. It also demonstrates the immense costs that must be incurred to stop COVID-19 once significant clusters of infection have been established locally.

Our assessment is that **failure to aggressively monitor and limit inbound international travel from countries with infection clusters has a high probability to lead to the eventual need for internal travel controls and quarantines as internal clusters develop.**

We estimate **the costs and challenges of these internal controls are likely to be far greater than the costs associated with limiting entry of infection over international borders**. We also see a dynamic developing where countries that fail to thwart entry of COVID-19 into their jurisdiction and then see significant domestic clusters of infection develop are subsequently the target of international travel restrictions. This multiplies the costs that derive from failure to take initial action.

Understanding Clinical Aspects of COVID-19 Contagion and Disease Progression

Similarities with SARS

Though significant misinformation has circulated regarding COVID-19, its most important dynamics are fairly well understood. This is in part because the virus that causes COVID-19 is very similar to the virus that previously caused SARS (Sudden Acute Respiratory Syndrome)†.

Because of these similarities, much of the information regarding clinical aspects of COVID-19 has been inferred from SARS clinical observations.

However, as a mass epidemic threat there are important differences that make COVID-19 significantly more dangerous than SARS. COVID-19 has had far greater numbers of infections and evolved on a much faster epidemiological trajectory than SARS.

Our assessment is that despite these significant differences **a key source of confidence regarding the likelihood of COVID-19 being contained and minimized as a threat relates to previous success in eliminating SARS.**

SARS was Contained by Summer

After emerging in November of 2002, SARS was contained by July of 2003. Were COVID-19 to follow a similar trajectory following its emergence in December 2019, the disease would be contained in late July of this year.

Not only are there significant differences between the epidemiological trajectory of COVID-19 and SARS thus far, making such an assumption questionable. Even if COVID-19 is contained 4 to 5 months from now, the scale of the interim threat is huge as the virus has been reproducing at an exceptional rate. Six weeks ago, China reported less than 1,000 cases. As of March 1, there are nearly 90,000 cases worldwide.

The speed and extent of COVID-19 contagion is only one reason for caution that the SARS trajectory will prove elusive.

COVID-19 Now in Southern Hemisphere

In the last week of February, COVID-19 infections emerged in underdeveloped Southern Hemisphere countries. Because of its speed of contagion and current epidemiological trajectory, **COVID-19 has the potential to establish infection clusters in the Southern Hemisphere** to a far greater extent than SARS did.

If COVID-19 becomes firmly established in the Southern Hemisphere, seasonal dynamics that are expected to assist in the virus's containment in the Northern Hemisphere could be offset. **This has the potential to result in the virus remaining as a year-round phenomenon globally.**

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† The structural similarity of the two viruses is reflected in their names. COVID-19 is caused by the 'SARS-CoV2' virus, whereas the the outbreak of SARS was caused by the first 'SARS-CoV' virus 17 years ago.

Formulating strategies based on assumptions that COVID-19 will follow a seasonal and epidemiological trajectory similar to SARS strikes us as highly injudicious.

An Overview of How COVID-19 Works

Understanding the clinical characteristics of COVID-19 offers a better understanding of the scale and likely progression of the systemic economic and health threat. A further benefit is insight into sectoral investment and resource impacts as well as optimal personal and community preventive behavior.

Public health policies taken thus far in the US are likely inadequate to stem the growth of COVID-19, indicating not only an underestimated impact from the virus but also potential major policy shifts and political risk.

Clinical similarities with SARS have combined with ongoing clinical research from China and elsewhere to provide a fairly clear picture of how COVID-19:

- enters and infects a human's system
- advances clinically once within that system
- is distributed from that infected system to cause further contagion

COVID-19 Contagion Paths

Preventing COVID-19 contagion depends upon preventing the body fluids of a human that is infected from entering your system.

Viruses do not move on their own. **To enter and infect a human's system, COVID-19 depends upon hitching a ride via human body fluids.**

Infected body fluids can enter only where there is an opening not covered by intact skin:

- the eyes
- the nostrils
- the mouth
- urogenital openings (anus, vagina, urethra)
- wounds or bites that breach the skin barrier (needles, cuts, insects, animals, etc.)

There is no clinical evidence that the COVID-19 virus is transmitted through insect or other bites. Transmission through sexual activity has also not been clinically established.

The ear "opening" is actually protected by skin cells and not a common virus entry path.

Defend Your Eyes, Nose, & Mouth

The primary point of entry of the COVID-19 (SARS-CoV2) virus has been identified as the eyes, nose, and mouth.

Preventing infected body fluids from entering your eyes, nose, and mouth is key to preventing infection by COVID-19 (SARS-CoV2).

How the Virus Enters

Entry through your eyes, nose, and mouth can happen in one of two ways:

1. **contaminated body fluids are splashed or inhaled into the opening**
    - for example, by an infected human coughing or sneezing their body fluids directly into your eyes, nose, or mouth
    - by inhaling contaminated body fluids that are airborne
        - the only airborne fluids that might contain COVID-19 are respiratory droplets from infected humans
        - these droplets are significantly larger than the virus itself and do not remain airborne long, making environmental contamination of surfaces their primary risk
2. **contaminated body fluids are transferred into the opening via something that has picked them up**
    - for example: your hand touches a surface or item that has an infected person's body fluids on it, and you then transfer that infected body fluid into your system by touching your eyes, nose, or mouth
    - you do something similar with a towel or other item that has an infected person's body fluids on it (for example, rubbing a contaminated towel in your eyes, a pen in your mouth, etc.)

Though some viruses can also gain entry if you put food or water that has been contaminated by an infected person's body fluids in your mouth (or nose or eyes), the extent of this route of transmission has not been established for COVID-19. Food and water contamination are lower risk than the direct undiluted entry of infected body fluids.

Risk Accelerates Quickly

Once COVID-19 is prevalent in an area, disease protocols become very important to prevent exponential growth in infection rates.

Multiple infected persons in an area leads to a higher saturation of surfaces with COVID-19 contaminated body fluids - especially in an enclosed area where ventilation is poor or there is significant shared touching of surfaces (for example, public transportation)**.**

At low concentrations of COVID-19-infected humans, the environmental contamination of the virus (and thus risk of infection) is fairly low without direct close personal contact with an infected person.

With high levels of concentration of infected persons or close personal contact, COVID-19 has proven extremely contagious.

COVID-19 Community Infection Trajectory

The trajectory of the disease in an area reflects the above dynamic. It has generally been:

- an initial infected individual enters a community through travel, with further communal infection minimal at first
- close personal contacts of the first index case become infected (often without their immediate knowledge)
- this expanded node of infected humans passes COVID-19-infected body fluids further to other individuals, sparking localized nodes as above - but still with minimal general community risk overall
    - if these initial nodes are effectively quarantined, a relatively low overall number of initial cases can hold and community risk remains low (assuming multiple new nodes are not introduced through travel)
- if quarantine is ineffective or new cases are introduced, the COVID-19 virus begins to become significantly more prevalent in the general community
- **environmental saturation then leads to an epidemiological inflection point being passed and COVID-19 cases explode exponentially**
- this exponential explosion continues and spreads to other jurisdictions until extreme quarantine and travel restriction measures are enacted

The factors which drive the evolution of the above epidemiological dynamic are:

- the scale at which the virus is initially introduced into the community or is being introduced on an ongoing basis
- the effectiveness of quarantine measures to thwart the virus's replication
- the extent to which community behavior leads to density of interaction:
    - population density factors
    - weather factors that drive indoor interaction and virus survivability on surfaces

Current US Stage in Trajectory

Our assessment is that as of March 1st **the US is in the early stages of the above epidemiological trajectory**, with a low number of initial cases and generally only close personal contacts further infected.

The recent emergence of limited community infections, however, indicates a possible progression on this trajectory, making **effective quarantine of initial cases essential**.

Our concern is that there is a substantial **potential for the US to advance quickly towards later stages of exponential development**, given a general lack of awareness of effective virus protocols alongside what has appeared to be a minimization of the scale of COVID-19 risks.

To prevent this epidemiological evolution, significant policy steps will have to be taken, in particular relating to the limit of travel. Our assessment is that **these steps are not being effectively implemented in the US, which is increasing the risk that the US will evolve along the above epidemiological trajectory.**

EVOLUTION OF SYMPTOMS OF COVID-19

The epidemiological trajectory of COVID-19 within a jurisdiction has similarities with its trajectory within the human body.

Once COVID-19 has entered a human's system, a multistage process begins. These stages can last a variety of time periods, depending upon the concentration of virus that enters as well as the characteristics of the infected human's system.

STAGE 1: LANDS ON INTERNAL MEMBRANE

The virus (and the body fluid it is hitching a ride with) initially settle on the internal mucous membranes of the nose, mouth, throat, or lungs.

- Mucous membranes offer protection for the cells in your eyes, nose, throat, and lungs.

As the virus settles on these mucous membranes, it must travel via the viscous mucous until it comes into contact with internal cells.

- Some humans will produce and expel enough mucous during this process so that the virus is never able to get past that line of defense.
- Such mucous is potentially infectious for others when expelled.

The length of Stage 1 depends on a variety of factors, but **a human system "infected" at this initial stage would show no symptoms and no viral count in any testing.**

Concentration of virus entry is a key factor driving evolution beyond this stage.

STAGE 2: CONNECTS WITH INTERNAL CELLS, REPLICATES

If the virus is transported through the membranes and finds a cell that it can bind with, it hijacks the internal structure of that cell to rapidly replicate itself.

- the virus needs to make direct contact with a cell that has its needed receptor (ACE-2 for the SARS-CoV2 virus)
- once it comes into contact with such a cell, it forms a link by connecting to the cell receptor via a "lock and key" or "male/female" action
- the virus then uses this connection to inject that cell with virus genetic material
- this injected material hijacks the infected cell to begin to produce more of the virus
- this process can result in the rapid replication of the virus

Growing high levels of the virus in the system during this stage can cause human body fluids to have a high virus count and thus make that person infectious, even though they might show only limited or even no symptoms.

The above "incubation period" from COVID-19 initially entering the system until symptoms begin to show varies depending upon the level of initial and ongoing virus exposure, as well as the ability of the human system that is infected to defend itself against the replication process.

This period has been estimated to be as fast as 2 days or as long as 14, with reported outliers of 27 days and a reported clinical average of approximately 5-6 days.

The suggested quarantine period of 14 days is based on this incubation period estimate. It should be recognized, however, that this process of viral replication is associated with an internal battle as the immune system of the infected human fights the virus. This internal battle is not always linear, so that levels of COVID-19 fluctuate. This can make clinical observations and accurate testing difficult.

The viral load can build rapidly during this stage and make individuals contagious despite appearing asymptomatic. Even if they "show no symptoms" during this internal battle, an infected person is likely to have fleeting indications that something is wrong, such as lethargy or a periodic minor fever.

STAGE 3: NOTICEABLE SYMPTOMS APPEAR

As the virus rapidly replicates and the infected human's immune system mobilizes to fight it, noticeable symptoms begin to emerge in tandem with cellular inflammation.

- muscular and joint inflammation can lead to physical pain
- a general fever develops
- inflammation in the lungs can lead to a sense of shortness of breath
- inflammation in the lungs can lead to fluid buildup and coughing

The severity and length of these symptoms varies from individual to individual, depending upon:

- the ability of the infected person's system to fight and limit the replication of COVID-19 internally
- the ability of the infected person's internal systems to absorb and adjust to the inflammation, especially in the lungs

It is estimated that 80% of COVID-19 cases will exhibit symptoms of no more severity than the above, which are equivalent to a mild to moderate case of the common flu. However, **during this stage the body is expelling significant amounts of the virus via respiratory droplets (coughing, sneezing, talking, and breathing), leading to extensive environmental contamination with infected body fluids**.

Symptom crossover with flu is a key factor making diagnosis difficult, but also offers insight into how the seasonal end of flu season can be expected to assist anti-COVID-19 efforts.

STAGE 4: LUNG SYMPTOMS WORSEN

At a fundamental level, **COVID-19 can be thought of as a virus that attacks the lungs and uses the lungs to spread itself.**

As inflammation builds in an infected human's system, a key target of COVID-19 is the infected person's lungs. Not only does inflammation do damage to the lungs directly. **As the lungs suffer inflammation, their alveoli begin to accumulate liquid**. (Alveoli are the small sacs where oxygen is transferred into the blood from inhaled air and carbon

dioxide is transferred out of the blood into the lungs for exhalation.)

As liquid fills the lungs' alveoli**, the lungs can no longer effectively transfer oxygen into the infected person's blood** or expel carbon dioxide out of the blood.

This process of lung deterioration can be very rapid (hence the SARS acronym: Sudden Acute Respiratory Syndrome). As COVID-19 leads to the lungs filling with fluid, a process similar to pneumonia complications results (COVID-19 is often referred to as "new pneumonia" in Chinese).

Increased fluid in the lungs leads to increased coughing and hence more environmental contamination. **Increased fluid in the lungs not only significantly increases difficulty breathing but also leads to further complications as reduced levels of oxygen are transferred to other internal organs.**

STAGE 5: INFECTED SYSTEM FACES COLLAPSE

Decreasing levels of oxygen being transferred into the blood places pressure on other body organs that no longer have enough oxygen to properly function. **Other body systems can rapidly begin to collapse** – particularly if already weakened by age-related deterioration or other pre-existing conditions.

At this stage, major interventions are required to prevent death. This often entails connecting the infected person to a ventilator so that their blood can be oxygenated mechanically to try and prevent organ failure.

Even with major interventions, 12% of the 16% of cases that develop severe respiratory symptoms have been estimated to end in death.

PARALLELS WITH SYSTEMIC DYNAMICS

The above clinical process indicates the importance of preventing COVID-19 from entering the system and the immense consequences that can occur in systems that are not adequately protected.

This dynamic applies not only at the individual but also health system level.

Though preventive measures to stop the entry of COVID-19 into a system are incredibly challenging and entail significant costs, **the cost of failure to prevent entry and aggressively respond is much higher.**

EFFECTIVE COVID-19 PREVENTION

EFFECTIVE PREVENTION IS VERY DIFFICULT

- **Full infectious disease protocols require exceptional discipline and entail significant costs and inconvenience**.
- The level of discipline should reflect the risk associated with becoming infected.
- **The level of discipline in the public health response in the US has thus far appeared to be far lower than that required to prevent COVID-19 from becoming established.**

Public health messages that have minimized the risk of COVID-19 to average healthy adults appear to be based on a desire to minimize economic impact and guard limited public health resources.

These messages have led to **an overall perception of risk that is accurate only when COVID-19 exposure is low.** They also encourage a permissive environment for the virus to expand.

THE CHINA ROAD MAP

Dismissal of the extreme measures taken in China to halt the spread of COVID-19 as inappropriate and unnecessary for the American environment has likely been premature.

Should COVID-19 become established in the US, measures similar to what were enacted in China (or permutations as used elsewhere in Asia, e.g. Singapore) have a high potential to prove necessary at least at the localized level of outbreaks.

Such a shift in approach is likely to prove very jarring for a population that had seen the threat of COVID-19 minimized and lead to significant political and economic repercussions.

From a systemic and markets level, however, such moves are likely to be critical to stabilize the epidemiological and economic trajectory, despite short-term costs.

Measures taken in China to stem the exponential growth of COVID-19 include:

- significant travel restrictions
  - internationally
  - internally between provinces
  - to and from local neighborhoods in areas of outbreak
- aggressive quarantine of infected individuals and jurisdictions
- prevalent checkpoints to check citizens' temperatures in order to identify individuals showing a fever (an initial potential symptom of COVID-19)
- extensive monitoring of citizen movement and contacts
- mandatory universal face mask usage

Resistance to enacting measures such as above are likely to be significant given the extent of misinformation that has been circulated regarding the level of risk of COVID-19.

CONCLUSION

It is our assessment that **delay of dramatic isolation measures represents the greatest overall economic threat of COVID-19.** By leading to the virus gaining a stronger foothold, delays in aggressive action can be expected to increase the scale of measures that will eventually be required to secure health systems, and lead to greater overall economic dislocation.

This implies that **the implementation of aggressive virus mitigation measures is likely to mark positive momentum turning points.**

This report has focused on epidemiological and clinical aspects of COVID-19 as relevant to policy and economic and financial pressures. For further macroeconomic and financial analysis regarding underlying resilience of the US economy in the face of the COVID-19 threat, contact us for our ongoing reports that cover macro and financial dynamics.

This report is part of the analysis and advisory service we provide clients on COVID-19 dynamics. That service and access to all of our data is available to private sector clients for $375, and to government and public health entities for free. Bespoke research tailored to client interests and portfolios is also available on contract. Contact us at client.relations@greygcapital.com for further details.

ABOUT OUR BACKGROUND IN PREPARING THIS REPORT

In leading the preparation of our COVID-19 analysis, Director of Research Mark Reedy draws on extensive field and analytical experience with pandemic prevention programs.

Mr. Reedy was a team leader for the United Nations on the ground in Equatorial Guinea, Central Africa, where he led the development of infectious-disease prevention and treatment programs on behalf of the Global Fund to Fight AIDS, Tuberculosis, and Malaria. Following this field leadership experience, Mr. Reedy worked on a Gates Foundation / Clinton HIV-AIDS Initiative co-project called the Consortium for Strategic HIV Operations Research, where he designed systems to apply advanced data analysis for the assessment of epidemiological trajectory, clinical operations, and best practices in the fight against the Human Immunodeficiency Virus pandemic.

For details on material in this report, or to contract specific bespoke research of interest to you, please contact reedy@greygcapital.com