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PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS

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COVID-19: long-term health impacts

Long-term health impacts of COVID-19

Where are we today?

— Most investors seem to be focusing on the health impacts of COVID-19 in a binary way: either the infected individual recovers (and lives) or they do not recover (are deceased).

— Although rarely discussed by investors, there is a growing body of research by medical experts that suggests a significant portion of COVID-19 survivors face longer-term, often severe, health problems. These issues are known as "long COVID".

— It seems to us that every institution that has researched long COVID effects has reached a similar conclusion: longer-term health effects from COVID-19 are surprisingly prevalent and the supporting evidence is strong. In other words, most everyone who has honestly researched this space seems to agree that the effects exist and the risks are real. At the same time, those who have not researched this space (most of the broader investor community) remain unconcerned.

— To us, this rhymes with January/February 2020 when most epidemiologists (the experts) were highly concerned about a possible global pandemic, while the broader investor community (mostly non-experts) remained unconcerned.

Who has acknowledged long COVID?

Very few institutions seem to be following these effects

*"Furthermore, for my benefit and for yours, **please do not focus solely on mortality risks**. There are well-documented long-term health risks that some COVID survivors face (see page 7) which should also affect public policy decisions. To exclude them from the narrative is disingenuous at best"*
–Michael Cembalest, J.P. Morgan

"There are some areas where the mortality implications could be mixed: behavioural and societal impacts, for example. Indeed, we've noted that COVID-related social distancing measures may significantly reduce the spread of flu. But it's clear to the authors that the net medium-term impact of 'long COVID' is to reduce life expectancy compared with a world absent the pandemic."
–Ben Bennett, Head of Investment Strategy & Research, Legal & General

"…it will be important to develop therapies for the persistent debilitating symptoms that many patients struggle with months after getting sick, like memory fog, loss of smell and digestive and heart problems."
–Daniela Hernandez, Wall Street Journal

Long-term health impacts of COVID-19

What does the research suggest?

COVID-19 is broadly thought of as a virus that affects the lungs. However, it can severely impact the brain and heart as well.

—**Lungs**: COVID-19 can inflict long-term or perhaps permanent damage to the lungs, resulting in scarring and persistent breathing problems.

—**Heart**: being affected with the virus can result in lasting damage to the heart muscle. Surprisingly, this can occur even in individuals who experienced more mild symptoms originally and were not hospitalized. Heart damage may increase risks of heart failure or other issues later in life.

—**Brain**: COVID-19 can significantly increase risk of stroke, seizure, and Guillian-Barre syndrome—which causes temporary paralysis. Being affected by the virus, even for those with mild symptoms at the outset, may increase risks of Parkinson's Disease and Alzheimer's later in life.

Long-term health impacts of COVID-19

How common are these issues?

"Some studies find that more than 50% of people who 'recovered' from COVID remain hobbled by these symptoms three months later. They can't return to work. They can't fulfill their responsibilities at home. They are being called 'long haulers'." –Anthony L. Omaraoff, M.D. Editor in Chief, Harvard Health Letter

"Researchers estimate about 10% of COVID-19 patients become long haulers, according to a recent article from The Journal of the American Medical Association and a study done by British scientists. That's in line with what UC Davis Health is seeing." –UC Davis Health

Lungs: "We don't know, but data from severe acute respiratory syndrome (SARS) and middle east respiratory syndrome (MERS) suggests that as many as 50% of people who have had COVID-19 may have some lung damage. How bad it will be and how much of an impact they will have on their life is unclear." -UC Health

Heart: "Nearly one-fourth of those hospitalized with COVID-19 have been diagnosed with cardiovascular complications, which have been shown to contribute to roughly 40% of all COVID-19-related deaths." "Another JAMA Cardiology study used cardiac MRIs on 100 people who had recovered from COVID-19 within the past two to three months. Researchers found abnormalities in the hearts of 78% recovered patients and 'ongoing myocardial inflammation' in 60%. The same study found high levels of the blood enzyme troponin, an indicator of heart damage, in 76% of patients tested, although heart function appeared to be generally preserved. Most patients in the study had not required hospitalization." –Laura Williamson, American Heart Association News

Brain: "Doctors in a large Chicago medical center found that more than 40% of patients with COVID showed neurologic manifestations at the outset, and more than 30% of those had impaired cognition. Sometimes the neurological manifestations can be devastating and can even lead to death." "Particularly troubling is increasing evidence that there may be mild—but very real—brain damage that occurs in many survivors, causing pervasive yet subtle cognitive, behavioral, and psychological problems." –Andrew Budson, M.D. Harvard Health Publishing

https://www.health.harvard.edu/diseases-and-conditions/what-are-the-long-lasting-effects-of-covid-19#:~:text=Some%20studies%20find%20that%20more,fulfill%20their%20responsibilities%20at%20home.
https://health.ucdavis.edu/coronavirus/covid-19-information/covid-19-long-haulers.html
https://www.uchealth.com/en/media-room/covid-19/short-and-long-term-lung-damage-from-covid-19
https://www.heart.org/en/news/2020/09/03/what-covid-19-is-doing-to-the-heart-even-after-recovery

What might this mean?

For human capital:

- Prolonged illness may result in longer time away from employment and further deterioration in skills and opportunities.
- Damaged organs may reduce the working lives of workers as quality of life is diminished.
- A realization of possible serious long-term health issues may hurt the willingness of workers to return to the employment if not yet vaccinated.

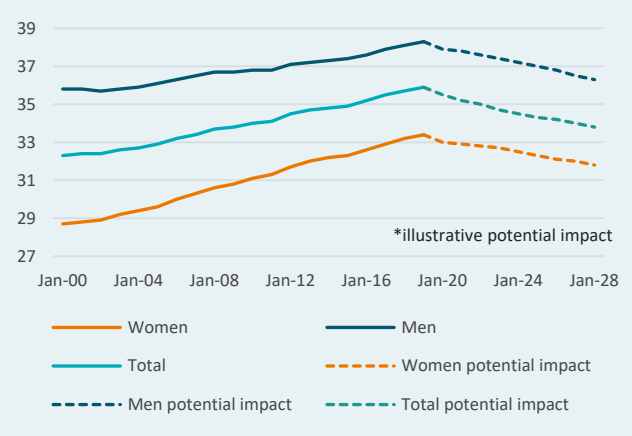
For the economy:

- Labor force participation rates may remain under pressure for some time.
- Structural headwinds if workers fall out of the labor force, lose purchasing power, and miss out on opportunities.
- Awareness of long-term risks reduce economic activity, and/or perhaps increase risk of government-imposed restrictions.

For markets:

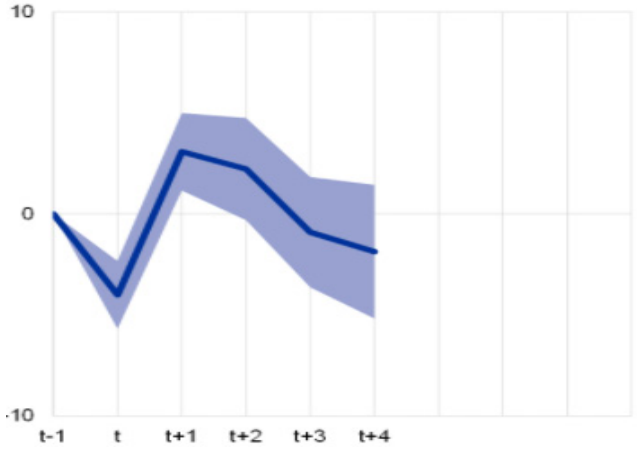
- Health effects cause longer-term headwinds to U.S. labor force, and therefore create ongoing drag on economy.
- Global monetary and fiscal policy remains accommodative, and financial conditions remain easy.
- Low yield environment incentivizes investors to further reach for yield/return.

EXPECTED DURATION OF WORKING LIFE (YEARS)



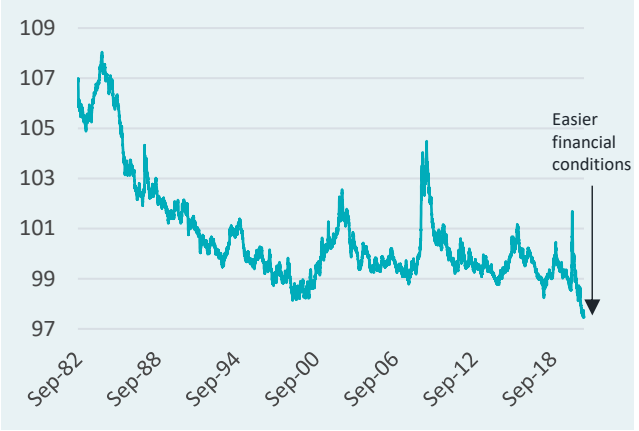
Source: Eurostat, as of 2019, estimates the number of years someone age 15 is expected to be in the labor market (employed or not)

IMPACT OF PAST EPIDEMICS ON POTENTIAL OUTPUT GROWTH (% GROWTH RATES)



Source: ECB, Fuentes & Moder, as of August 2020

U.S. FINANCIAL CONDITIONS INDEX



Source: Goldman Sachs, as of 2/12/21

Takeaways

1. There are potentially significant longer-term health impacts for a material proportion of the population which has been diagnosed with COVID-19. These health impacts may exist even for those who felt mild COVID-19 symptoms during infection.
2. These health issues do not seem to be acknowledged (yet) by the broader investor community, though these issues do seem to be clearly acknowledged by those who have taken the time to study long COVID.
3. We believe long COVID is a risk to the economy and markets, but that it has not (yet) been priced in by investors. The magnitude of its effects on the economy and the level of risk to markets is difficult to gauge at this point.
4. While we are not predicting that a broader understanding of this issue will necessarily cause negative price impact, we believe investors should be aware of the science that is developing on this topic and should be watchful as it becomes more widely known.

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