Charles Ruff

Subject: RE: Another COVID-19 Email

From: Charles Ruff
Sent: Sunday, March 29, 2020 9:37 PM
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Happy Weekend,

Going through my notes I wanted to pass along the highlights. A bit rambling but I went for content over organization. Most of this is probably review but I hope some of it is helpful.

Like everyone, I've spent a good portion of the last few weeks learning everything I can about this virus. I'm reading everything and I've also spoken to everyone I can about this including other investors, contacts in the insurance and banking industries, MDs, nurses, and even a biomedical engineer. I've broken down some observations down into three segments. Negatives, Positives, and Other Interesting Data Points.

Negatives

- **Difficult to contain** because a) severity varies widely across populations b) people are very contagious for days before they show symptoms and c) the virus can be passed very easily as an aerosol simply from someone exhaling.
- **Lack of Preparation.** Basically no country, outside of South Korea or Singapore was not prepared. The US was late to the party but we also have too few ventilators and a fraction of the tests we need.
- **Deadly.** Mortality rate is 1-4%. The reason for the dispersion is because there isn't enough testing. We don't know how big the denominator is.
    - Even if we use the lower bound of 1%, COVID-19 is much more deadly compared to the seasonal flu at 0.1% or the 2009 H1N1 outbreak at 0.02%.
- **Highly contagious** which will cause the spike that pressures the hospital system.
    - R-naught, or the measure at which it spreads is estimated at 2-3.5. The R-naught of the seasonal flu is 1.3.
    - Cases are still climbing dramatically. NYC is the worst hit in the US but it remains to be seen how bad this spreads across the country.
- Will we see another spike in cases as the economy opens back up?

Positives

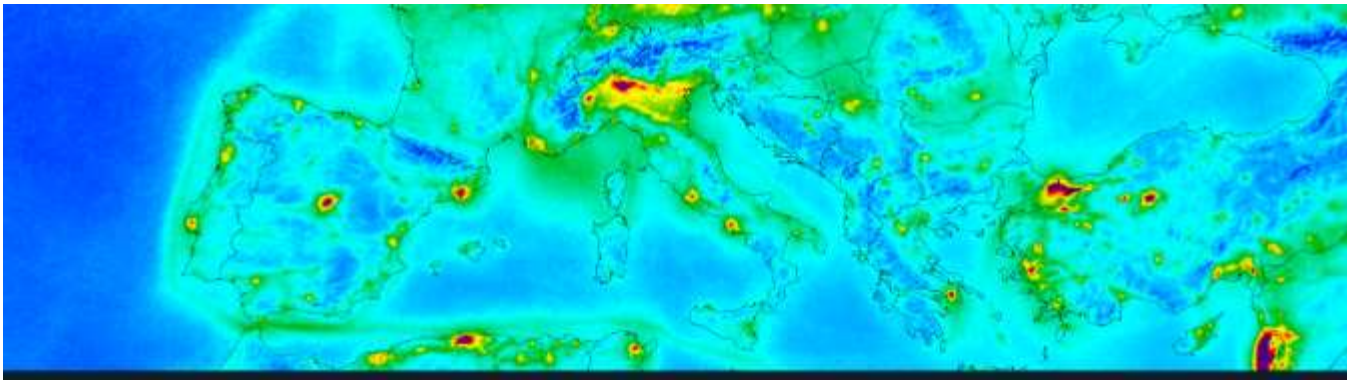
- **Treatment of Those Already Infected**
    - Treatment of a patient is very simple as far as medical procedures go. Simply managing inflammation in the lungs and putting patients on ventilator is a fairly straight forward process.
    - Ventilators are projected to be in short-supply but we are making more of these. The US economy is very good at making things. The question is- can we make them fast enough?
    - Pharmaceutical treatments can help patients handle the side-effects. These include antiviral drugs and drugs that handle inflammation of the lungs. These drug treatments can keep people off ventilators which reduces overall pressure on the system.
- **Prevention**

- Social distancing works and people are taking this seriously. This will slow the spread of the virus and alleviate pressure on the healthcare system.
- Protective gear is also in short-supply but we are making more of this. Again, the US economy is very good at making things. Can we make it fast enough? Local efforts like Hickey Freeman repurposing its operation are an example of how production can grow beyond stated capacity.
- Abbot Labs (ABT) is working on a 5 minute COVID test. Quick, easy testing like this can help us not only slow the current spread but prevent and contain future spikes (if they happen)

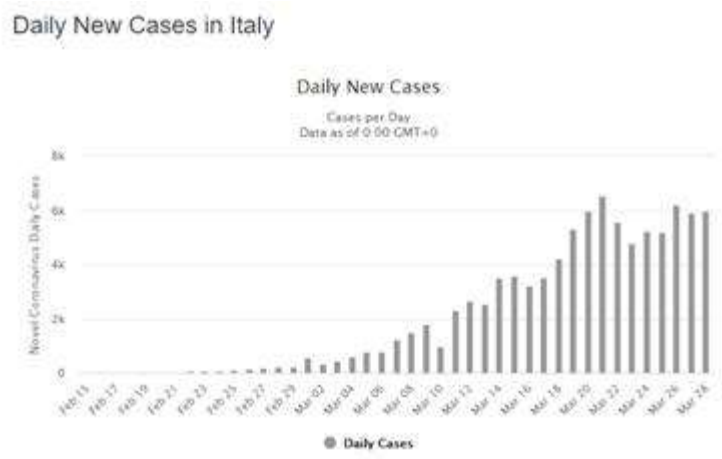
- **Vaccine?**
  - There are multiple companies working towards this. Barron's covers what looks like some of the most serious efforts.
  - They are already doing some human trials. Moderna (MRNA) seems to be the furthest along. Right now the best case scenario for timing is Fall 2020.
    - The turnaround on this is absolutely incredible. This was supposed to take years, not months.
- **Economic Impact**
  - Government is supporting via fiscal & monetary policy in a BIG way.
    - The recent stimulus bill is a big positive for helping individuals and small businesses get through this difficult time. Tim Gerlach has the specifics if you're interested.
    - The Fed is at 0% rates.
  - **As I've said before, the ultimate economic impact is a question of duration.**
    - A shutdown lasting 30-45 days is something bankers and creditors/ tenants and land-lords have the ability to work out.
    - 120-180 days is a much darker scenario
    - Unless we assume a worst-case scenario **I am highly confident that the economy will recover when quarantine measures are lifted.** The economy was not structurally imbalanced the way it was in 2008/2009. This was a purely exogenous shock. We will need restaurants, hotels, bars, airports, and people to staff them.
      - As a consumer, how would you feel in August 2020 if: COVID-19 is behind us, you refinanced your mortgage at 2.5%, and gasoline costs $1.80/gal? Not a prediction but let's just appreciate for a second how expansionary these policies are.

Food for Thought/Other Interesting Data Points

- One of the key issues that seems to be determining the mortality rate is whether or not someone is a smoker. Early on, the virus was much more deadly for men. In China, 50% of men over the age of 60 smoke. Only 3% of Chinese women over the age of 60 smoke.
- Age- COVID-19 is more deadly for elderly people. Italy has the second oldest population in the world which is one reason why their mortality rate is so much higher than anywhere else.
- Another datapoint that has been called out as possibly contributing to a higher mortality rate is pollution. We all know China's air is filthy. I was surprised by how dirty the air is in Northern Italy. Apparently the Po Valley in the North is notorious for poor air quality. The below map shows NO2 emissions. Correlation does not mean causation but I thought this was interesting.



- **Timing**- as this progresses and we get more and better data, scientists are getting better at understanding the trend.
    - One earlier study called for restrictive measures to be put in place until September. This study didn't account for contact tracing, banning large crowds, or travel restrictions (all of which materially reduce transmission). The more we learn, the better we get at understanding this pandemic.
    - A team modeled out Italy 2 weeks ago and claimed that the peak in new cases would be hit around March 25th… this looks decently accurate now. Let's hope it holds.



- **What will the US trajectory look like?** The US isn't a single location like Northern Italy or South Korea. What is happening in NY isn't in Wyoming or Alabama (yet).
    - **The most respectable that I came across suggested that new cases in the US will peak in May**. Obviously NY would be ahead of the trend since it was one of the earliest to be hit and lock-down. Lots of moving pieces in this… we will see.

- **Characteristics of the Virus**- We still know so little of this virus!
    - Will warmer weather this summer help slow the spread? This is a very controversial topic. There are very intelligent and informed people on both sides of this.
    - Viruses mutate over time. In Hollywood they always become more dangerous but in reality a virus's mutations typically make it more benign. This is a little counterintuitive but the goal of a virus is to replicate. If a virus keeps killing its host, it isn't going to last very long. As it was explained to me, Ebola, which is incredibly fatal, is actually a very primitive virus. The common cold, on the other hand, which is just annoying, is highly evolved. We keep passing the cold

around and no one dies. The cold virus gets to keep living and its benign mutations are reinforced.

- Can a vaccine even be developed for this novel coronavirus? We can do it for COVID-19 but can we do it for other possible mutations?
    - COVID-19 is a specific virus in a coronavirus family. There are actually currently 4 coronavirus families that are constantly cycling through human populations. For example, the common-cold. Could this novel coronavirus become the 5th?
    - We can target a vaccine at a single virus (or a tight range of virus possibilities) but we can't carpet-bomb the whole thing. That's why the flu vaccine is never 100%.
    - On a positive note, my friend the engineer believes that if the virus does become that 5th family, it would likely mutate to become more benign because our vaccine efforts would focus on the more deadly varieties.

Let me know if you'd like to discuss any of this further.

Thanks,

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