

**“ The greatest shortcoming of the human race is our inability to understand the exponential function. ”**

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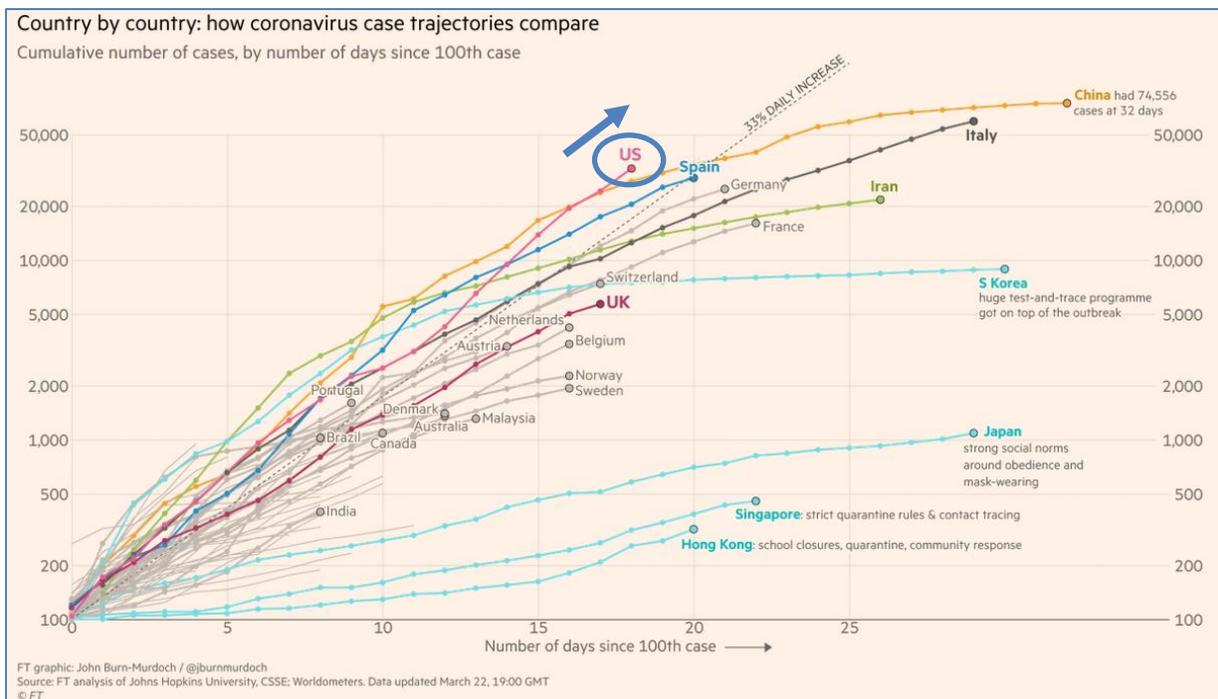
**Living in Exponential Time**

The concept of virality in social media comes from viral epidemics, like the Covid-19 pandemic we are currently all living through.

Epidemics are driven by the exponential growth function, which means that contagion doubles every N hours (or days). For example, if contagion doubles every day, it implies four times the contagion level in 2 days, 8 times in 3 days and so on. A quick calculation

using that same daily doubling rate means that the contagion level would be 1024 times the original level only 10 days later, assuming nothing is done to slow down the rate of contagion.

In everyday life, human beings think in linear time. This makes the concept of exponential time foreign to most individuals, and even appears as a ridiculous concept for some people. However, many natural phenomena in physics and biology operate in exponential time. This is the reason why many prominent scientists and epidemiologists have been urging governments around the world to act proactively, immediately and with strong resolve to protect the population.



## Covid-19 Contagion Analysis

The Figure on the previous page, published today by the Financial Times using data from John Hopkins University, illustrates the challenge we all face, most prominently in the United States and Europe.

The Figure contains a lot of useful information. First, notice the Y axis is a logarithmic scale instead of the common linear scale. Logarithmic scales are used by scientists to help visualize the rate of exponential growth (known as the exponential growth factor), when studying natural processes. By looking at the axis closely, you will notice that every equidistant tick on the Y axis represents a doubling of the one below. This means growth is represented as a doubling rate rather than an additive rate. To illustrate in numbers, we can see the bottom tick showing 100 cases, the middle one showing 2 000 cases, and the top one showing 50 000 cases. I hope you can see how this can quickly get in the millions in a matter of days from this point forward.

The slope of the growth curve can be used to make a rough projection of how things may look like N days in the future. The dotted grey line also shows a daily exponential growth factor of 33% as a useful point of reference. A 33% growth rate implies about 2.4 times more cases three days later, and nearly 10 times more cases only 8 days later. Note how the US rate factor is roughly similar to this 33% daily factor.

## Asia vs. Italy

Observe how Japan, South Korea, Singapore and Hong Kong managed to flatten their curves by taking early proactive and drastic measures such as imposing complete country-wide lockdowns and enforcing strong cooperation within the community, including imposing severe fines to people who didn't comply in many cases. That behavior, even if not particularly welcome by cultural norms in the Western world, is clearly paying off for these countries.

China, the origin of the outbreak, was late to impose full quarantine but when they did react, they did so aggressively and with resolve, and as a result is also managing to contain the pandemic reasonably well as shown by the flattening of their curve. As of yesterday<sup>1</sup>, China had 81 054 cases, with less than 50 new daily cases during the past 2 days.

An important point here is that **it is possible to contain the outbreak, provided that governments take aggressive and immediate action. In addition, people must comply and cooperate as this is ultimately a community effort.**

Most people are currently talking about Italy as the worst-case disaster scenario. Certainly, Italy is in serious trouble. Still, Italy imposed its full country-wide lockdown on March 9<sup>th</sup>, corresponding to Day 15 in the Figure, almost 2 weeks ago. Even so, the growth factor has not slowed much yet because it takes that much time for the virus to incubate in the victim, for the victim to seek help and be tested, and finally to get the test results and seek treatment (assuming treatment is available, which is not a given since hospitals are overwhelmed). Incubation time estimates vary<sup>2</sup>, being about 5 to 7 days on average but taking as long as 2 weeks in certain cases.

The good news for Italy is their full country lockdown should have a positive impact on their growth factor very soon. Sadly however, the number of victims will nevertheless surpass China by a large amount when all is done.

## What About the United States?

The Trump administration is way behind the curve in its response compared to all other countries shown in the Figure, as it has not yet imposed full countrywide lockdown. As mentioned above, Italy imposed its countrywide lockdown on Day 15 in the Figure, which is equivalent to last Friday, March 20<sup>th</sup> for the US.

Not only is the US government slow to react, but the exponential factor is about the highest observed to date for any country shown in the Figure, implying a

rapidly accelerating contagion level. Such a lack of leadership in providing the appropriate response to protect its own population is downright irresponsible at the highest level for a developed world government, in my humble opinion.

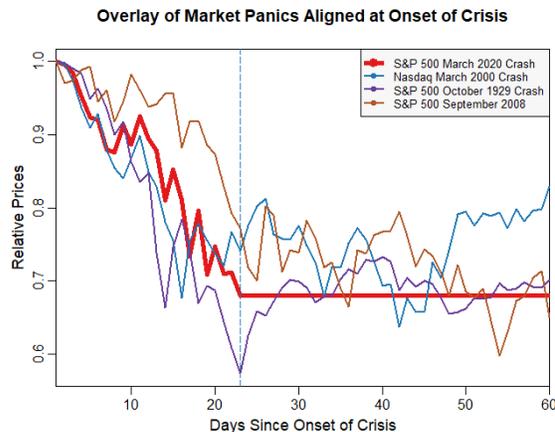
There are some good news however. Some local and state governments have unilaterally decided to impose their own lockdowns, including New York, California, Illinois, Connecticut and New Jersey. The San Francisco Bay Area, in California, was early to act, and is already starting to see some benefits with a slowing growth rate<sup>3</sup>. Large tech firms initially urged their employees to work from home, such as Google on March 11<sup>th</sup>. On March 16<sup>th</sup> at midnight, the entire SF/Bay Area was in lockdown, and on Thursday, the state of California followed suit.

New York, however, the US epicenter of the outbreak, was unfortunately too slow to react. With only 700 cases at the beginning of last week, according to the New York Times, it has now reached 15 000 cases as of yesterday, with nearly 5000 new cases in the last 24 hours alone. The state has officially gone into lockdown today, but given the incubation and testing time, it's easy to see well over 100 000 cases by the end of this coming week and possibly much higher.

I would expect that many other states will rapidly grow to a similar level as New York. For example, Florida, which has yet to go into full lockdown (and where people are reportedly ignoring social distancing health advice), added 350 new cases yesterday, representing a daily growth rate of 35%. Full countrywide lockdown is needed immediately in order to reduce the human toll and economic price.

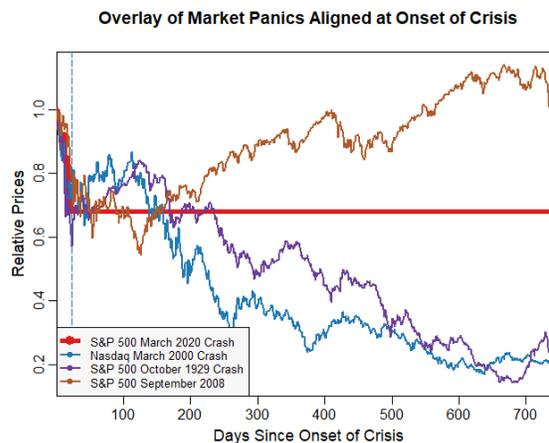
## Financial Market Reactions

The next chart shows three previous market panics, aligned at the onset of their crises on Day 0. It illustrates the Nasdaq dotcom crash in March 2000, and the S&P 500 during the 2008 Financial Crisis (brown), the 1929 stock market crash (purple), and the current Covid-19 panic (red).



From a purely technical perspective, we can see that the initial panic has run its course, and the market is clearly due for a technical rebound. What's less clear however, is how much of a rebound we are likely to see, if any. It is worth remembering that this is not a financial panic like most previous crises. The exogenous nature of an out-of-control pandemic makes it a natural disaster of a global scale. So the right question to ask is whether the initial panic will be followed by a second leg crash and the beginning of a bear market shortly thereafter.

The chart below shows the same information as above, but on a longer time scale covering 3 years of data (750 market days). The color legend is the same as above.



During the 2008 Financial Crisis (in brown), we can see high volatility after the initial panic, followed by another leg down until the market hit bottom several months later. This contrasts with the 2000 dotcom crash and the 1929 crash where both had technical rebounds after the initial panic. Following the rebound came a grinding multi-year bear market, eventually wiping over 80% of the index value nearly three years later.

### Can the Fed Save the Day?

The Federal Reserve has demonstrated strong leadership during the last couple of weeks, injecting massive amounts of stimulus in an attempt to ensure that the US treasury market and the banking system stays liquid and functional. Although many pockets in the system have been under stress, including dysfunctions in the treasuries market such as wide bid/ask spreads and the yield curve going all over the place, the enormous efforts led by the Fed seems to be generally working, at least so far. This is welcome news and may provide some fuel for a short-term technical rebound, even if it is muted.

What is more worrisome are the long-term impacts of the Covid-19 pandemic on the global economy. To flatten the exponential curve will take time and will strain society in many ways. It is likely for lockdowns to last for months rather than weeks because an early lift of lockdowns could trigger new viral outbreaks. Conversely, an extended lockdown will impact the psyche of people and their behaviors. Until we get a vaccine, which by most estimates is 12 to 18 months from now, social distancing will be the recommended norm to reduce the probability of new outbreaks. Once the lockdown is lifted, behavioral changes could mean that many workers are likely to appreciate working from home, at least for a few days a week, and companies may welcome the idea after they see good employee productivity without the need for costly office space, especially during a recession. Consumers may resist shopping at local stores for longer, preferring to buy online instead. The point is, this a huge shock that is changing the world and with

it, major economic dislocations are likely to occur. Coming on the back of the longest economic expansion ever recorded in modern history, negative global interest rates, and record levels of corporate debt brings the possibility of massive financial deleveraging at many levels. Should such a scenario become reality, my sincere hope is that central banks and governments around the world will do whatever it takes to ensure that the deleveraging stays reasonably orderly, with the objective of minimizing the pain to society at large.

On this basis, I am more likely to believe a scenario where a major bear market is currently in its early formative stages. If this scenario is right, we are therefore more likely to follow the 1929 S&P 500 curve or the March 2000 Nasdaq curve than the 2008 Financial crisis curve. In other words, other than the possibility of a muted near-term technical rebound, a grinding bear market is now likely.

Of course, we may instead be lucky and the virus could mutate itself in the coming weeks to become inoffensive to humans. This would likely chart a course like 2008. But counting on luck is generally not a responsible investment strategy.

### What Is Columbus Doing Now?

Our Columbus Strategy was designed to navigate the progression of bear markets with the objective of protecting investor's capital. Although it adapts monthly and therefore cannot react in time to avert market panics, it is very good at adjusting its asset allocation to protect capital and capture some upside when the risk-return equation warrants it.

As discussed above, a week seems like an eternity when living in exponential time. We can therefore expect an escalation of more bad news this coming week as the pandemic hits all US states and Europe gets hammered with exponential growth. Although Columbus is scheduled to run using data on Monday, March 30<sup>th</sup>, we judged it helpful for our subscribers to

run it early using data from this past Friday, March 20<sup>th</sup>.

Given the extreme level of volatility experienced in the past couple of weeks (the VIX index exceeded the level reached during the 2008 Financial Crisis), it is not surprising to see Columbus going heavily into cash assets. You can see the allocation details in the Columbus report sent to subscribers in a separate email.

By running the Columbus strategy one week early, we run the risk of missing a technical bounce that could happen this week. However, given the accelerating pandemic situation and since Columbus is meant to be a tactical allocation to an otherwise balanced portfolio, we felt it was important to let our subscribers know what the model is doing at this time.

We will therefore trade our model account to reflect this allocation at the market close tomorrow, Monday March 23, 2020.

## What Can You Do Now?

Since bonds are very expensive and stocks can also be considered expensive despite the crash given an expected major slowdown in economic activity, it's worth re-evaluating the risk-return equation at this time. For example, consider the following mathematical truths:

Portfolio	Theoretical Loss	Subsequent Gain Needed to Get Back to Even
A	-15%	+18%
B	-25%	+33%
C	-50%	+100%

Most balanced portfolio lost around 20% from their peak in the past few weeks. While recovering from such a level is not the end of the world, taking a further substantial loss would compound the damage, making it more difficult to recoup the losses later on. Portfolio C above is quite telling: a 50% loss

from peak value translates into a required gain of 100% just to get back to even.

For the Columbus strategy model portfolio, we must rebalance the portfolio all at once to keep it simple. However, as an investment advisor, you have the flexibility of averaging out of positions over several trades, possibly taking advantage of an overdue technical bounce. Such an approach may be worth considering given the unusual situation in the markets right now. Bear in mind however that the pandemic situation is quickly accelerating in both Europe and the US, so time is of the essence.

## AI Platform Software Release

As mentioned in last week's update, our recent research in artificial intelligence has borne some very good results over the past year. We continue to be on track to release an updated version of our AI platform at the end of this month. The Columbus strategy runs on our Laplace AI™ proprietary artificial intelligence platform, and so from time to time we do a platform software update to take advantage of our most recent research findings. This includes the addition of improved forecasting models to expand the quality of forecasts made by our platform, in addition to including new indicators to better inform the AI system decision making process. Our AI platform is now trained using over 120 years of historical data, so it can draw useful lessons from many thousands of history's key financial market events during that period.

In this next release and in subsequent releases, we will be adding some important exogenous indicators that we believe will be very helpful in guiding our model in the months to come. These indicators will look at important anomalies such as economic and financial system stresses in order to provide a better assessment of future outcomes in the markets.

Using history as its guide, Columbus will continue to help protect investor's capital should a bear market materialize in the coming months. This is precisely

the time when a non-emotional, data-driven AI-Powered tactical allocation strategy can prove very helpful to gain insights and help protect investor's portfolios. Our platform is designed to bring a deeper and more thorough analysis of historical data to help us navigate the markets more effectively and proactively in the coming months.

## References

[1] Worldometer Covid-19 Coronavirus Pandemic, <https://www.worldometers.info/coronavirus/>

[2] Worldometer Covid-19 Incubation <https://www.worldometers.info/coronavirus/coronavirus-incubation-period/>

[3] Worldometer Covid-19 United States <https://www.worldometers.info/coronavirus/country/us/>

## About Columbus and Laplace AI™

Columbus is a data-driven and emotion-free computerized strategy built to determine how to survive turbulent markets and come out with healthy long-term performance on the other side. By combining the intelligence of data and the analytical power of robust statistical methods, it delivers useful insights while being free of human emotions and biases. It runs on Laplace AI™, our proprietary Artificial Intelligence software platform. Laplace AI™ leverages over 120 years of financial market data to learn the historical lessons of financial market history. This includes extreme events such as the two World Wars, the Great Depression, the Cold War and more recent events such as the Dotcom crash and the Financial Crisis. In addition to running Columbus, our platform is available as a service to financial firms and institutions to help them run customized strategies.

## About Laplace Insights

Laplace Insights™ was founded by Jean-Marc Patenaude out of his lifelong passion to find a better and safer way to invest. A machine learning data scientist and electrical engineer, Jean-Marc has a clear vision to deliver data and technology driven investment strategies to investors. Laplace Insights partners with financial advisors and investment firms to effectively introduce investors to these strategies and to enable the benefits made possible by these advanced technologies.

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