

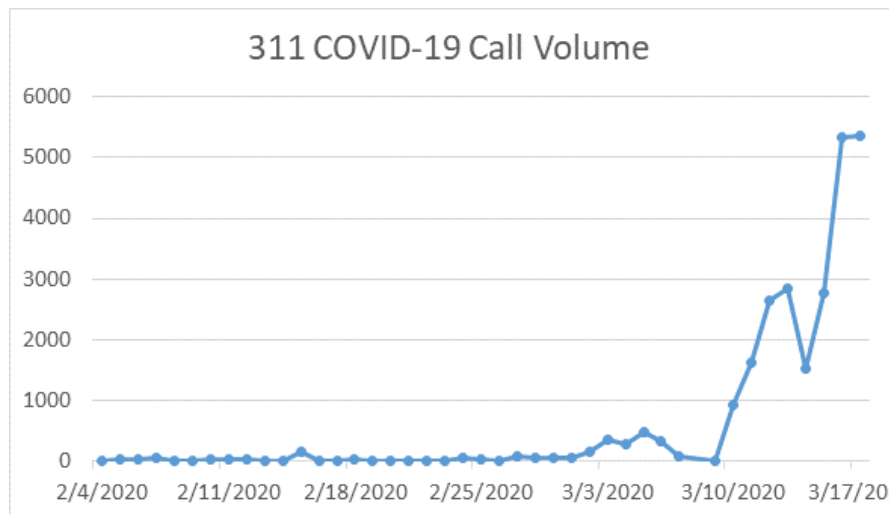
Neuberger Berman Data Science Team

CHIEF DATA SCIENTIST: Michael Recce

What the Data Say About COVID-19

New York is the Epicenter, particularly in Brooklyn:

Today (3/22/20), the US has almost 39,000 Coronavirus (the virus that causes COVID-19) cases (third largest) and is second only to Italy in the number of active cases. New York State has more cases than any other state and the majority of those are in New York City (9000 out of 15,000). As the number of cases of COVID-19 has increased, there has also been a corresponding increase in 311 call center traffic. These calls are categorized by the operators, and while there has been an increase in several categories, the subset labeled as COVID-19 has significantly increased. We will be automatically updating this type of data to track changes by borough (where possible).



Source: Neuberger Berman

There has also been a corresponding increase in emergency room visits for influenza-like symptoms. In the graph below, the current flu season is shown in red. It started a bit early and was not as severe as the 2016-17 season, but after dropping off, it has shown a dramatic increase. This data is also automatically obtained from ny.gov.

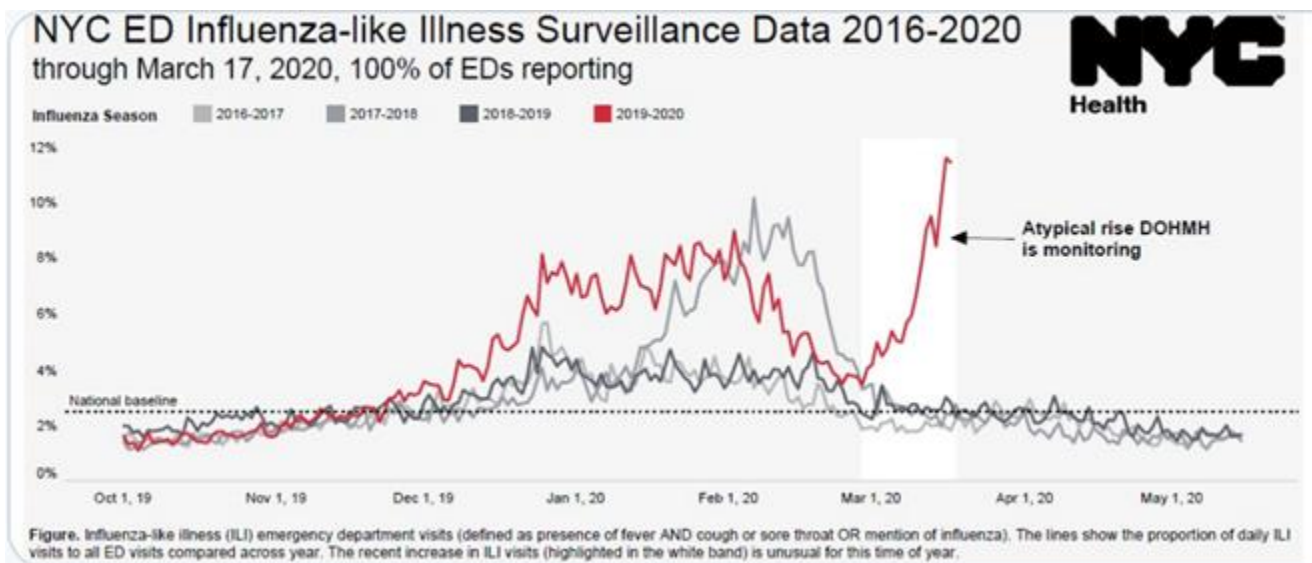
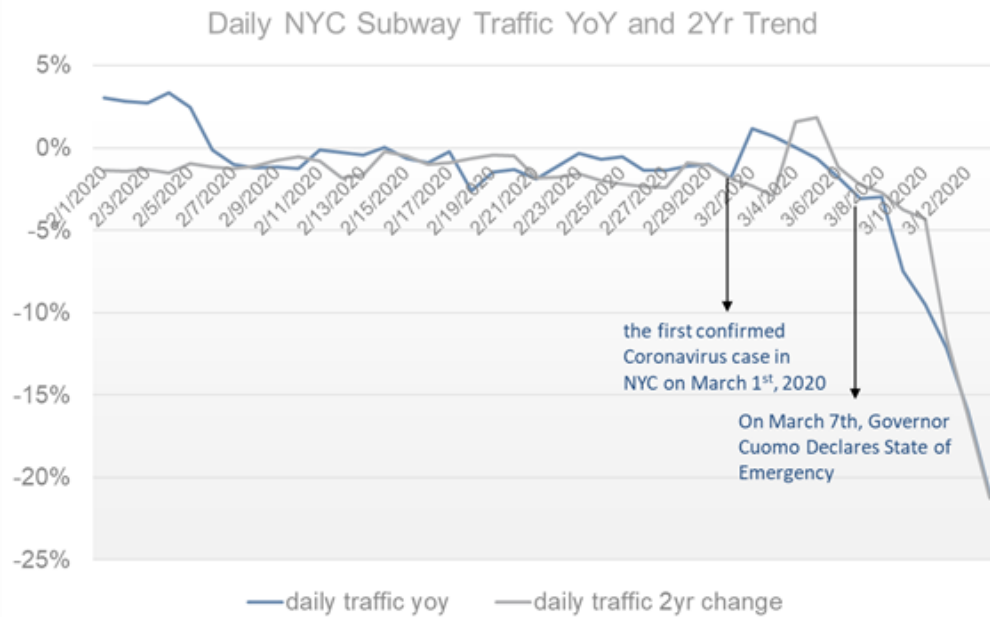


Figure. Influenza-like illness (ILI) emergency department visits (defined as presence of fever AND cough or sore throat OR mention of influenza). The lines show the proportion of daily ILI visits to all ED visits compared across year. The recent increase in ILI visits (highlighted in the white band) is unusual for this time of year.

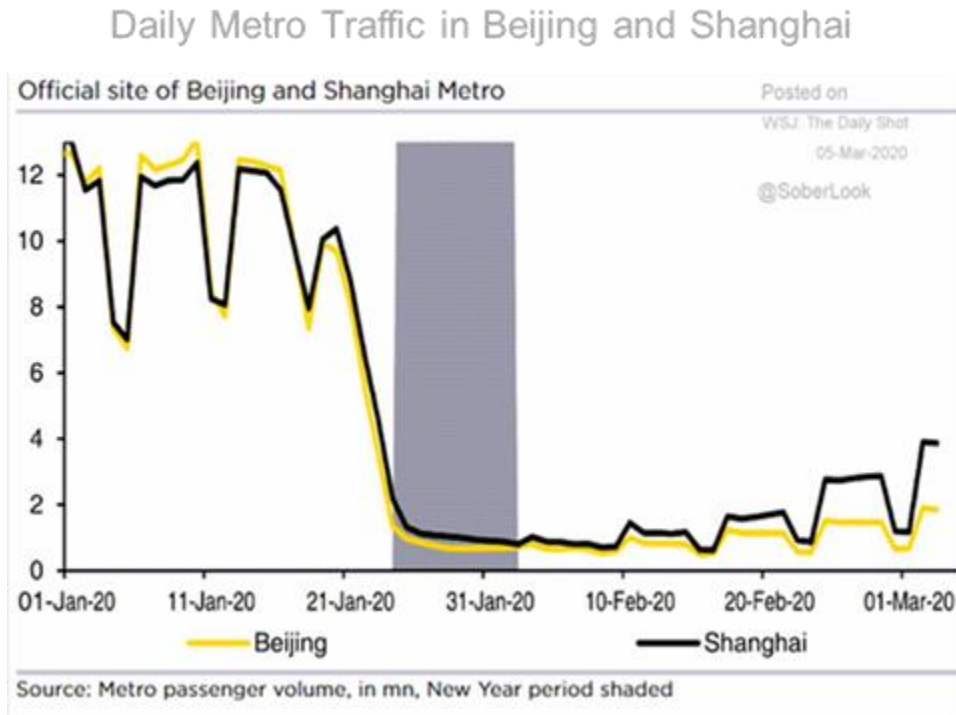
Source: ny.gov

We are also watching changes in subway traffic, construction permits, and bridges and tunnels. All have decreased significantly.



Source: ny.gov

This can be compared to the daily subway traffic trend over time in Beijing and Shanghai.

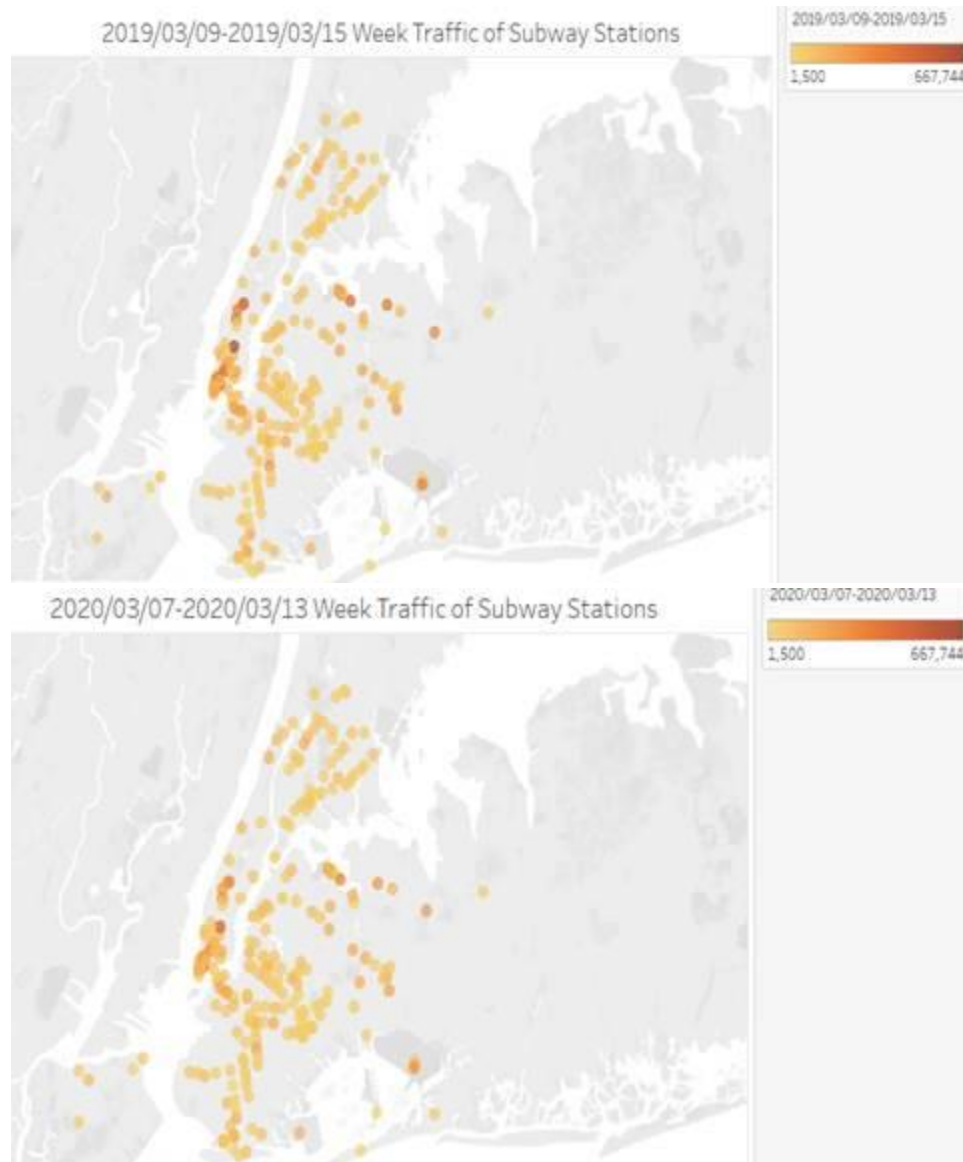


Source: The Wall Street Journal

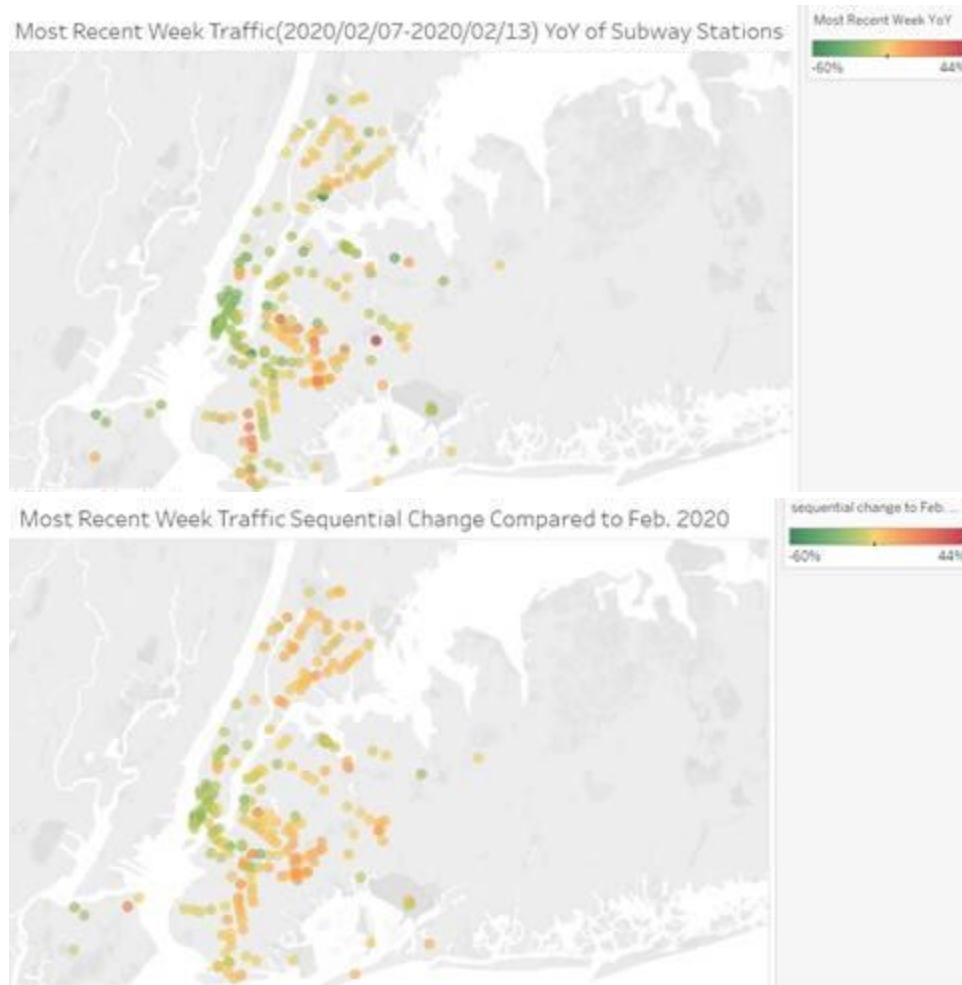
We will continue to track the recovery of subway traffic in China and the subway traffic in New York in order to measure the time to recovery.

From the New York data (ny.gov), we track the subway activity from each of the subway stations on a daily basis. As shown below, while there is a decrease at Manhattan subway stations, there are YOY increases in residential areas, **indicating that people are not staying home.**

There are four graphs below that show (1) subway traffic one year ago, (2) last week, (3) YOY change, and (4) month over month change.



Source: ny.gov



Source: ny.gov

This indicates that there is a 30% to 40% drop in activity in Manhattan, but there is an increase in activity in the living areas, particularly Brooklyn, which probably indicates that people are not staying in their homes. This may be part of the reason for the significant increase in the number of cases in Brooklyn.

Hospitalization Rates:

There is growing evidence that SARS-COV2 is an outlier in the extension of spread by asymptomatic people (ref. Z. Du et al. J Emerging Infectious Disease – in print), with over 10% of infections in the initial study occurring this way. In particular, there is a documented case (Y. Bai, et al, JAMA 2/21) where an asymptomatic 20 year old woman from Wuhan infected 5 patients in Anyang. This paper also suggests that she was able to infect others for 19 days, without any symptoms. A second issue is the half-life of the SARS-COV2 virus on surfaces (3.5 hours on cardboard, 5 hours on steel and 7 hours on plastic - NEJM van Doremalen et al 3/17). These findings suggest that the virus will not be contained until there is much broader testing of asymptomatic individuals. In addition, the success in other countries (China, Singapore, South Korea, etc.) has been driven largely by tracing the contacts of infected individuals. At this point there has been insufficient contact tracing in the US.

The largest problem though is the inconsistency of movement restrictions in different states and cities, and the general lack of compliance of western populations to this type of restriction. The Financial Times has a daily updated tracker of new cases by country, plotted on a log scale. Currently, the number of cases in the US is growing faster than other countries, in part driven by the recent increase of testing. We will develop similar graphs on a state-by-state basis to see if differences in state isolation policies have an impact on spread.



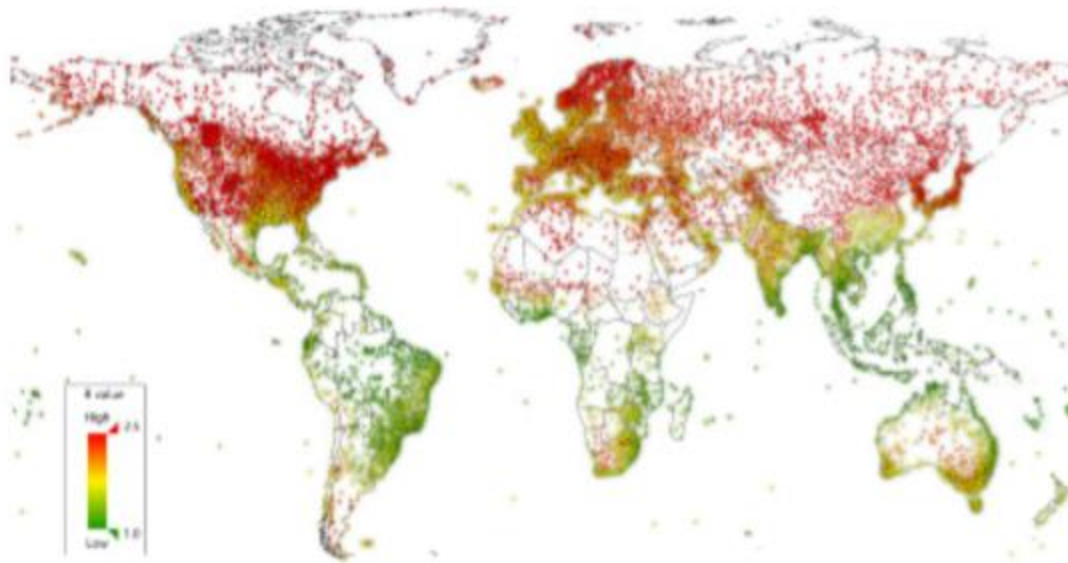
Source: The Financial Times

The bad news is that the US government may need to take additional steps before our containment process becomes sufficiently effective. In particular, different states are implementing diverse and lagged policies that are based on the scale of infection in each state. Borders between states are open, and the combination of these two may lead to less control of reintroduction of the virus. Also, we of course, do not have the same level of control over imposed policies as is possible in Singapore and China, nor the compliance evident in South Korea. We don't think the rate of infection growth in the US will be under control until more stringent steps are taken.

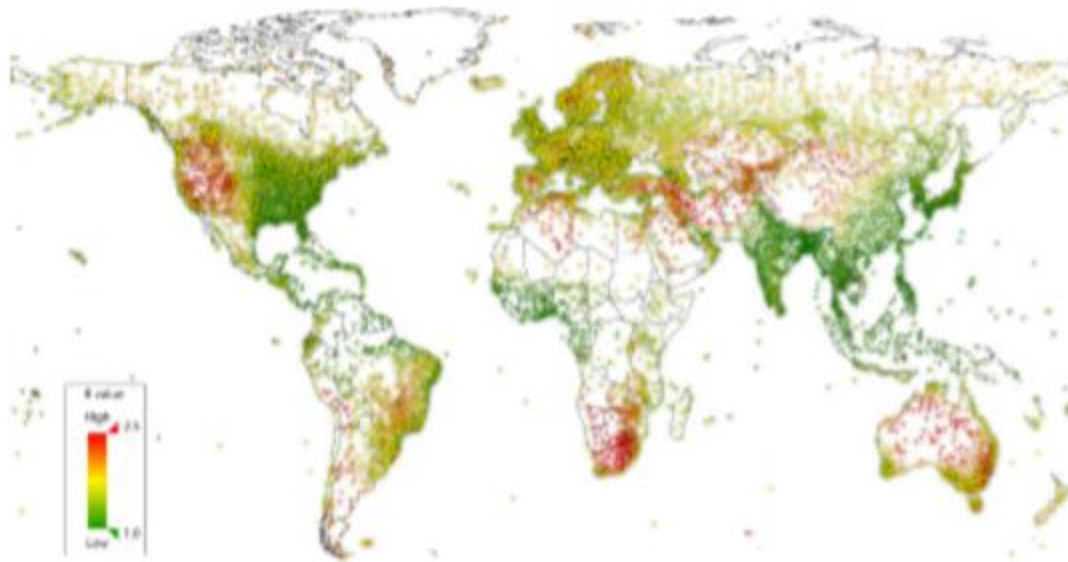
The other bad news is that the hospitalization rates may become high, unless the treatment methods using drugs that are approved for other conditions (e.g. Hydroxychloroquine and Azithromycin – see note from Terri Towers) work. The data published from China on 2/28/20 in the New England Journal of Medicine showed that 55% of the people hospitalized were under 50 years old, and that 41% of people who had severe symptoms were under 50 years old. The median hospital stay was 11 days for the less severe cases and 13 days for the severe cases. These data were initially interpreted as potentially unique to China due to pollution or other factors. However, new data just published by the CDC last Wednesday shows that the hospitalization age demographics in the US are similar. The CDC data includes 4,226 COVID-19 cases with 38% to 55% of hospitalized younger than age 55. The mortality rates are much higher with increasing age, but the hospitalization demographics will put pressure on existing capacity. This is already happening in Italy.

Will Spring Weather Help?

Is spring weather going to help? Several groups are analyzing the data to look for temperature and humidity effects on the spread of the virus (e.g. see SSRN M.M. Sajadi et al from U. of Maryland). The best way to quantify this effect is to look at the change it brings about in R naught (the average number of people infected by an infected person).



(a) R values in March



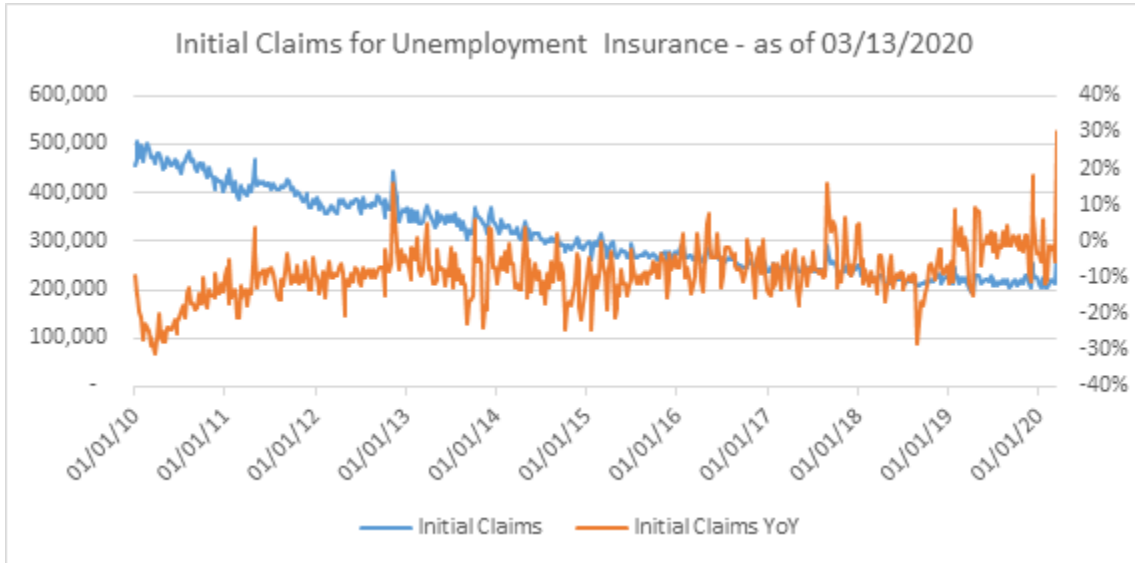
(b) R values in July

Source: SSRN M.M. Sajadi et al, University of Maryland

The authors use the average temperature and humidity to estimate R naught in different regions in both March and July. This data (which is very actively debated at the moment) suggests that the spread in the Eastern US could decrease with the coming summer weather. However, as you can see, Malaysia is green (low R naught) in both seasons. Furthermore, there is evidence from prior outbreaks of viruses that seasonal temperature changes do reduce the spread in the first years.

Economic Impact:

We are monitoring unemployment claims and the number is, as expected, rising. The FactSet numbers are shown below as of the last update.



Source: FactSet as of 3/13/2020

One of the data sources that we regularly evaluate is the “Link-Up” online job postings data that has been scraped from multiple posting sites. The graph below shows that job listings have been on a steady decline since February 26th.



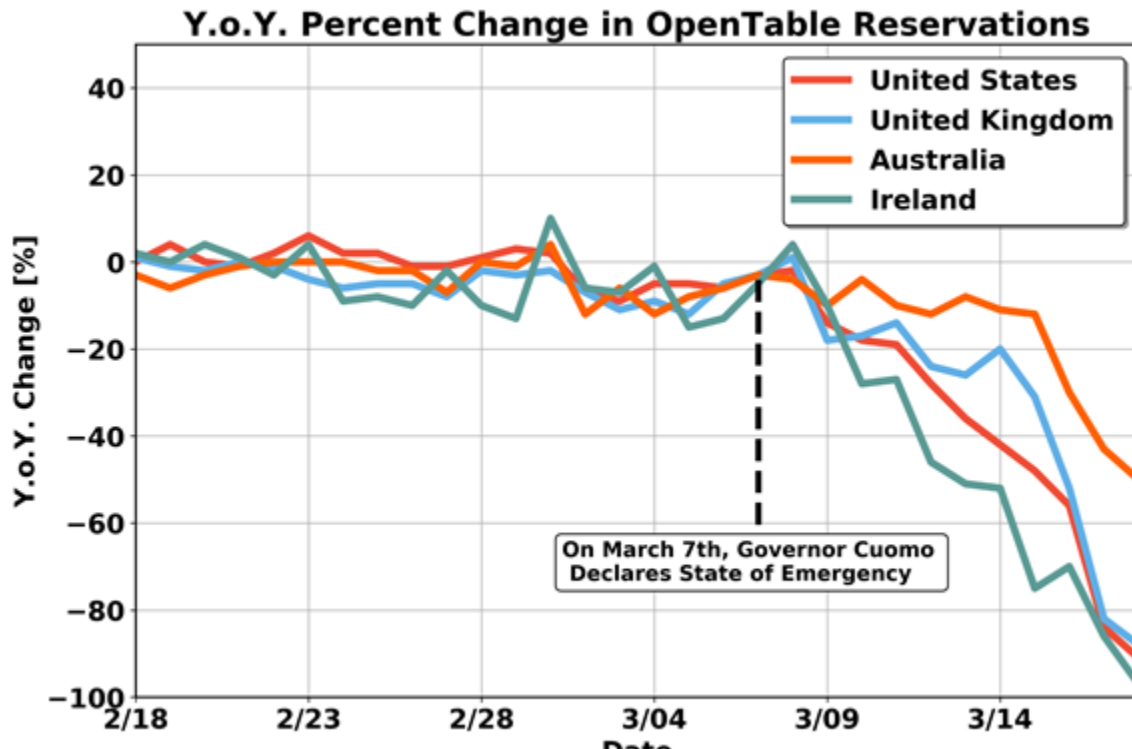
Source: Link-Up

In this job listing data, we have a full text description of the open positions, and we are using natural language processing methods to categorize the open jobs. This will allow us to see secular shifts to new types of jobs. As is shown in the graph below, the Casinos and Gaming sector has seen the most dramatic decline in job listings.



Source: Link-Up

The restaurant industry has been significantly impacted, and as expected, OpenTable reservations have essentially dropped to zero in most of the world, but as shown in the plot below they have not fully gone to zero in Australia.

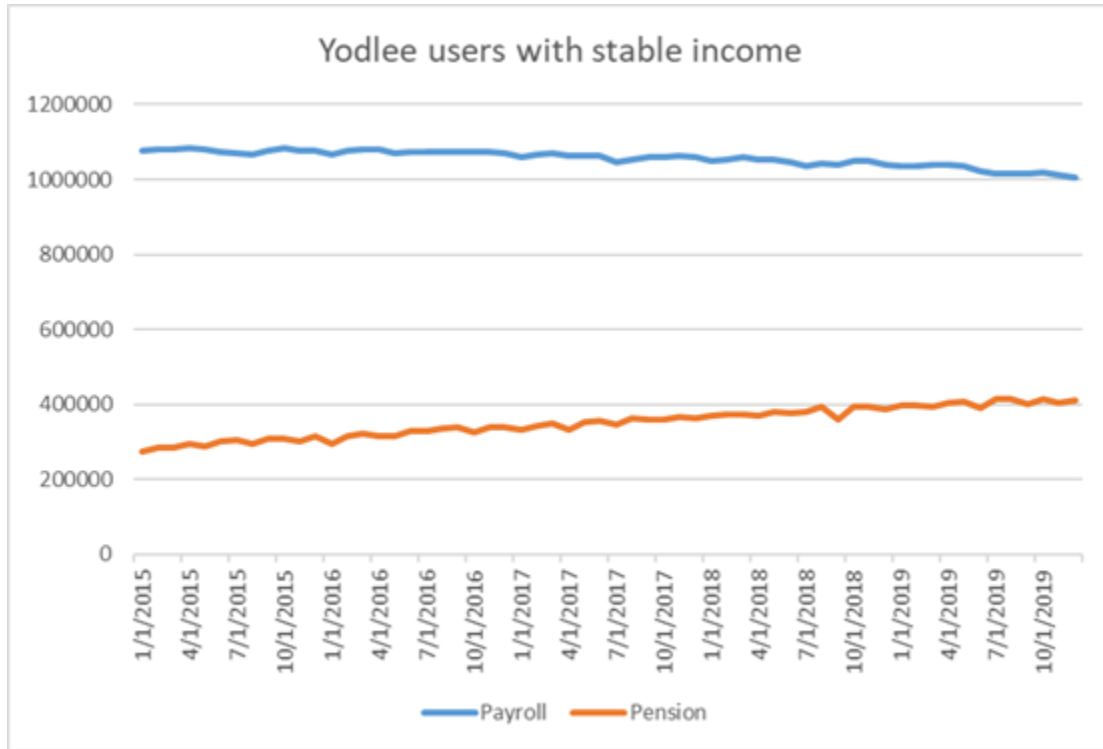


Source: OpenTable

Credit Card Panel Data:

One of our key datasets is a large credit card panel, however this data is delayed by a month, with the most recent data from about February 20th. We have labeled and categorized the members of this panel in order to better measure the economic impact on households. The panel has been divided by age, income level, monthly expenses, rent payers vs mortgage payers, and by geography. For example, we have 70,000 panel members in New York City who make less than \$60,000 per year and 30,000 members of this set are millennials.

The graph below shows trends in the credit card panel for members with a stable income and those on a pension.



Source: Yodlee

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For more information on COVID-19, please refer to the Center for Disease Control and Prevention at [cdc.gov](https://www.cdc.gov)

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