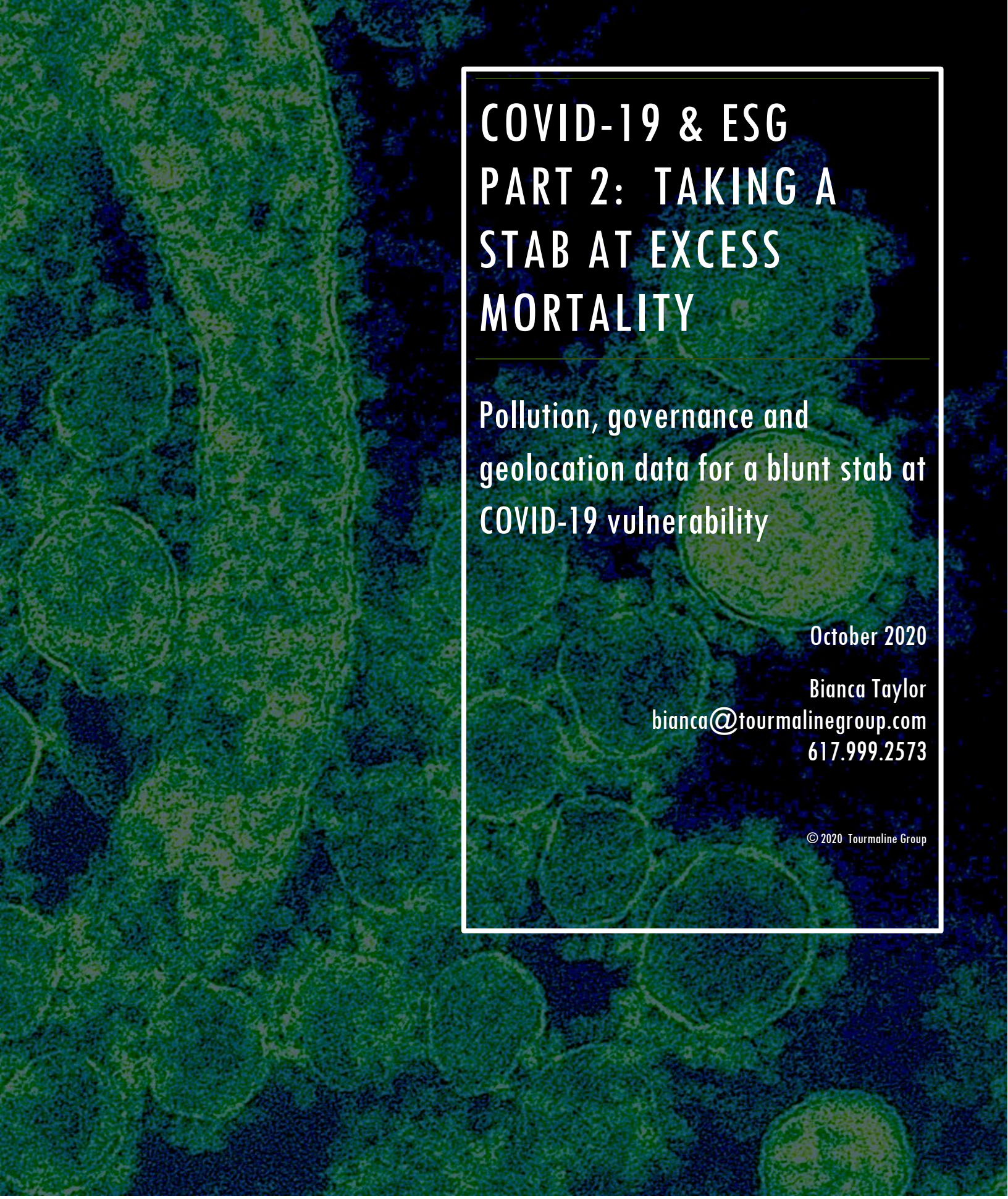

COVID-19 & ESG PART 2: TAKING A STAB AT EXCESS MORTALITY

Pollution, governance and geolocation data for a blunt stab at COVID-19 vulnerability

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COVID-19 & ESG, PART 2: TAKING A STAB AT EXCESS MORTALITY

Bottom Line

The countries with the lowest mortality risk, and therefore best prospects for a post-pandemic economic recovery are **Panama, Brazil, Dominican Republic, Costa Rica and Colombia.** The countries that appear most compromised by a high excess mortality risk are **Turkey, Libya, and India[1].**

Figure 1: Most and least vulnerable to high excess mortality rates

Country Name	Global Percentile: Geolocation/Movement	Global Percentile: Avg Stringency Percentile	Global Percentile: PM2.5
Panama	0.01	0.10	0.14
Brazil	0.44	0.28	0.21
Dominican Republic	0.12	0.15	0.24
Costa Rica	0.17	0.38	0.27
Colombia	0.09	0.09	0.31
Turkey	0.56	0.55	0.79
Libya	0.86	0.05	0.90
India	0.15	0.11	0.99

Source: Global Burden of Disease Study 2017, Oxford University, Google, Tourmaline

Executive Summary

Following the release of our first report, we tried to locate excess mortality data and were disappointed. Thus, we created a perhaps blunt, but nevertheless useful ranking system to find the countries with the highest and lowest COVID-19 mortality risk. We of course recognize that there is a myriad of other variables not considered here that could hamper recovery. Likewise, there are policy responses not covered here that can enhance recovery. Nevertheless, this is a first step. We look forward to sharing further insights in Part 3.

[1] If you are interested in developed economies, please email research@tourmalinegorup.com.

INTRODUCTION

Establishing an ordinal North[2]

The ideas presented in this three-part series are new – both in terms of the academic research we have selected, as well as in the way the ideas are brought together.

While collectively we find ourselves in strange and perhaps disorienting territory, we hope that these new ideas will provide and a sense of direction.

After the release of COVID-19 & ESG Part 1 report in July, which found that non-pharmaceutical interventions (NPI) reduce mortality -- and in so doing also increase the prospects for a post-pandemic economic recovery, we wanted to see if it were possible to forecast excess mortality based on pollution levels.

Would we be able to conduct an econometric analysis that establishes a beta for the level of pollution in a country and the expected excess mortality rate? Unfortunately, the answer was no – or not now at least.

Excess mortality data is not widely available for emerging market countries, and where it is available the veracity of the data sometimes comes into question. There are several in-country experts that have their own estimates, but getting reliable, uniform data does not appear possible for now. Saying nothing at all is better than using mediocre data for flawed or misleading conclusions.

Instead, a blunt knife stab at excess mortality

Ultimately our goal is to provide guidance to private sector investors about country allocation decisions in the emerging markets. (Public sector policy makers may also find this of interest).

Given that portfolio decisions are made on a relative basis, and portfolio managers only care about the top and the bottom of the

[2] Because a cardinal North was not possible.

range[3], a crude and blunt ordinal ranking of pollution and NPI seemed like it should be sufficient to answer the overriding question about excess mortality.

Afterall, we know pollution has a directly relationship with COVID-19 mortality, and we know that NPI reduces transmission.

Assuming we can get good data on NPI policies globally, the next problem of course is: can we trust that people are following the guidelines? The headlines about lack of mask wearing and overcrowded bars in the US make NPI policy seem irrelevant.

The good news is that we found excellent data on both fronts. Oxford launched a series of indices covering pandemic policy responses and Google made all their aggregated, anonymized, geolocation data publicly available.

The weak and the strong

In this report, we take you on a tour of the policy response data and the geolocation data -- and how they relate/compare -- to then couple these with pollution data and create our ranking of the most and least vulnerable countries [4] to COVID-19 mortality.

The big idea is to predict which countries will have the lowest and highest excess mortality rates – because we know that will factor prominently in post-pandemic economic recovery.

We of course understand that there are a myriad of confounding factors that could derail an economic recovery in spite of low mortality rates such as an insignificant fiscal response, or too many bankruptcies, or too many people falling into destitution… the list goes on.

Similarly, there are other policy responses that could improve economic recovery despite a high mortality rate such as a widescale infrastructure investments, universal basic income, and other large-scale fiscal outlays.

But we must start somewhere, and this is a first step.

After identifying the lowest and highest risk countries according to an ordinal ranking

[3] The top question from portfolio managers is: "What's your top pick, and what would you short?"

[4] Market relevant emerging market countries

system, we will take a deeper dive to finesse the top picks and the shorts.

Short Summary of COVID-19 & ESG: Part 1 report

COVID-19 & ESG: Part 1 report was inspired by two separate / distinct research papers:

FIRST

Fed/MIT paper that looked at the Spanish Flu pandemic of 1918 from the perspective of 43 US cities and concluded that:

High mortality rates were negatively correlated with economic recovery.

Non-pharmaceutical public health interventions (NPI) such as masks, social distancing, lockdowns, etc. did not exacerbate the economic crisis caused by the pandemic.

NPI reduced mortality rates and therefore these cities experienced better economic outcomes after the pandemic.

SECOND

A Harvard study found that a 1 microgram increase in PM2.5 pollution per cubic meter increases COVID-19 mortality by 8 percent.

This we find to be key in attempting to gauge the baseline vulnerability – or rather *relative* baseline vulnerability of populations because it is data that is readily available and speaks *directly* to COVID-19 mortality.

(While the incidence of pre-existing conditions in a population would seem to be the best way to establish a country's baseline vulnerability to COVID-19 mortality, these data suffer from a variety of problems.)

MEASURING NPI[5]

In COVID-19 & ESG: Part 1 report we provided pollution rankings and translated these into relative COVID-19 mortality rates – relative to the US and Europe.

Knowing that NPI is required to reduce mortality, the next step is to look at how stringently governments are deploying these public health interventions.

[5] Non-pharmaceutical interventions / public health interventions

Oxford University's Blavatnik School of Government has launched a series of indices that measure government response to the pandemic.

Oxford offers two indices for tracking NPI: The Stringency Index and the Containment & Health Index. For purposes of this analysis we will only consider the Stringency Index. While the Containment & Health Index is more comprehensive, our purpose here is only to compare the NPI with social distancing measures people are factually taking.

OXBSG Stringency Index

The Stringency Index is a composite index of 9 subindices. The composite is a simple average of the subindex scores, rescaled to vary between 0 to 100.

The subindices are:

- School closures
- Workplace closures
- Public event cancellation
- Restriction on public gatherings
- Closure of public transportation
- Public information campaigns
- Stay at home orders
- Restrictions on internal movements
- International travel controls

These subindices measure government response on an ordinal scale between 0 to 4. Zero represents no measures taken, and 4 is maximum restriction, although some indices have only 0-2 or 0-3 scales.

Once combined and rescaled, 100 represents a maximum level of restriction and 0 no measures or restrictions at all.

The authors note that a higher figure does not necessarily mean it is better than a lower figure. We agree. Countries with low pollution levels may not need to interfere as much as countries with high pollution levels. A great example of this is the juxtaposition of China and Sweden, shown in Figure 2. As discussed in COVID-19 & ESG: Part 1 report, China's pollution level equates to a COVID-19 mortality rate that is 3-4X higher than in the US or Europe. If we have a 1-5% mortality rate, China has a 3-20% mortality rate. Thus, one would expect China to have a high stringency rating, whereas low pollution (e.g. Sweden) countries can afford to be less stringent.

Figure 2: Pollution vs Stringency

Relative Vulnerability			Non-Pharmaceutical Interventions	
Global Burden of Disease Study			Oxford University	
	Population weighted mean annual exposure to PM2.5 pollution in micrograms/m^3	Global Pollution Percentile Ranking	Stringency Index (Covid-19)	Percentile Ranking
	2017	2017	Avg Feb to Aug 2020	Based on Avg of Feb to Aug 2020
Country / Area		100 = Worst Polluter	100 = Strictest	1 = Most Stringent
Sweden	6	2	33	96
China	53	88	77	3

Source: World Bank Data, Global Burden of Disease Study 2017, Our World in Data, Google, Tourmaline Group

HOW DO COUNTRIES STACK UP ON NPI?

Without exception, every country that was measured had deployed some type of NPI. Belarus and Nicaragua hold the lowest average value. Honduras and China hold the highest average value between February and September of this year. Figure 3 shows a color-coded map of all the countries for which a figure is available.

Interactive data on the Stringency Index is available here.

Figure 3: Average Stringency February to September 2020

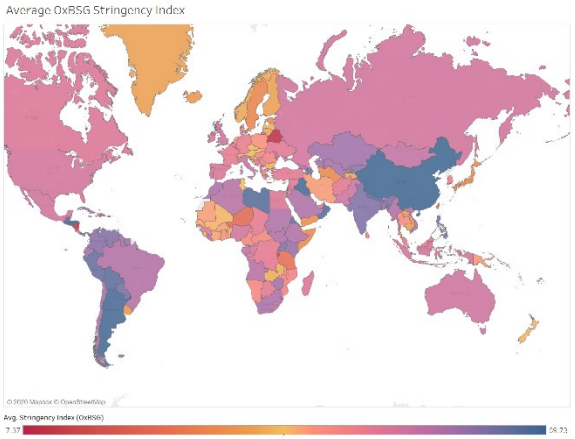
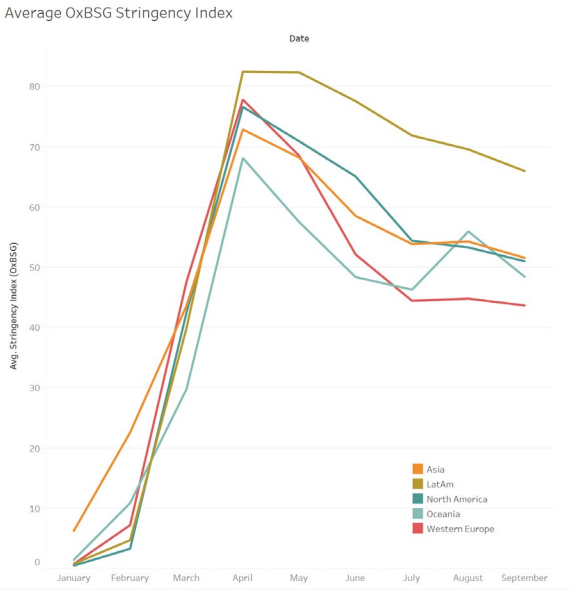


Figure 4 below plots the average stringency level per month for the regions LatAm, Asia, Western Europe, North America and Oceania.

Stringency Indices all peaked in April.

LatAm has scored the highest average stringency level, and Oceania was the lowest until July. Western Europe is currently at the bottom of the range.

Figure 4: Average Stringency February to September 2020



ARE PEOPLE HEEDING ADVICE?

Yes.

Measures to restrict movement only prevent a spread if the population heeds the guidelines.

Google has made anonymized smart phone geolocation data publicly available. The review of the data suggests that yes, people have restricted their movements, in line with government guidance.

Google geolocation data has six categories

Google packages the anonymized geolocation into six categories:

- **Retail and recreation** – captures trends for cafes, restaurants, shopping centers, theme parks, museum, libraries and movie theatres.
- **Grocery & Pharmacy** – captures trends for grocery markets, food warehouses, farmers markets, specialty food shops, drug stores, and pharmacies.
- **Parks --** captures mobility trends for places like national parks, public beaches, marinas, dog parks, plazas, public gardens.
- **Transit Stations –** captures trends for public transport hubs.
- **Workplaces –** captures trends for places of work (further definition of how that is captured is not provided.)
- **Residential –** captures mobility trends around places of residence.

Data is available for all countries that allow data tracking (e.g. you will not find China on the list).

We've aggregated movement data into two groups, omitting others

For purposes of this analysis, we found it easier and more intuitive to take an average of all the categories where we would clearly expect a decline during social distancing namely:

- Retail/recreation
- Transit Stations
- Workplace

The three categories above will hence forth be referred to as RTW. The data from residence we expect should increase, thus we have looked at it as a separate category.

We have omitted data on parks and grocery/pharmacy because it is not clear how people *should* behave with respect to these locations during social distancing. Furthermore, access to parks and grocery stores is often correlated with income levels and could bias the analysis.

For some visualizations regarding the Google geolocation data, we have posted a Tableau Dashboard online where you can filter at your leisure by country or region.

Mobility according to our aggregated categories troughed in April, as Stringency Peaked

Figures 5 through 8 plot the average Stringency Index and mobility for the RTW category aggregate.

These graphs show a virtual mirror image of one another – except for the US. It is beyond the scope of this report to go into all the reasons the US' chart looks different, but we included it because it is often easier to contextualize other graphs once you know how the home turf compares.

Figure 6: LatAm Avg Mobility & Stringency

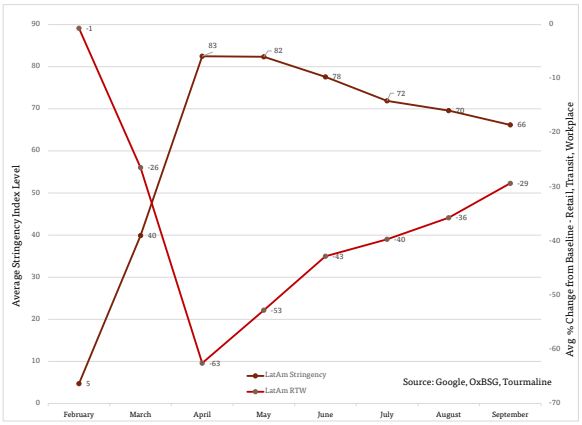


Figure 7: Western Europe Avg Mobility & Stringency

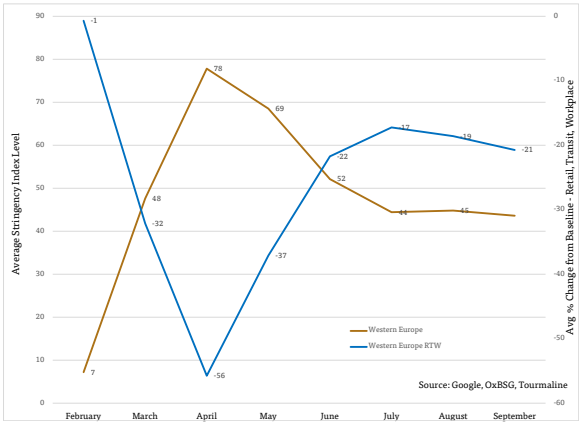


Figure 5: Asia Avg Mobility, Stringency

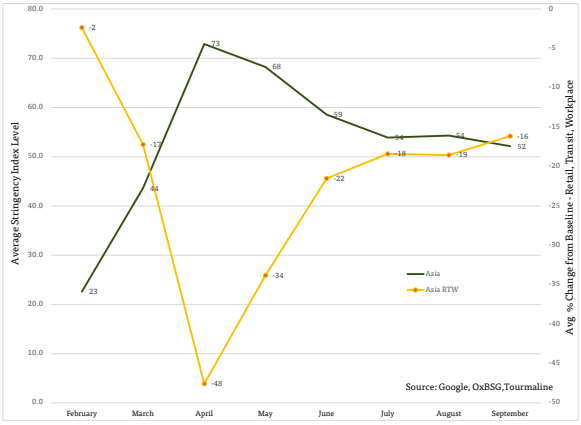
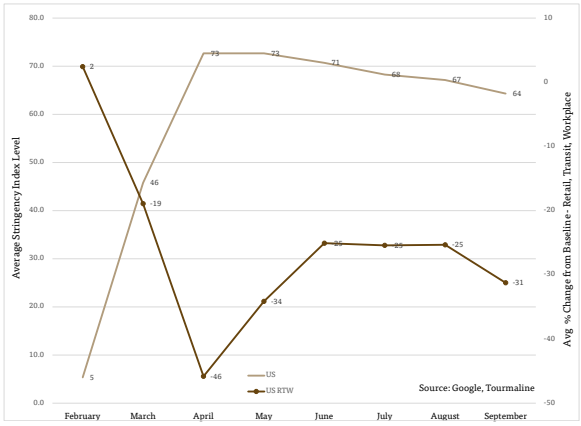


Figure 8: US Avg Mobility & Stringency



CONCLUSION

In COVID-19 & ESG: Part 1 report we found that pollution could be used as a relative yard stick for COVID-19 morbidity and affirmed the value of public health interventions (non-pharmaceutical interventions / NPI). They reduce mortality, and in so doing also increase the prospect for a robust post-pandemic economic recovery[6].

Since NPI only work if people follow guidelines, in this report we look at whether people are heeding social distancing guidelines.

Using Google's geolocation data and Oxford University's pandemic policy response indices, we find that people are following guidelines.

As explained in greater detail in the introduction, we rank ordered countries according to their percentile rankings in pollution, Stringency Index, and geolocation mobility.

All else equal those countries with the lowest mortality risk, and therefore the best prospects for an economic rebound are those with low pollution, high stringency, and strong reduction in mobility.

Limiting the list to emerging market countries of market relevance, the lucky ones are:

- **Panama**
- **Brazil**
- **DR**
- **Costa Rica**
- **Colombia**

The emerging market countries whose recoveries look **most compromised** because of high pollution levels and either low stringency or lack of social distancing are as follows:

- **Turkey**
- **Libya**
- **India**

A longer list of countries sorted by this metric can be found in the appendix.

[6] US cities with high mortality rates during the last pandemic had difficulty recovering economically.

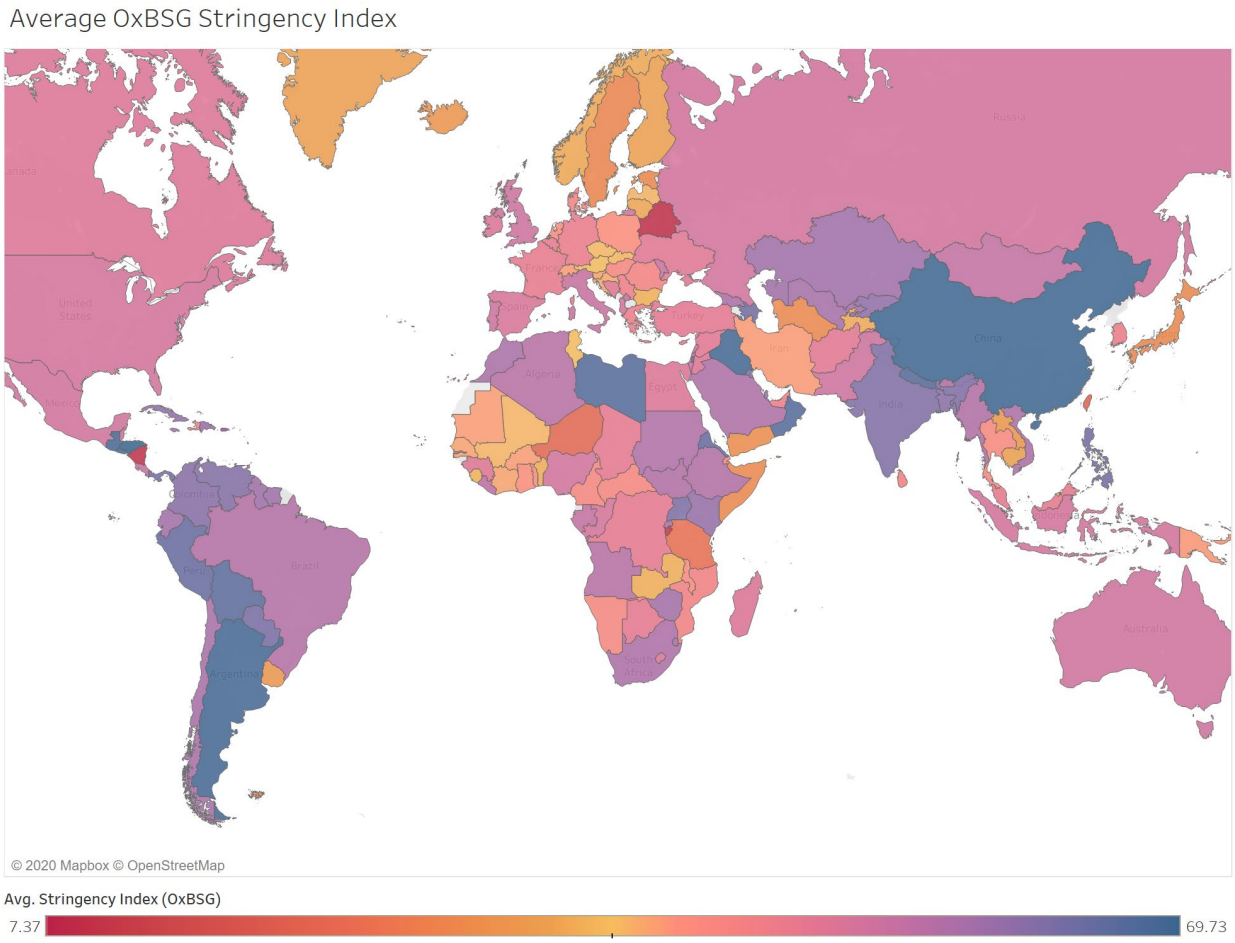
APPENDIX

Figure 9 below is a longer list of countries sorted by pollution, movement, and stringency. Each item is color coded with green being most favorable and red being most challenged.

Figure 9: Full List of Top Picks & Danger Zone Countries

Country Name	Global Percentile: Geolocation/Movement	Global Percentile: Avg Stringency Percentile	Global Percentile: PM2.5
Panama	0.0074	0.1027	0.1369
Paraguay	0.2777	0.0973	0.1826
Brazil	0.4386	0.2811	0.2116
Argentina	0.1226	0.0378	0.2241
Dominican Republic	0.1154	0.1514	0.2365
Ecuador	0.0520	0.1189	0.2656
Costa Rica	0.1747	0.3784	0.2739
Colombia	0.0855	0.0919	0.3112
Nicaragua	0.6018	0.9892	0.3527
Serbia	0.5261	0.6000	0.5436
Laos	0.7986	0.8919	0.5643
Tanzania	0.9218	0.9676	0.6141
Mali	0.7720	0.7946	0.7012
Benin	0.8877	0.8486	0.7261
Mongolia	0.9963	0.2541	0.7386
Turkey	0.5552	0.5459	0.7884
Tajikistan	0.8895	0.8432	0.8340
Yemen	0.9438	0.9243	0.8589
Libya	0.8628	0.0486	0.9004
Cameroon	0.8314	0.6865	0.9668
India	0.1452	0.1081	0.9876
Niger	0.8883	0.9730	0.9959

Figure 10: Average Stringency Index – February to September 2020



A full look at mobility and stringency trends by country and region is available to browse at Tourmaline ESG Intel. (Below is a static picture of what you will find online.)

Animated, interactive stringency maps can be found here, and similar population movement maps can be found here.