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Macroeconomic Outcomes and COVID-19: A Progress Report

ABSTRACT This paper combines data on GDP and unemployment and from Google's COVID-19 Community Mobility Reports with data on deaths from COVID-19 to study the macroeconomic outcomes of the pandemic. We present results from an international perspective using data at the country level as well as results for individual US states and key cities throughout the world. The data from these different levels of geographic aggregation offer a remarkably similar view of the pandemic despite the substantial heterogeneity in outcomes. Countries like South Korea, Japan, Germany, and Norway and cities such as Tokyo and Seoul have comparatively few deaths and low macroeconomic losses. At the other extreme, New York City, Lombardy, the United Kingdom, and Madrid have many deaths and large macroeconomic losses. There are fewer locations that seem to succeed on one dimension but suffer on the other, but these include California and Sweden. The variety of cases potentially offers useful policy lessons regarding how to use non-pharmaceutical interventions to support good economic and health outcomes.

This paper combines data on GDP and unemployment and from Google's COVID-19 Community Mobility Reports with data on deaths from COVID-19 to study the macroeconomic outcomes of the pandemic and suggest tentative policy lessons. We present results from an international perspective using data at the country level as well as results for individual US states and key cities throughout the world.

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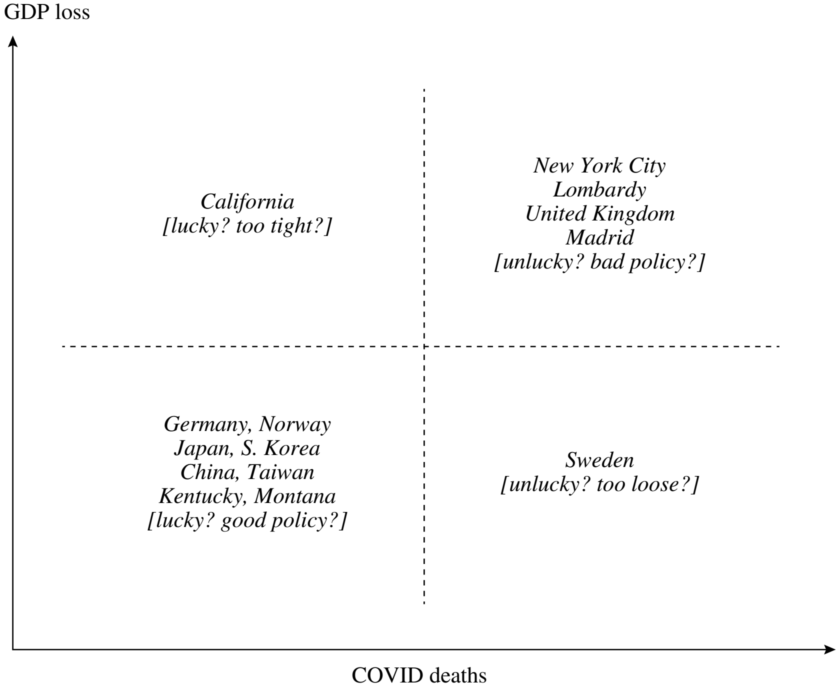
Figure 1. Summary of the Trade-Off Evidence



Source: Authors' construction.

The evidence to date can be summarized in a stylized way as shown in figure 1. On the horizontal axis is the number of deaths (per million population) from COVID-19. The vertical axis shows a cumulative measure of the macroeconomic losses apart from the value of the loss in life; for simplicity, here we call this the GDP loss. Throughout the paper, we will show data for various countries, US states, and global cities to fill in this graph quantitatively. We will also show the dynamics of how countries traverse this space over time. For now, though, we summarize in a stylized way our main findings.

One can divide the graph into four quadrants, based on many versus few deaths from COVID-19 and on large versus small losses in GDP. Our first significant finding is that there are communities in all four quadrants.

In the lower left corner of the diagram—the quadrant with the best outcomes—are Germany, Norway, China, Japan, South Korea, and Taiwan as well as US states such as Kentucky and Montana. Some combination of good luck and good policy means that these locations have experienced comparatively few COVID-19 deaths as a fraction of their populations while simultaneously keeping economic activity losses relatively low.

In the upper right quadrant—the one with the worst outcomes—New York City, Lombardy, the United Kingdom, and Madrid are emblematic of places that have had comparatively high death rates and large macroeconomic losses. Some combination of bad luck and policy mistakes is likely responsible for the poor performance on both dimensions. These locations were unlucky to be hit relatively early in the pandemic, perhaps by a strain of the virus that was more contagious than the one prevalent in other locations. Being hit early also meant that medical protocols at hospitals were less well developed and communities often did not take appropriate measures in nursing homes and care facilities to ensure that the most susceptible were adequately protected.

The other two quadrants of the chart stand out in interesting ways, having good performance on one dimension and poor performance on the other. Compared to New York City, Lombardy, Madrid, and the United Kingdom, Sweden and Stockholm had comparable death rates with much smaller losses in economic activity. But of course, that is not the only comparison. Relative to Norway and Germany, Sweden had many more deaths and comparable losses in economic activity. Relative to the worst outcomes in the upper right quadrant, Sweden is a success. But relative to what was possible—as illustrated by Germany and Norway—Sweden could have done better.

California, in the upper left quadrant opposite Sweden, also makes for a fruitful comparison. Relative to New York City, California had similarly large losses in economic activity, but far fewer deaths. At the start of the summer, both states had unemployment rates on the order of 15 percent. But New York City had 1,700 deaths per million residents, while California had just 300. From New York City's perspective, California looks enviable. On the other hand, California looks less successful when compared to Germany, Norway, Japan, and South Korea. These places had similarly low deaths but much smaller losses in economic activity. Once again, relative to what was possible—as illustrated by the best-performing places in the world—California could have done better.

One essential caveat in this analysis is that the pandemic continues. This chart and the graphs below may very well look quite different six months from September 2020. One of the most critical dimensions of luck is related to whether a location was hit early by the pandemic or had not yet been severely affected at the time of writing. Will a vaccine or cheap, widespread testing end the pandemic before these places are affected?

Still, with this caveat in mind, probably the most important lesson of the paper is that there are many observations that can be made based on the lower left quadrant of the graph: good outcomes on both the GDP and COVID-19 mortality are possible.

GOOD POLICY CAN SUPPORT BETTER OUTCOME We read our findings as suggestive (although not conclusive) evidence of the importance of good policies. Places like China, Germany, Japan, Norway, South Korea, and Taiwan are heterogeneous along various dimensions. The set includes large, dense cities such as Seoul and Tokyo. The set contains nations that were forewarned by experiences with SARS and MERS and countries like Germany and Norway that did not have this direct experience. There are places that were hit early, like China and South Korea, and places that were hit later, like Germany and Norway.

At the same time, our paper does not highlight precisely what these countries did to get these good outcomes. Such a task is next to impossible using aggregate data and requires the use of micro data analysis that exploits local variation (as in the many papers we cite below).

However, our findings suggest where to look for these more in-depth lessons. For example, China, Taiwan, and South Korea focused early on non-pharmaceutical interventions (NPIs) such as widespread use of masks, protection of the elderly, better indoor ventilation, limited indoor contact, and widespread testing and quarantine. In the case of Taiwan, Wang, Ng, and Brook (2020) report how the aggressive use of IT and big data supported the successful application of NPIs, a model copied to a large extent by China and South Korea.

Conversely, countries such as Spain and Italy, which suffered a harsh first wave but did not improve enough in terms of using analytics to track the epidemic, are again in a tight spot regarding number of cases, hospital occupancy, and deaths. As we move through the second wave of COVID-19 cases in the United States and Western Europe, the lessons regarding NPIs can improve both economic activity and death rate outcomes.

GOVERNMENT-MANDATED POLICY VERSUS SELF-PROTECTING BEHAVIOR By good policy, we do not just mean government-mandated actions but also all self-protecting voluntary changes in private behavior (perhaps induced by government information campaigns). Think about the case of the airline industry. Flight occupancy can fall because of government-imposed mandates such as international travel quarantines but also through the widespread voluntary cancellation of travel.

A growing consensus suggests that voluntary changes have played a crucial role. For instance, Arnon, Ricco, and Smetters (2020), using an integrated epidemiological-econometric model and county-level data, argue that the bulk of reductions in US contact rates and employment came from voluntary changes in behavior. However, the authors show that government-mandated NPIs reduced COVID-19 deaths by 30 percent during the first three months of the pandemic.

Goolsbee and Syverson (2020) compare consumer behavior within the same commuting zones but across boundaries with different policy regimes to conclude that legal restrictions account only for 7 percentage points of the overall reduction of more than 60 percentage points in consumer traffic. Nonetheless, the authors document that NPIs shift consumer activity across different industries (e.g., from restaurants into groceries).

Equivalent results to Arnon, Ricco, and Smetters (2020) and Goolsbee and Syverson (2020) are reported by Gupta and others (2020) using smartphone data and by Forsythe and others (2020) using unemployment insurance claims and vacancy posting. Similar findings regarding the preponderance of voluntary changes in behavior are reported for Europe by Chen and others (2020), for South Korea by Aum, Lee, and Shin (2020), and for Japan by Watanabe and Yabu (2020).

At a more aggregate level, Atkeson, Kopecky, and Zha (2020), using a range of epidemiological models, highlight that a relatively small impact of government mandates is the only way to reconcile the observed data on the progression of COVID-19 across a wide cross-section of countries with quantitative theory.

Notice that even if most of the reduction in mobility comes from voluntary decisions, we might still be far from a social optimum as agents do not fully account for the contagion externalities they create. Importantly, government information surely plays a key role in shaping agents' beliefs about the state of the epidemic and therefore influences voluntary behavior.

LITERATURE REVIEW Over the last few months, a gigantic body of literature on COVID-19 and economics has appeared. It is beyond our scope to review such literature, which touches on multiple questions, from the design of optimal mitigation policies (Acemoglu and others 2020) to COVID-19's impact on gender equality (Alon and others 2020). Instead, we highlight three sets of papers that have explored the interaction between COVID-19, the policy responses to it, and economic outcomes.

The first set of papers has extended standard economic models to incorporate an epidemiological block. Among those, early efforts include Alvarez, Argente, and Lippi (2020), Eichenbaum, Rebelo, and Trabandt (2020), Glover and others (2020), and Farboodi, Jarosch, and Shimer (2020). In this tradition, the contributions of models with many different sectors by Baqaee and Farhi (2020a, 2020b) and Baqaee and others (2020) are particularly interesting for the goal of merging micro data with aggregate outcomes and the design of optimal reopening policies. These models will also serve, in the future, as potential laboratories to measure the role of luck versus policy that we discussed above.

A second set of papers has attempted to measure the effects of lockdown policies. The results using Chinese data in Fang, Wang, and Yang (2020) indicate that early and aggressive lockdowns can have large effects in controlling the epidemic, and findings using German data (Mitze and others 2020) and Canadian data (Karaivanov and others 2020) point to the effectiveness of face masks in slowing contagion growth. Amuedo-Dorantes, Kaushal, and Muchow (2020) study US county-level data to argue that NPIs have a significant impact on mortality and infections.

A subset of these papers has dealt with Sweden, a country that implemented a much more lenient lockdown policy than its northern European neighbors. Among the papers that offer a more favorable assessment of the Swedish experience, Juranek and others (2020) have gathered administrative data on weekly new unemployment and furlough spells from all fifty-six regions of Sweden, Denmark, Finland, and Norway. Using an event-study difference-in-differences design, the authors conclude that Sweden's lighter approach to lockdowns saved between 9,000 and 32,000 seasonally and regionally adjusted cumulative unemployment/furlough spells per million population by week 21 of the pandemic. If we compare, for example, Sweden with Norway, these numbers suggest a crude trade-off (without controlling for any other variable) of around sixty-one jobs lost per life saved.[1] On the negative side, Born, Dietrich, and Müller (2020) and Cho (2020), using a synthetic control approach, find that stricter lockdown measures would have been associated with lower excess mortality in Sweden by between a quarter and a third.

The third set of papers has studied how to monitor the economy in real time (Cajner and others 2020; Stock 2020), how the sectoral composition of each country matters for the reported output and employment losses (Gottlieb and others 2020), and the impact of concrete policy measures. Among the latter, Chetty and others (2020) argue that stimulating aggregate demand or providing liquidity to businesses might have limited effects when the main constraint is the unwillingness of households to consume

1. Among many other elements, this computation does not control for the possibility that Sweden, by getting closer to herd immunity, might have saved future deaths or, conversely, that higher death rates today might have long-run scarring effects on the Swedish GDP and labor market.

due to health risks and that social insurance programs can be a superior mitigation tool. Goldberg and Reed (2020) extend the analysis of current economic conditions related to COVID-19 to emerging market and developing economies.

STRUCTURE OF THE PAPER In the remainder of the paper, we present the detailed evidence that underlies this stylized summary. Section I lays out a basic framework for thinking about figure 1. Section II presents evidence for countries using data on GDP from the first and second quarters of 2020 to measure the macroeconomic outcomes. It also shows evidence for US states, using monthly unemployment rates. Section III then turns to a complementary source of data on economic activity, the Google COVID-19 Community Mobility Reports.[2] We show that these economic activity measures are highly correlated with GDP and unemployment rates. The Google measures have additional advantages, however. In particular, they are available for a large number of locations at varying geographic levels of aggregation and are reported at the daily frequency and with a lag of only just a few days, an important feature given the natural lags in National Income and Product Accounts (NIPA) reporting. We reproduce our earlier findings using the Google data and produce new charts for key cities worldwide. The city-level data are important because of concerns about aggregating to, say, the national level across regions of varying densities. Section IV shows the dynamic version of our graphs at the monthly frequency using the Google data, so we can see how different locations are evolving. Finally, section V offers some closing thoughts.

I. Framework

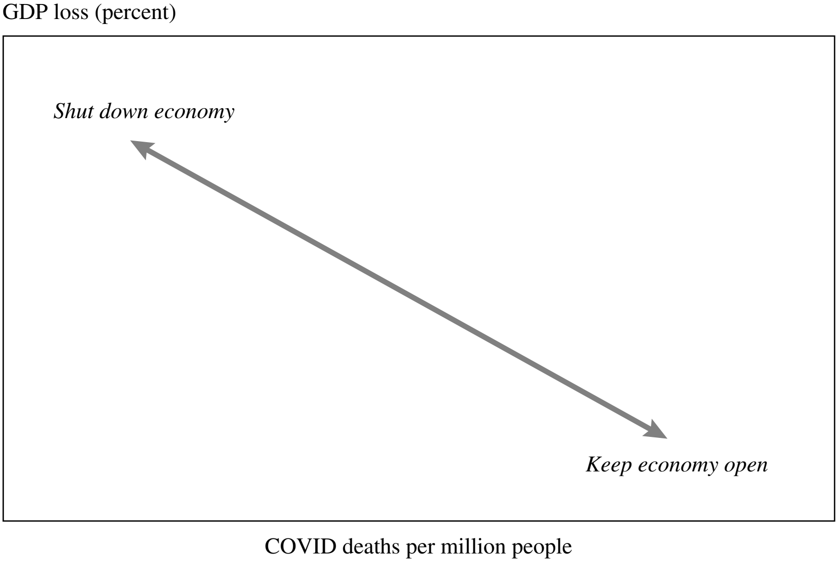
We focus on two outcomes in this paper: the loss in economic activity, as captured by reduced GDP or increased unemployment, and the number of deaths from COVID-19 per million people.[3] Even with just these simple outcome measures, it is easy to illustrate the subtle interactions that occur in the pandemic.

To begin, figure 2 illustrates a simple trade-off between economic activity and deaths from the pandemic. In the short term, economic policy can shut the economy down sharply, which increases the economic losses

2. Google COVID-19 Community Mobility Reports, accessed October 9, 2020, https://www.google.com/covid19/mobility/.

3. There is a growing concern about the long-run health consequences for individuals who survived a COVID-19 infection. However, it is too early for any systematic international comparison of those long-run effects.

Figure 2. Economic Policy Trade-Off, Holding Health Policy and Luck Constant



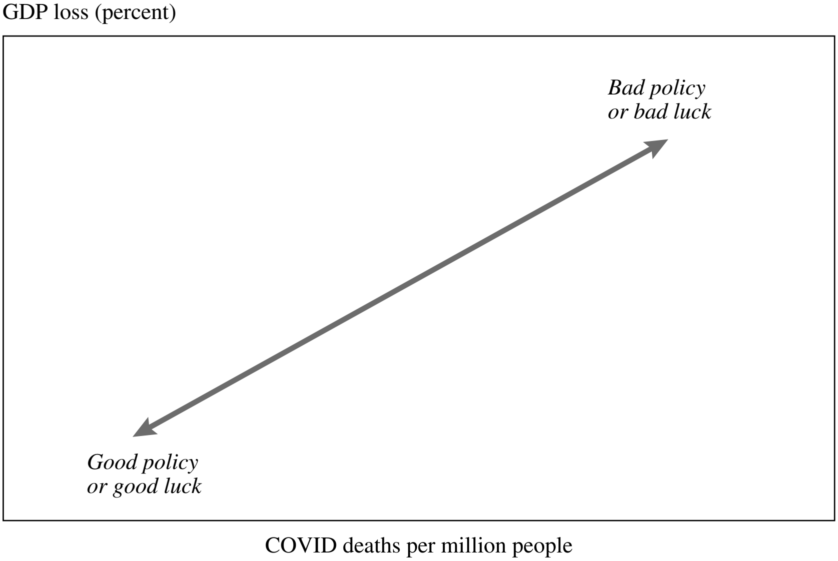
Source: Authors' construction.
Note: Holding health policy and luck constant, economic policy implies a trade-off between economic activity and deaths from COVID-19.

on the vertical axis but saves lives on the horizontal axis. Alternatively, policy could focus on keeping the economy active to minimize the loss in GDP at the expense of more deaths from the pandemic.

Figure 3 shows that the story is more complicated when health policy and luck are brought under consideration. There can be a positive correlation between economic losses and COVID-19 deaths. Good NPIs—for example, widespread use of masks, better indoor ventilation, protecting nursing homes, and targeted reductions in super-spreader events such as choirs, bars, nightclubs, and parties—can reduce the number of deaths with a limited impact on production. Furthermore, by reducing the death rate, such policies encourage economic activity by allowing people to return safely to work and the marketplace.

Similarly, luck plays an important but not yet fully understood role. Where does the coronavirus strike early versus late? Perhaps a country is in the lower-left corner in September 2020 with low deaths and little loss in GDP, but only because it has been lucky to avoid a severe outbreak. By early 2021, things may look different. Alternatively, was a region hit by a less infectious and deadly virus strain (see our next subsection)?

Figure 3. **Health Policy Decisions and Luck Can Shift the Trade-Off**



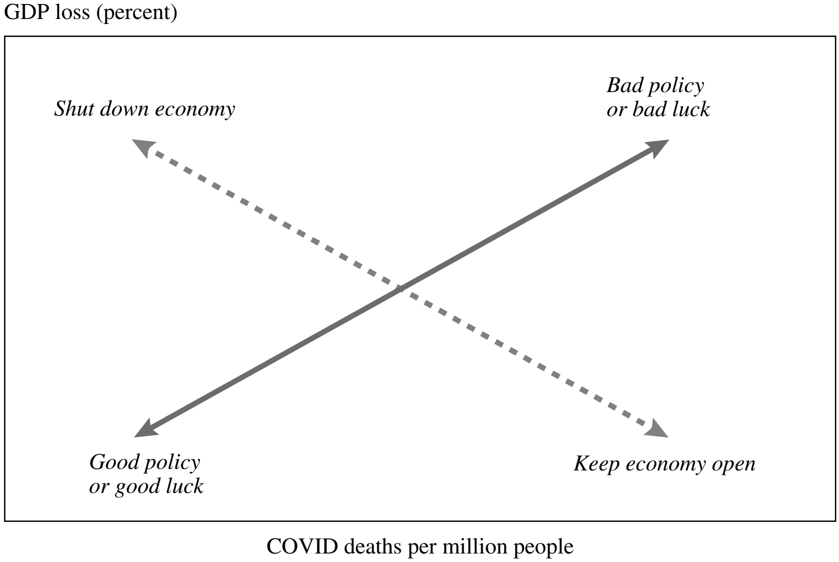
Source: Authors' construction.
Note: Health policy and luck can shift the trade-off between economic activity and deaths from COVID-19.

Given the steep age pattern of COVID-19 mortality rates, basic demographic differences influence the trade-off between deaths and GDP losses. This is another dimension of what we can call luck. COVID-19 has a steep age and obesity gradient. Younger and less-obese countries, many of them emerging market and developing economies, have experienced much better outcomes than one would have expected (Goldberg and Reed 2020).

To complicate matters, all of these forces play out over time, which gives rise to important dynamic considerations. For example, a community may keep the economy open in the short term, which may lead to a wave of deaths, and then be compelled to shut the economy down to prevent even more deaths. Two communities can end up with large economic losses, but very different mortality outcomes, because of these timing considerations. This can be thought of as being embodied in figure 3.

Figure 4 puts these mechanisms together in a single chart. It reveals that the correlation between economic losses and COVID-19 deaths that we see in the data is governed by a sophisticated collection of forces, both static and dynamic. When we see a cloud of data points in the empirical versions of this graph, we can think about how these various forces are playing out.

Figure 4. Economic Activity, COVID-19 Deaths, Health Policy, and Luck



Source: Authors' construction.
Note: Putting the two lines on the same chart explains why the data can be difficult to interpret.

I.A. Evidence on the Role of Mutation

We have mentioned that a simple mechanism behind luck is the strain of the virus that attacked a given location. From March to May 2020, a SARS-CoV-2 variant carrying the spike protein G614 which likely appeared in some moment in February replaced D614 as the dominant form of the virus globally (Korber and others 2020).

While the global transition to the G614 variant is a well-established fact, its practical consequences are still debated. Korber and others (2020) present experimental evidence that the G614 variant is associated with greater infectivity and clinical evidence that the new variant is linked with higher viral loads, although not with greater disease severity. Hu and others (2020), Ozono and others (2020), and Zhang and others (2020) report similar findings. However, these latter results regarding greater infectivity and higher viral load are not yet the consensus among scientists (Grubaugh, Hanage, and Rasmussen 2020).

In other words, there is some evidence—although far from conclusive—that the pandemic's timing may have played a role in determining the quadrant where each location falls in figure 1. If indeed the original D614 variant is less infectious, Asian countries (who were exposed more to this earlier form of the virus) faced a more straightforward trade-off between containing the epidemic and sustaining economic activity. Even within the United States, California, likely due to its closer ties to Asia, experienced a higher prevalence of lineages of D614 at the start of the health crisis than New York City, closer to Europe, and thus it had better initial outcomes regardless of the policies adopted.

II. Cumulative Deaths and Cumulative Economic Loss

This section shows the empirical versions of the trade-off graphs for various countries and US states using GDP and unemployment as measures of the economic outcomes.

II.A. International Evidence

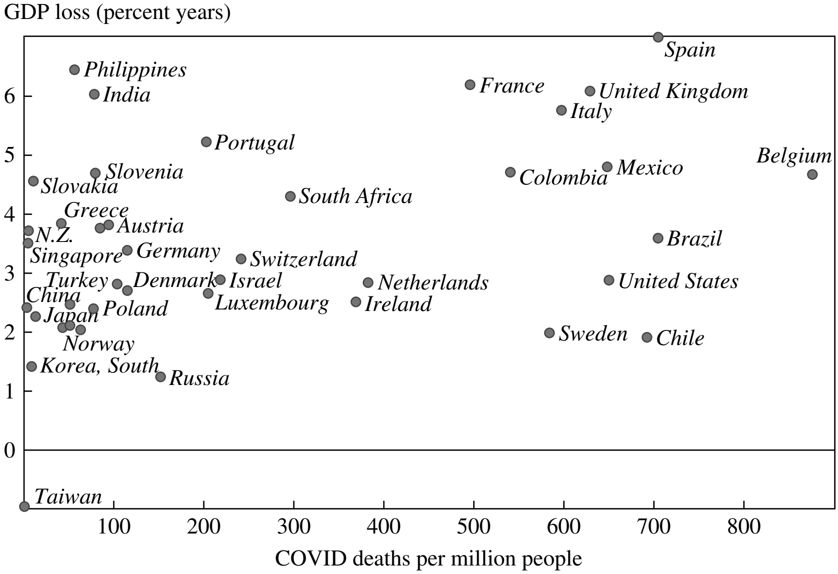
We use GDP data from the OECD and death data from Johns Hopkins University Center for Systems Science and Engineering (CSSE) to study the international evidence on COVID-19 deaths and GDP.[4] Figure 5 plots the COVID-19 deaths per million population as of October 9 against the loss in GDP. GDP loss is the cumulative loss in GDP since the start of 2020 (data from Q1 and Q2) and is annualized. For example, a value of 6 means that the loss since the start of 2020 is equivalent to a 6 percent loss in annual GDP.

Before discussing our findings, some warnings are appropriate. First, we only have observations up to 2020:Q2. Second, the numbers released so far are likely to be revised substantially. Even in normal times, the revisions of GDP early releases are considerable (Aruoba 2008). The difficulties in data collection during the pandemic suggest that the revisions for 2020 are bound to be even larger.[5] Third, GDP is only an imperfect measure of

4. OECD, Quarterly GDP, accessed October 1, 2020, https://data.oecd.org/gdp/quarterly-gdp.htm; Johns Hopkins University Center for Systems Science and Engineering, "2019 Novel Coronavirus COVID-19 (2019-nCoV) Data Repository," accessed October 9, 2020, https://github.com/CSSEGISandData/COVID-19/.

5. Recall, for example, the note on the Coronavirus (COVID-19) Impact on June 2020 Establishment and Household Survey Data: "The collection rate for the establishment survey in June was 63 percent. This is lower than the average for the 12 months ending in February 2020, before data collection was impacted by the pandemic, and lower than May (69 percent). This rate was also lower than that for June 2019 (71 percent)." https://www.bls.gov/cps/employment-situation-covid19-faq-june-2020.pdf. A similar issue relates to the state unemployment rates that we will use later. These rates are a combination of survey measurement on small state-level samples and a pooled time series model run by the Bureau of Labor Statistics. During the last months, we have seen large revisions in these rates.

Figure 5. International COVID-19 Deaths and Lost GDP



Sources: Johns Hopkins University CSSE, OECD, and authors' calculations.
Note: "GDP loss" is the cumulative loss in GDP in the first two quarters of 2020 and is annualized. For example, a value of 6 means that the loss is as if the economy lost 6 percent of its annual GDP.

economic activity. There are reasons to believe that those imperfections are even more acute in 2020.

For instance, consider government consumption. This item is measured by the sum of employee compensation, consumption of fixed capital, and intermediate goods and services purchased. Many government services, from the local DMV to public schools, were not offered (or only offered under a very limited schedule) during the lockdowns. However, most government employees were still paid (furloughs were rare in OECD countries), and the consumption of fixed capital is imputed according to fixed depreciation tables. Thus, except for some reduction of intermediate goods and services purchased, government consumption remained unchanged from the perspective of GDP. Indeed, in the United States, real government consumption increased .6 percent in 2020:Q2 with respect to 2020:Q1 while GDP dropped 9.0 percent. While part of the increase can be attributed to the fiscal stimulus and the fight against COVID-19, a substantial part of government consumption operated well below normal levels during that quarter with little impact on measured GDP.

With these considerations in mind, figure 5 suggests that there has not been a simple trade-off between deaths and GDP. Rather, countries can be seen to fall into several groups.

First, we have countries with low deaths and moderate GDP losses: Taiwan (with positive GDP growth!), South Korea, Indonesia, Norway, Japan, China, and Germany. Such countries illustrate an important lesson from the crisis: it was possible to emerge with relatively good performance on both dimensions. Importantly, this group is heterogeneous. It includes countries in both Asia and Europe. It includes countries with large, densely populated cities. And it includes countries that are globally highly connected to the rest of the world, including Germany and China, the two major export powerhouses of the world economy. Other countries nearby in the diagram include Poland, Greece, and Estonia.

Presumably, both good policy and good luck play important roles here. For example, Greece, a dense country with a poor track record in terms of economic governance and a public health system starved of resources after a decade of budget cuts, has performed so far surprisingly well. Greece's government approved restrictive measures when the number of cases was minimal and directed a well-coordinated health strategy. At the same time, Greece is less well connected with the rest of the European Union and has a fragmented geography, which has slowed down the virus's spread. Uncovering the explanation for Greece's success could yield important lessons.

Next, in the graph's upper-right part, we have countries with high death rates and large GDP losses: France, Spain, Italy, the United Kingdom, and Belgium. Some combination of bad luck and imperfect policy led these countries to suffer on both dimensions during the pandemic. The United Kingdom, as an example, suffered from more than 600 deaths per million people and lost the equivalent of 6 percent of a year's GDP. Also, high COVID-19 incidence might trigger nonlinear effects on mortality. There is evidence that the Italian and Spanish health systems were overwhelmed in March 2020, leading to many deaths that could have been avoided. Ciminelli and Garcia-Mandicó (2020) show that mortality in those Italian municipalities that were far from an ICU was up to 50 percent higher, which they argue was due to the congestion of the emergency care system during those crucial weeks.

A few countries in figure 5 are harder to classify. India and the Philippines have experienced a considerable reduction in GDP but comparatively few deaths per million people. As we will see later, however, the situation in India is still evolving. The United States and Sweden also stand out, with many COVID-19 deaths but smaller reductions in GDP than France, Italy, or Spain. As with India, however, the dynamic graphs we show later suggest that the position of the United States is still in flux.

The case of Sweden is particularly interesting because its government defied the consensus among other advanced economies and imposed much milder restrictions, explicitly aiming for herd immunity. Compared to the United Kingdom, Spain, or Italy, Sweden looks like a success story: it has a comparable number of deaths when normalized by population, but a significantly smaller loss in GDP. The shutdown in the United Kingdom, Spain, and Italy has already cost these economies the equivalent of 6 percent of their annual GDP, while the loss in Sweden has been just 2 percent of GDP.

On the other hand, with an alternative comparison, Sweden looks worse. In terms of deaths, Sweden has had around 575 deaths per million population vs. 50 in Norway, 60 in Finland, 115 in Denmark, and 115 in Germany. The other Nordic countries are a natural comparison group in terms of socioeconomic conditions, although differences in population distribution and mobility within this group should not be underestimated. Regarding economic outcomes, Norway and Sweden both report GDP losses of around 2 percent, while Denmark, Germany, and Austria are only slightly larger.

In the case of the United States, the current high levels of infection and deaths mean that the country is still moving to the right in figure 5. The rise in cases in Western Europe in August and September 2020 is at such an early stage that it is impossible to gauge whether these countries will also witness significant levels of additional deaths.

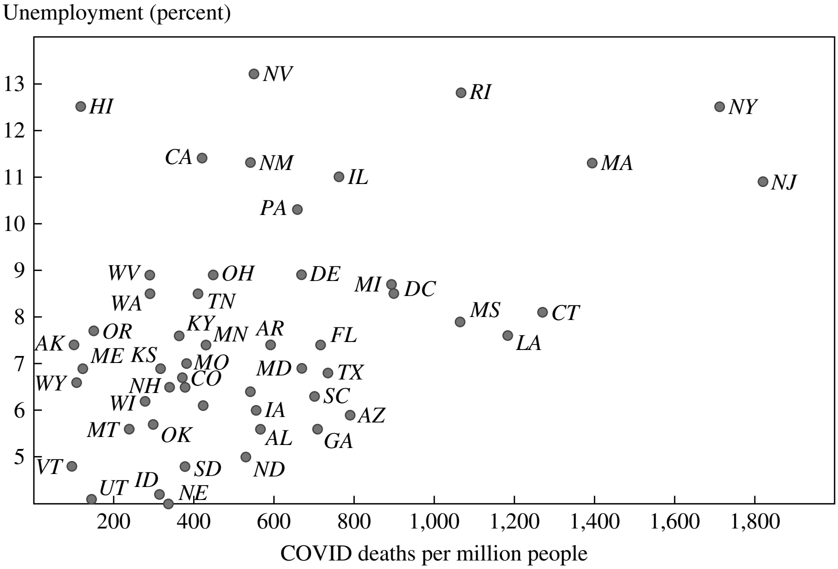
Finally, notice that figure 5 correlates COVID-19 deaths and GDP losses without controlling for additional variables (initial income per capita, industrial sectoral composition, density, demographics, etc.). We checked for the effects of possible controls, and we did not find any systematic pattern worth reporting.

II.B. US States and Unemployment

We now consider economic outcomes and deaths from COVID-19 across US states. In this case, our measure of economic activity is the unemployment rate. Figure 6 shows the unemployment rate for US states from August 2020 plotted against the number of deaths per million people as of October 9.

The heterogeneity in both the unemployment rate and in COVID-19 deaths is remarkable. States like New York, Massachusetts, and New Jersey have more than 1,200 deaths per million residents as well as unemployment

Figure 6. US States: COVID-19 Deaths and the Unemployment Rate



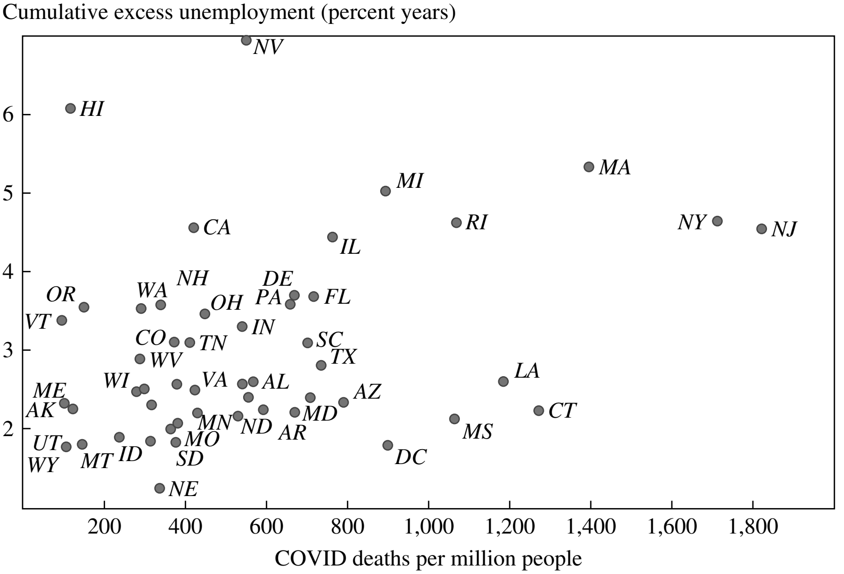
Sources: Johns Hopkins University CSSE, Bureau of Labor Statistics, and authors' calculations.
Note: The unemployment rate is from August 2020.

rates that, even after several months of recovery, exceed 10 percent. In contrast, states like Utah, Idaho, Montana, and Wyoming have very few deaths and unemployment rates between 4 and 7 percent.

Figure 7 cumulates the unemployment losses since February to create a more informative measure of the macroeconomic cost of the pandemic. In particular, we measure cumulative excess unemployment by summing the deviations from each state's February 2020 rate for each month and then dividing by twelve to annualize. In other words, a number like 6 in the graph implies that the loss to date is equivalent to having the unemployment rate be elevated by 6 percentage points for an entire year.

In this figure, it is interesting to compare New York, California, and Washington, DC. Both New York and California have had large declines in economic activity, the equivalent of having the unemployment rate be elevated by about 5 percentage points for an entire year. However, the number of deaths is very different in these two states. New York had around 1,700 deaths per million people, while California had around 400 as of October 9. What combination of luck and policy explains this outcome? Both states got hit relatively early by the coronavirus. Was California lucky

Figure 7. US States: COVID-19 Deaths and Cumulative Excess Unemployment



Sources: Johns Hopkins University CSSE, Bureau of Labor Statistics, and authors' calculations.
Note: Cumulative excess unemployment adds the deviations from each state's February 2020 rate for each month and then divides by 12 to annualize. In other words the loss to date is equivalent to having the unemployment rate be higher by a certain percentage for an entire year.

to get a strain from Asia that was less contagious and less deadly while New York got a strain from Europe that was more contagious and more deadly? Or did the policy differences between New York and California have enormous effects?

When compared to New York, California looks like a resounding success. On the other hand, one can also compare California to states like Washington and Minnesota, not to mention Montana and Nebraska. All of these other states had similar death rates but smaller employment losses. Did California shut down too much? Or were Nebraska and Minnesota lucky? Or did population density play an important role?

Finally, Washington, DC, stands out as a locale with relatively small employment losses—equivalent to an unemployment rate that is elevated by just 2 percentage points for a year—but substantial deaths. Washington, DC, looks somewhat like Sweden in this graph, but when we turn to the Google activity data below, the story will be a bit different: the prevalence of government jobs with stable employment may have limited the rise in the DC unemployment rate.

II.C. International Comparisons of Unemployment

Given our previous analysis, it would seem natural to compare the evolution of unemployment rates among the advanced economies. However, such a comparison is not especially informative in gauging the effects of COVID-19.

Many countries have passed generous government programs to induce firms to keep workers on the payroll even during lockdowns, count workers on furloughs with reduced pay as being employed, or classify workers who lost their jobs as out of the labor force if they are not searching for a new job due to the stay-at-home orders. Furthermore, severance costs make firing workers after a relatively transitory shock unattractive: firms might end up paying more in severance packages than the cost of just keeping their workers at home with pay for a few months. That means that the measured unemployment rate in some of the most severely hit countries has only increased by a few percentage points (from 13.6 percent in February 2020 to 15.6 percent in June 2020 in Spain) or even fallen (from 9.1 percent in February 2020 to 8.8 percent in June 2020 in Italy).[6]

The main exception is the United States, which features substantially different labor market regulations: unemployment jumped from 4.4 percent in March 2020 to 14.8 percent in April 2020 but then declined to 7.8 percent in September 2020.

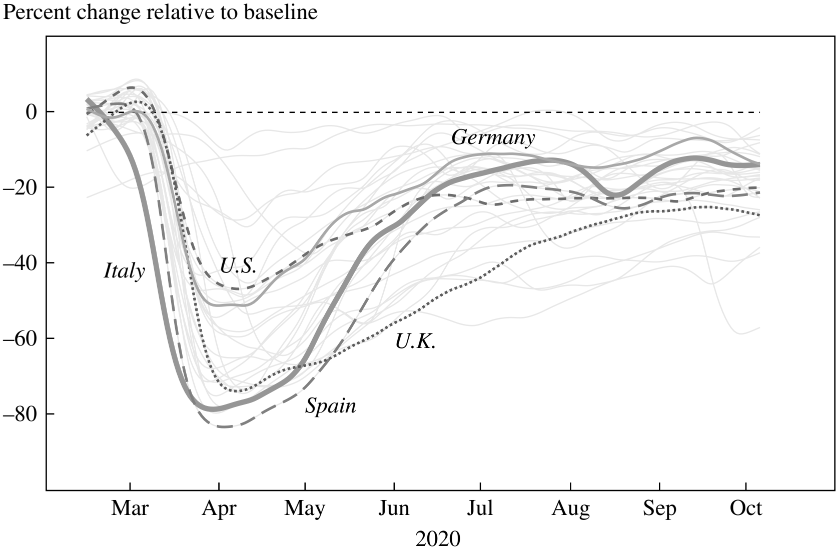
III. Activity from the Google Mobility Report Data

GDP and unemployment rates are standard macroeconomic indicators that are extremely useful. However, they also suffer from some limitations related to frequency and availability. In this section, we turn to another source of evidence: the COVID-19 Community Mobility Report data from Google for 2020. For shorthand, we will refer to this as the Google activity measure. These data show how daily location activity changes over time in a large number of countries and regions. The outcomes are grouped according to several destinations: retail and recreation, grocery and pharmacy, parks, transit stations, workplaces, and residences.

The Google activity measure has several key advantages relative to GDP or unemployment. First, it is available at a daily frequency, rather than quarterly or monthly. Second, it is reported with a very short lag of just a

6. Similar arguments would apply to a comparison of employment rates. The number of hours worked is reported by the OECD only at an annual frequency.

Figure 8. Google Activity: International Evidence



Sources: Google COVID-19 Community Mobility Reports and authors' calculations.

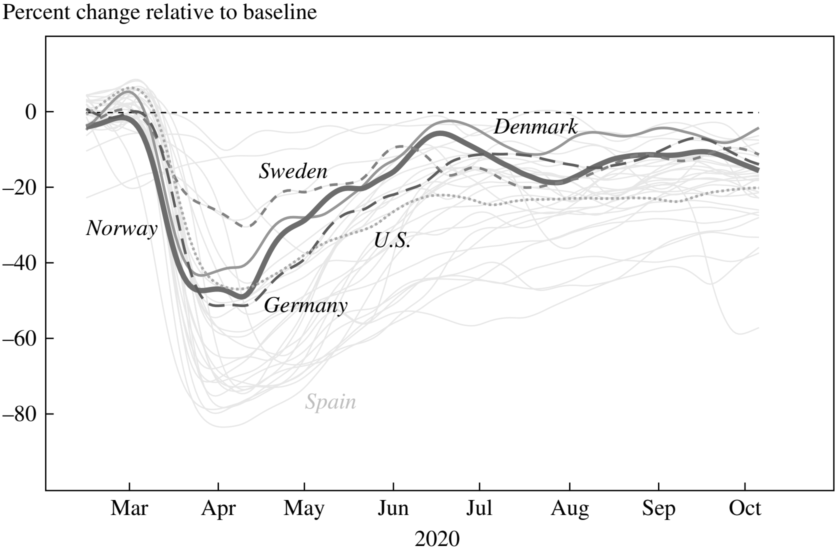
Note: Google activity is the equally weighted average of the retail and entertainment and workplace categories. The data are smoothed with an HP filter with smoothing parameter 400.

few days. By comparison, we only have 2020:Q2 GDP data for a handful of countries, and our latest unemployment rate data for US states are from September 2020. Finally, the Google data are also available at a very disaggregated geographic level, allowing us to look at cities as well as states and countries. In what follows, we focus on Google activity, defined as the equally weighted average of the retail and entertainment and workplace categories.

III.A. Google Activity over Time

Figure 8 shows the (smoothed) Google activity data over time for a large number of countries, highlighting a few. Italy and Spain show very sharp declines in activity starting quite early compared to the declines in the United States, the United Kingdom, and Germany. Activity recovers somewhat in May in Italy and Spain but only gradually in the United Kingdom. This appears to be a case of the United Kingdom being slow to get the pandemic under control, suffering from more deaths as a result, and being forced to keep its economy shut down for longer.

Figure 9. Google Activity: Northern Europe



Sources: Google COVID-19 Community Mobility Reports and authors' calculations.
Note: Google activity is the equally weighted average of the retail and entertainment and workplace categories. The data are smoothed with an HP filter with smoothing parameter 400.

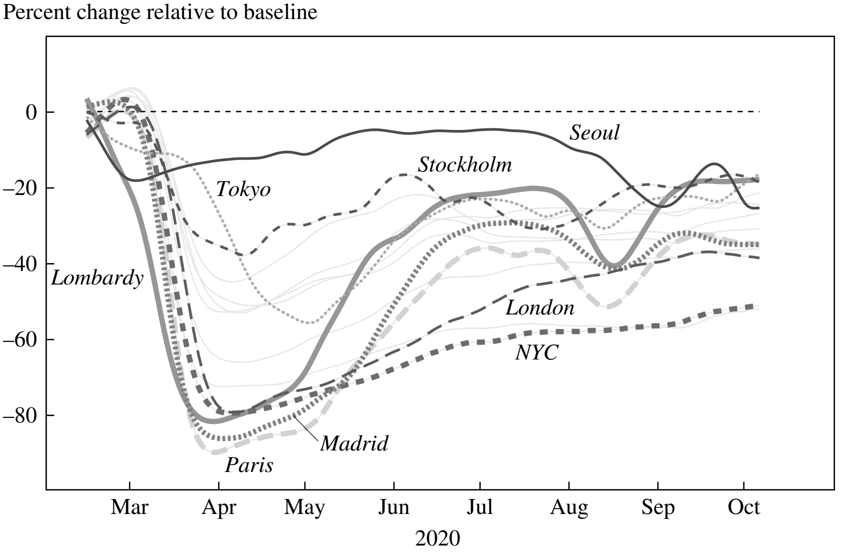
The United States and Germany are also interesting, in comparison. They have somewhat similar changes in activity but, as we've seen, very different COVID-19 outcomes. Among the highlighted countries, Germany had the smallest loss in economic activity and the fewest deaths.

Next, consider figure 9 which highlights the Scandinavian countries. These countries have even milder shutdowns than Germany and the United States. Sweden's shutdown is initially the mildest but by June it looks similar to Germany, Denmark, and Norway.

GLOBAL CITIES Figure 10 shows the Google activity measure for fourteen key international cities or regions. Lombardy and Seoul have very early shutdowns with 20 percent declines in activity by the first of March. Madrid and Paris and then New York City and finally London follow them down, with all four seeing activity down by around 80 percent as of April 1. Seoul recovers very quickly, while Tokyo sees a slow decline. Stockholm also has mild losses according to the Google activity measure.

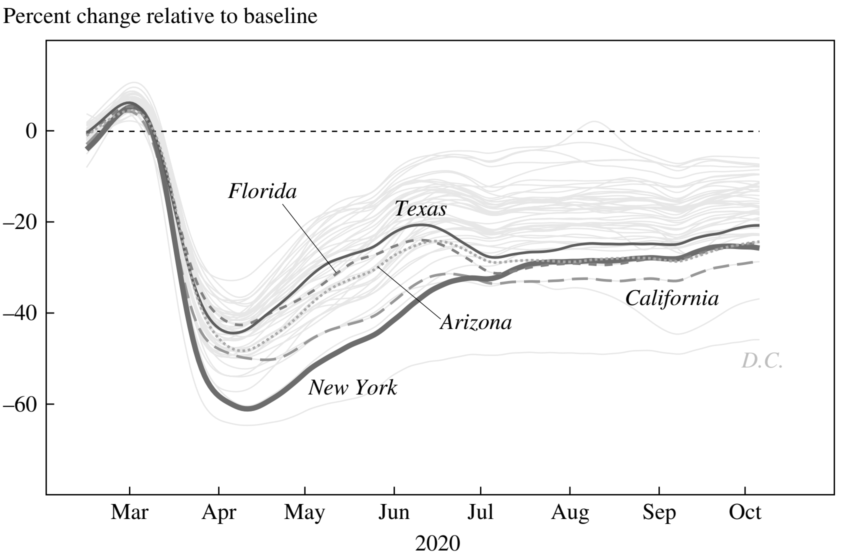
US STATES Figure 11 shows the Google activity data for US states. The heterogeneity of experience stands out, with some states close to normal by

Figure 10. Google Activity for Key Global Cities



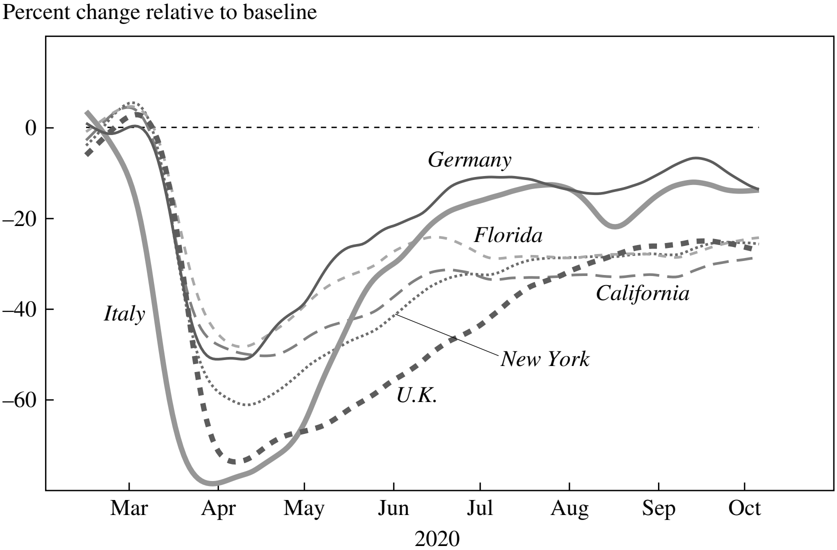
Sources: Google COVID-19 Community Mobility Reports and authors' calculations.
Note: Google activity is the equally weighted average of the retail and entertainment and workplace categories. The data are smoothed with an HP filter with smoothing parameter 400.

Figure 11. Google Activity for Key US States



Sources: Google COVID-19 Community Mobility Reports and authors' calculations.
Note: Google activity is the equally weighted average of the retail and entertainment and workplace categories. The data are smoothed with an HP filter with smoothing parameter 400.

Figure 12. Google Activity for Key US States and Countries

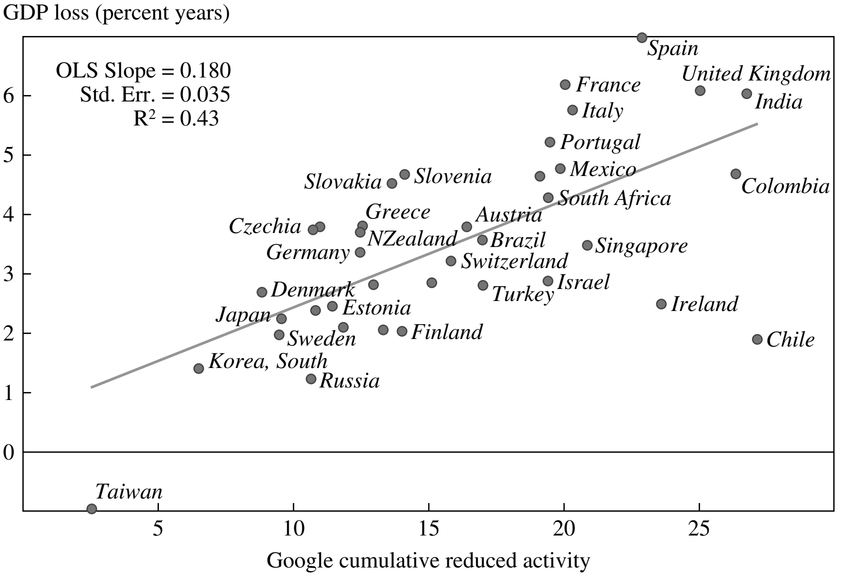


Sources: Google COVID-19 Community Mobility Reports and authors' calculations.
Note: Google activity is the equally weighted average of the retail and entertainment and workplace categories. The data are smoothed with an HP filter with smoothing parameter 400.

the summer while others remain 30 to 40 percent below baseline. Interestingly, Washington, DC, stands out: it has the largest decline of any state at virtually all dates, with activity more than 50 percent below baseline throughout the summer. Recall the contrast with the unemployment data shown earlier in figures 6 and 7. As the nation's capital, Washington, DC, is a special place: a large fraction of jobs are in the government sector and so therefore experienced small declines, while many employees are highly mobile, both nationally and internationally, resulting in large losses in Google activity.

Finally, figure 12 combines some of the key states and countries into a single graph for ease of comparison. The declines in Google activity in Italy and the United Kingdom are substantially larger than the declines in New York State and California, while Germany stands out as having even milder declines in activity than Florida. While the United Kingdom was slower than Italy (and slower than Spain and Germany—see figure 8) to shut down, it was as fast as New York and contracted economic activity more severely. New York had much worse outcomes in terms of deaths (1,700 versus 600), and this is true even if we compare New York City (2,800) versus London (650).

Figure 13. Cumulative Google Activity and Lost GDP



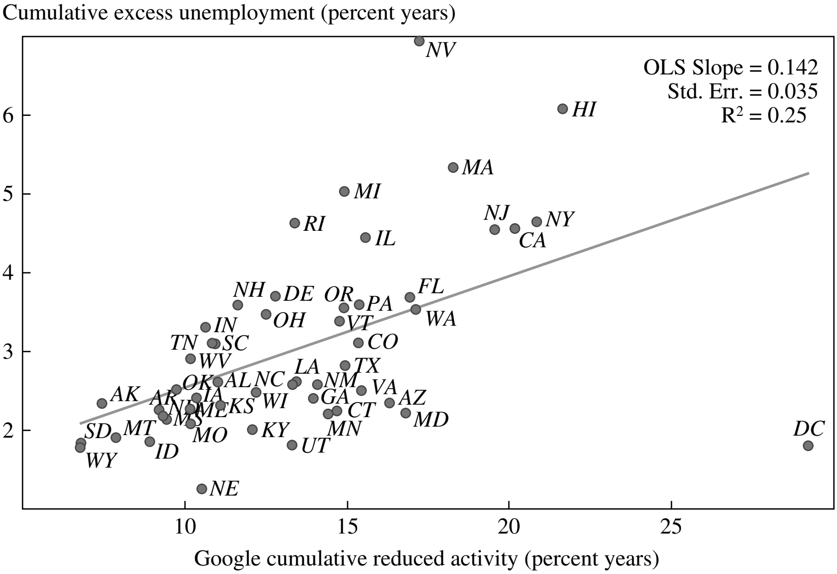
Sources: OECD, Google COVID-19 Community Mobility Reports, and authors' calculations.
Note: "GDP loss" reports the cumulative loss in GDP since the start of 2020 as a percentage of annual GDP. "Google cumulative reduced activity" measures the total amount of lost Google activity at an annual rate. The correlation in the graph is .65.

III.B. Correlating Economic Activity and Google Mobility

Before showing the trade-off graphs with the Google activity measure, we first demonstrate that this measure is correlated with the GDP loss and cumulative excess unemployment. The correlation with the GDP loss is shown in figure 13. Here and in what follows, we add up the areas in the Google activity graphs shown above to get a cumulative loss in Google activity. In particular, Google cumulative reduced activity measures the total amount of lost Google activity at an annual rate. A value of 20 indicates that, relative to baseline, it is as if activity at retail, entertainment, and workplace locations was reduced by 20 percent for an entire year. For example, a 40 percent reduction in activity each month for six months would deliver this value.

Figure 13 illustrates that the Google activity measure is a useful proxy for economic activity. The correlation between the loss in GDP and the cumulative reduction in activity is .65 (the square root of .43).

Figure 14. Cumulative Google Activity and Cumulative Excess Unemployment



Sources: Google COVID-19 Community Mobility Reports, Bureau of Labor Statistics, and authors' calculations.
Note: The correlation is 0.50; it rises to 0.69 if Washington, DC, is dropped.

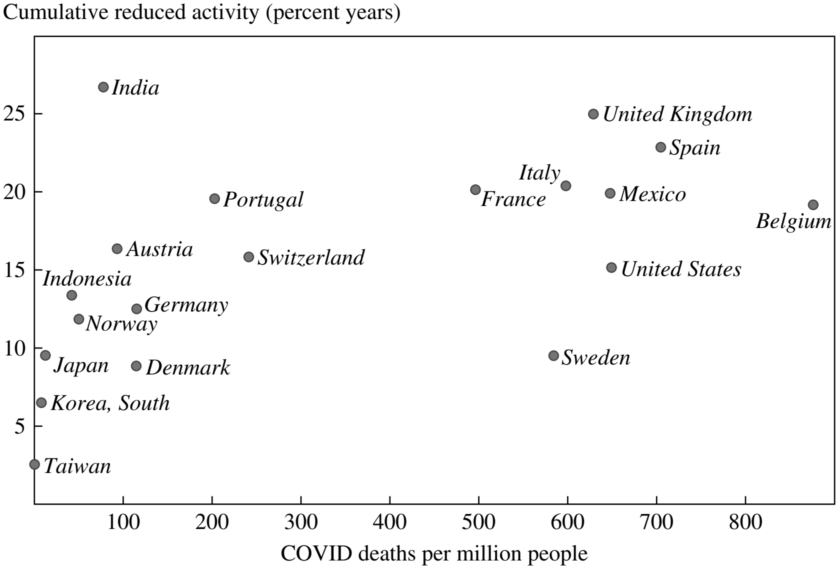
Figure 14 shows this same kind of evidence for US states, only this time for cumulative excess unemployment. The correlation with Google activity is .50 if Washington, DC, is included, but the District of Columbia is an outlier, as has already been mentioned; the correlation rises to .69 if this outlier is dropped.

III.C. Cumulative Results

COUNTRIES Figure 15 shows the cumulative lost activity according to the Google mobility data as of October 9. The first thing to appreciate is that the graph looks very similar to the GDP loss graph in figure 5. This is of course just another way of saying that the GDP data and Google data are highly correlated.

The key takeaways from this figure are therefore also similar. Belgium, the United Kingdom, Spain, and Italy have both very high deaths and very large losses in macroeconomic activity. Taiwan, South Korea, and Japan, as well as Denmark, Norway, and Germany are in the lower left of the graph,

Figure 15. COVID-19 Deaths (Latest) and Cumulative Google Activity (September)



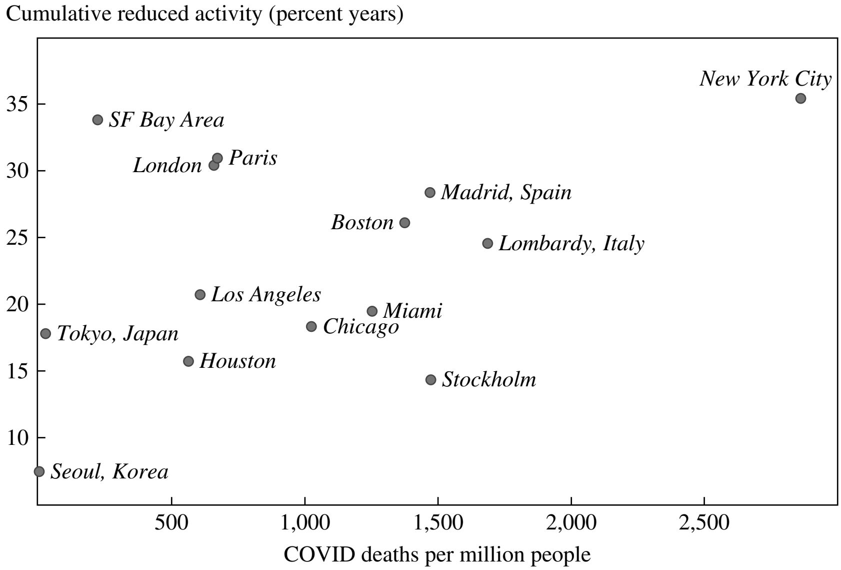
Sources: Google COVID-19 Community Mobility Reports, Johns Hopkins University CSSE, and authors' calculations.

Note: Google activity is the equally weighted average of the retail and entertainment and workplace categories. "Cumulative" refers to the fact that we add up the losses for every month between February and September 2020.

with good performance on both dimensions. Sweden stands out. It looks successful compared to countries like the United Kingdom, Spain, and Italy, with similar deaths but much smaller losses in GDP. On the other hand, compared to Norway and Germany, Sweden looks much less successful, with similar losses in economic activity but far more deaths. The United States is a similar case in that it has fewer deaths and smaller losses in economic activity than the United Kingdom, Spain, and Italy, but it looks much worse than Norway and Germany. India stands out in the upper left quadrant of the graph, having large losses in economic activity with comparatively few deaths. The United States and India have the additional disadvantage that their situations were still rapidly evolving at the time of writing.

CITIES Figure 16 shows one of the advantages of the Google data by disaggregating to the city level for a collection of key cities around the world. Broadly speaking, we see the same types of outcomes for cities that we saw for countries and states using macroeconomic data. New York City has by far the highest death rate in the world at around 2,800 per million people.

Figure 16. Global Cities: COVID-19 Deaths and Cumulative Google Activity



Sources: Google COVID-19 Community Mobility Reports, Johns Hopkins University CSSE, and authors' calculations.

Interestingly, it also has the largest cumulative economic loss, equivalent to around 35 percent of a year's activity.

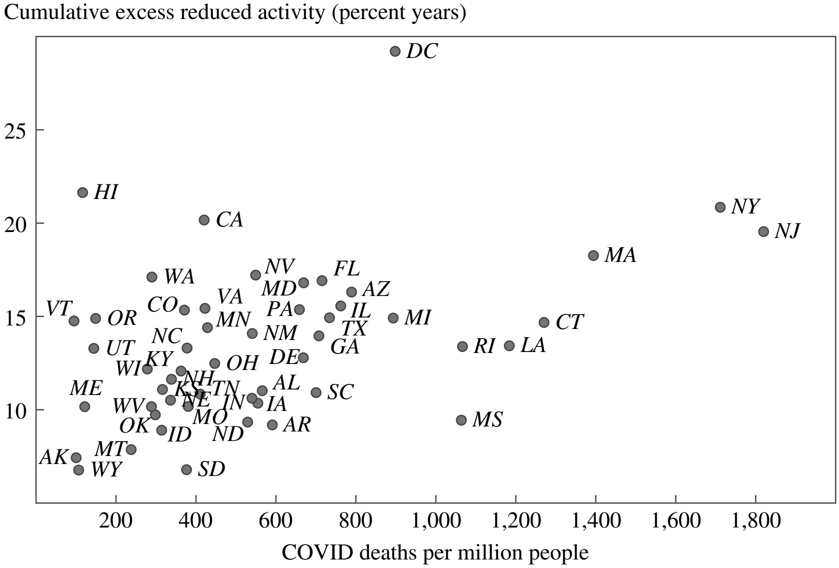
The economic loss is only slightly larger than losses in other cities such as London, Paris, and San Francisco. These cities have far fewer deaths than New York City, however, at around 650 per million for London and Paris and just 220 for the San Francisco Bay Area.

Madrid, Boston, and Lombardy stand out the way Spain and Italy did before, with a high death rate and large economic losses. In contrast, Seoul and Tokyo are much like South Korea and Japan. Stockholm also is positioned about the same as Sweden.

Finally, cities such as Los Angeles and Houston lie in the middle, with deaths somewhat similar to Paris and London, but with noticeably less cumulative loss in economic activity.

US STATES Figure 17 shows the Google activity data and deaths for US states. Apart from Washington, DC—where the large decline in activity contrasts with the small rise in the unemployment rate, as noted above—the pattern is quite similar to what we saw in the unemployment data in figure 7.

Figure 17. US States: COVID-19 Deaths and Cumulative Google Activity



Sources: Google COVID-19 Community Mobility Reports, Johns Hopkins University CSSE, and authors' calculations.

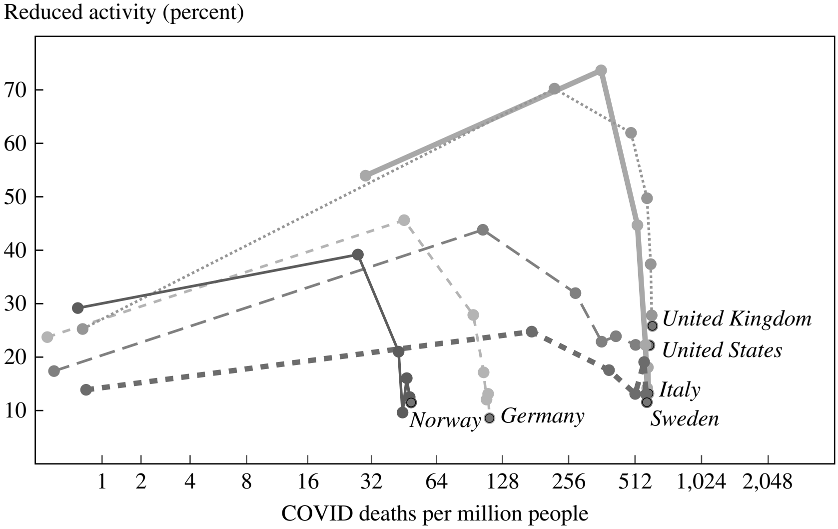
IV. Dynamic Versions of the Trade-Off Graphs

We now take advantage of the high-frequency nature of both the Google activity data and the COVID-19 data to examine the dynamic evolution of our outcomes. In what follows, we show outcomes at the monthly frequency, from March through September. Each dot on the graph is a monthly observation, connected in order, for selected locations identified at the most recent observation point. After experimenting with different ways of showing these data, we focus on plots for the current (flow) Google activity measure instead of the cumulative loss in economic activity.

IV.A. Countries

Figure 18 shows the dynamics for the flow of Google activity for a small set of countries, focused on the United States and some key European economies. The general pattern is that between March and April, countries move sharply up and to the right, as COVID-19 deaths explode and the countries severely restrict economic activity. After April, countries break in two directions. Italy, Germany, Norway, and the United Kingdom see COVID-19

Figure 18. Monthly Evolution from March to September, 2020, for Key Economies



Sources: Google COVID-19 Community Mobility Reports, Johns Hopkins University CSSE, and authors' calculations.

Note: The vertical axis is the current flow of Google activity, averaged for each month. The horizontal axis plots log(1 + deaths) where deaths are as of the 15th of each month.

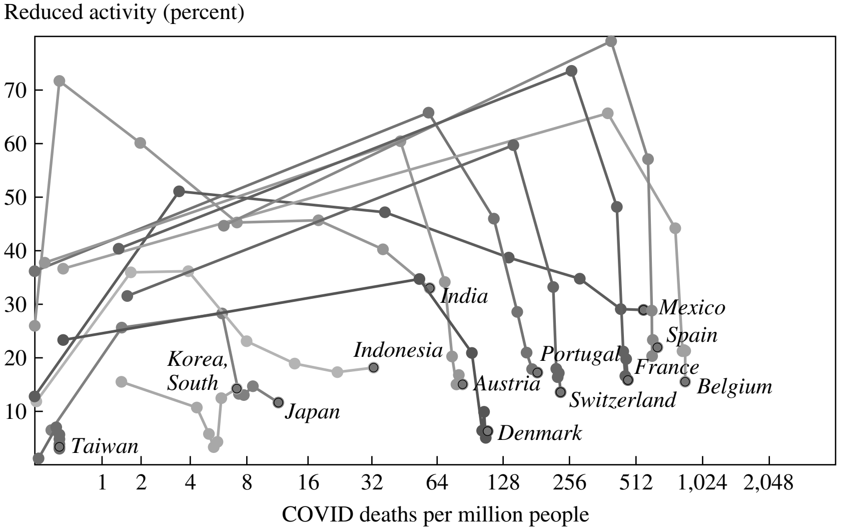
deaths stabilize by May or June, and economic activity starts to recover: the dynamics take the lines sharply downward. In Sweden and the United States, in contrast, deaths continue to increase and there is less economic recovery; the movement is more to the right instead of straight down.

Figure 19 shows this same kind of graph for an additional dozen countries, including Taiwan, South Korea, India, Japan, Mexico, France, and Spain. The same variation is seen among these countries. Most have a large sharp move up and to the right followed by a recovery in economic activity and a stabilization of deaths, illustrated by the vertical nature of the lines in the graph. In contrast, Mexico, India, and Indonesia experience a persistent move to the right as the pandemic continues and deaths have yet to stabilize.

IV.B. Global Cities

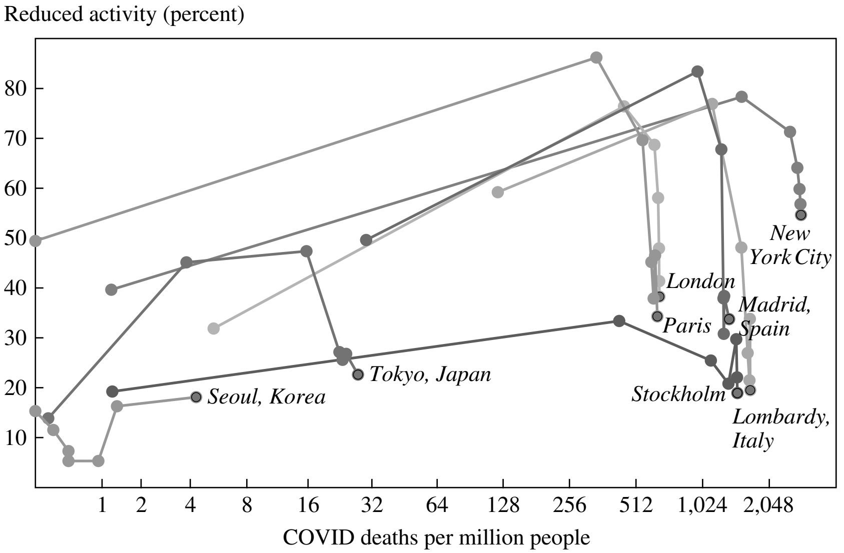
Figure 20 shows similar dynamics for key cities or regions around the world. New York City, Lombardy, Madrid, London, and Paris all move sharply up and to the right with the onset of the pandemic. By May, however, the stabilization of deaths and the gradual reopening of the economies is apparent in the vertical portion of the curve.

Figure 19. Monthly Evolution from March to September, 2020, for Additional Countries



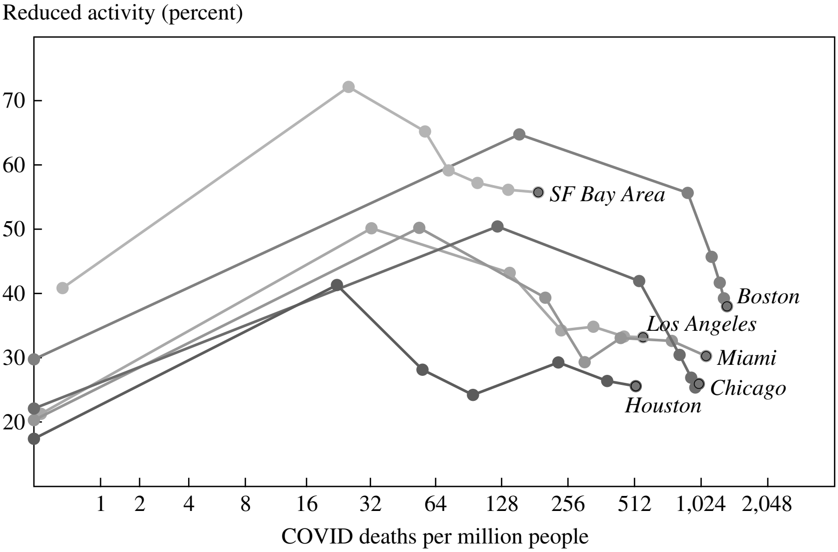
Sources: Google COVID-19 Community Mobility Reports and authors' calculations.
Note: The vertical axis is the current flow of Google activity, averaged for each month. The horizontal axis plots log(1 + deaths) where deaths are as of the 15th of each month.

Figure 20. Global Cities: Monthly Evolution from March to September, 2020



Sources: Google COVID-19 Community Mobility Reports, Johns Hopkins University CSSE, and authors' calculations.
Note: The vertical axis is the current flow of Google activity, averaged for each month. The horizontal axis plots log(1 + deaths) where deaths are as of the 15th of each month.

Figure 21. US Cities: Monthly Evolution from March to September, 2020



Sources: Google COVID-19 Community Mobility Reports, Johns Hopkins University CSSE, and authors' calculations.

Note: The vertical axis is the current flow of Google activity, averaged for each month. The horizontal axis plots log(1 + deaths) where deaths are as of the 15th of each month.

Stockholm is an interesting contrast in that Google activity declines by only about 20 to 30 percent for the entire spring, far less than in many other cities. On the other hand, the rightward move continues for longer, resulting in appreciably more deaths.

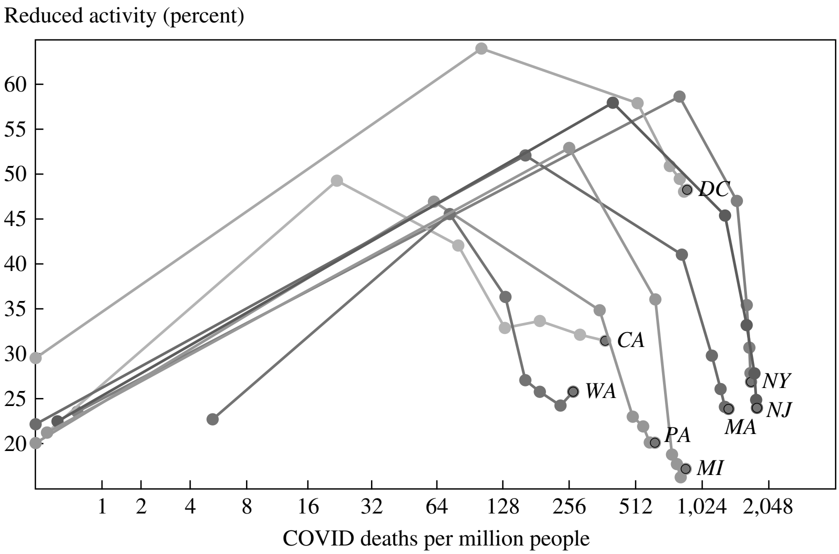
Finally, Tokyo and Seoul are interesting to compare. Tokyo had a much larger decline in economic activity peaking at around 45 percent in April and May. By comparison, Seoul saw reductions of 20 percent or less each month. While both cities end with enviably low deaths, the death rate in Seoul is about 4 per million versus six times larger at 24 per million in Tokyo.

Figure 21 shows a similar graph for cities in the United States. Here the continued rightward trends in Houston, Miami, Los Angeles, and San Francisco are evidence that the pandemic was not yet under control.

IV.C. US States

The next two figures show the dynamics for US states, confirming the two types of patterns we've seen in countries and cities. Figure 22 shows that in states like New York, New Jersey, Massachusetts, Michigan, and

Figure 22. US States: Monthly Evolution from March to September, 2020



Sources: Google COVID-19 Community Mobility Reports, Johns Hopkins University CSSE, and authors' calculations.

Note: The vertical axis is the current flow of Google activity, averaged for each month. The horizontal axis plots log(1 + deaths) where deaths are as of the 15th of each month.

Pennsylvania, deaths have stabilized. By contrast, figure 23 shows many states where this is not true. The continued movement to the right documents the continued rise in deaths from COVID-19.

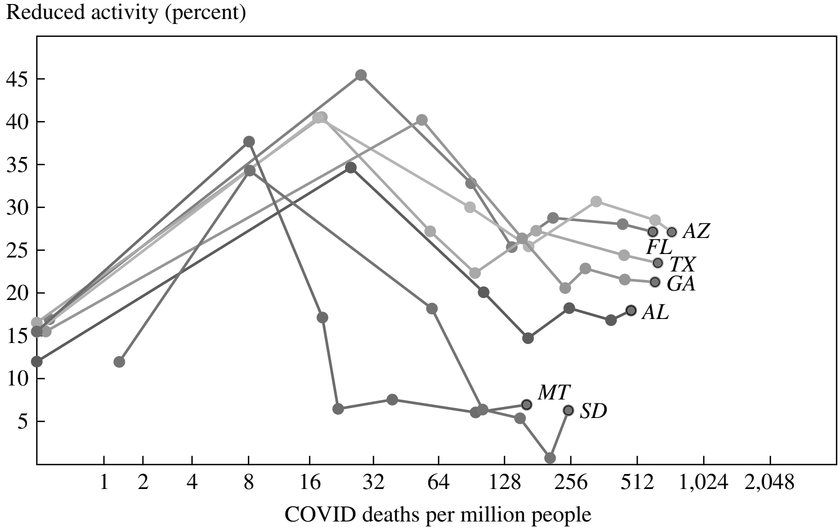
V. Conclusion

We have combined data on GDP, unemployment, and Google's COVID-19 Community Mobility Reports with data on deaths from COVID-19 to study the pandemic's macroeconomic outcomes.

Our main finding is that most countries, regions, or cities fall in either of two groups: large GDP losses and high fatality rates (New York City, Lombardy, United Kingdom) or low GDP losses and low fatality rates (Germany, Norway, Kentucky). Only a few exceptions, mainly California and Sweden, depart from this pattern.

This correlation has a simple explanation at a mechanical level. Through some combination of government mandates and voluntary changes in behavior, those areas that suffered high mortality reduced economic activity dramatically to lower social contacts and slow down the pandemic's spread.

Figure 23. Other US States: Monthly Evolution from March to September, 2020



Sources: Google COVID-19 Community Mobility Reports, Johns Hopkins University CSSE, and authors' calculations.

Note: The vertical axis is the current flow of Google activity, averaged for each month. The horizontal axis plots log(1 + deaths) where deaths are as of the 15th of each month.

In comparison, those locations that were able to control the virus from the beginning could maintain economic activity and suffer fewer deaths.

This observation suggests that controlling the epidemic is vital to mitigating GDP losses. It is easy to be sympathetic with this view, as it avoids the classic trade-offs in economics between alternative ends. With COVID-19, the evidence suggests that it is possible to be successful on both dimensions, minimizing deaths as well as other economic losses.

Nonetheless, it is challenging given our current data to gauge the extent to which a low death toll was the product of good luck versus good policy. Taiwan, South Korea, and Germany have been praised for their early and aggressive testing programs and intensive use of contact tracing, and several papers have highlighted the effectiveness of non-pharmaceutical interventions. But Taiwan and South Korea might have been hit by a less contagious form of the virus and might have benefited from prior experience with SARS and MERS. More of the circulation of SARS-CoV-2 in Germany might have occurred among younger cohorts than in other European countries. Further research will be required to separate the roles of luck from policy and to determine which policies were especially effective.

These arguments also work in reverse when we analyze the two main outliers in our data set: California and Sweden. California seems to have lost too much GDP given the severity of the health crisis it faced. Sweden could have reduced its mortality without too much GDP loss, at least as suggested by its Nordic neighbors' performance. But again, California was hit early by the first form of virus, perhaps less contagious. From the perspective of California's policymakers, the decisions taken ex ante in March might be fully justified even if too tight ex post. Sweden might have suffered from higher density in Stockholm, worse demographics, and other social differences with its neighbors.

Finally, we should notice that COVID-19 has policy spillovers, both in terms of health and economic outcomes. Had Italy controlled its epidemic earlier, France and Germany might have suffered a milder crisis. And if China had not undertaken draconian measures in Wuhan, South Korea might look very different today. Before rushing to judgment regarding the effect of different policies, these spillover effects must be analyzed in more detail. Regarding economic outcomes, a fall in global economic activity has dire consequences even for countries that have been able to control the virus. For example, Goldberg and Reed (2020) document that emerging market and developing economies have suffered from massive capital outflows and large price declines for certain commodities, especially oil and nonprecious metals.

Our conclusions are subject to a fundamental consideration. Health professionals in China started to suspect the presence of a new respiratory disease in the last week of December 2019. The first public message regarding the pandemic occurred on December 31, 2019, and was reported as a minor news item by a few Western media outlets. Only ten months have passed since that news.

Furthermore, the pandemic continues. Even in the best-case scenario in which effective vaccines and rapid tests become widely available by early 2021, we will still face, at the very least, a difficult first two quarters of 2021. There are already some indications that an additional wave of the pandemic may crest in the autumn of 2020 and winter of 2021. All the graphs that we report may look quite different by mid-2021. By then, it may be much more apparent how much the divergence in outcomes is driven by luck and by policy.

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