London Business School

Wheeler Institute for Business and Development

The economics of a pandemic: the case of Covid-19

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Paolo Surico and Andrea Galeotti
Professors of Economics at London Business School

london.edu

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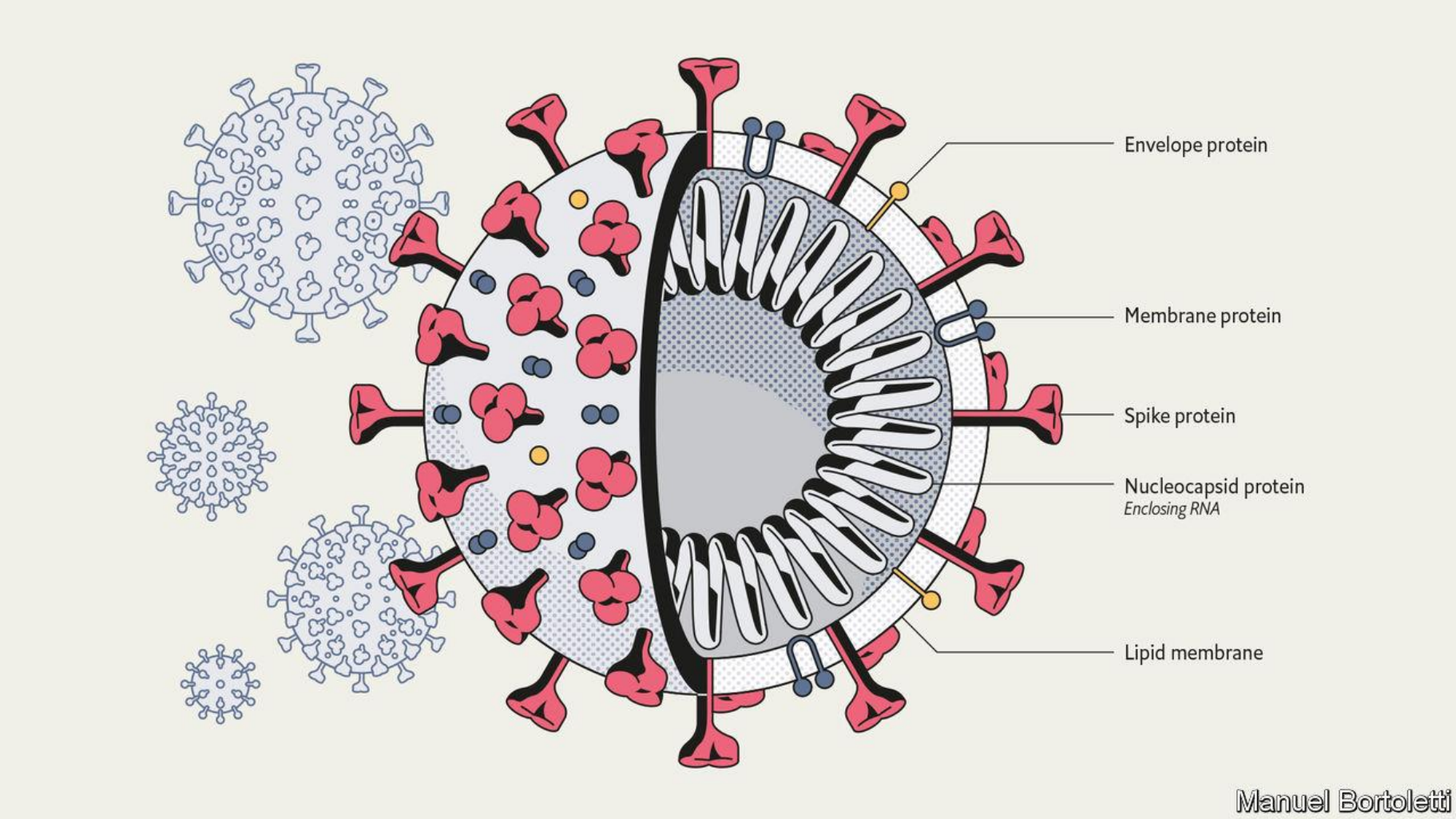
This Lecture

1. **Science**
2. Health policies
3. Economics
4. Macroeconomic policies

The enemy



Source: The Economist, 14th March 2020

The basics about Covid-19: what it is

- The cause: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
- The disease: Coronavirus disease 2019 (COVID-19)

- Possible origin in wet animal market in Wuhan, China, early Dec 2019
- A strain of the same virus as SARS-CoV-1, which affected 8,000 people in 2002/03
- 96% DNA match between bat coronavirus and human found in a study from February; suggests link to humans is not direct but through intermediate host
  - Initially pangolins were suspected, but now seems to not be so; still unclear
- Made of 4 proteins and a strand of RNA (molecule which can store genetic information)
  - One protein is the spike, which gives the crown-like appearance
  - Two proteins sit in the membrane between the spikes to provide structural integrity
  - In the membrane, the fourth protein is a scaffold around the genetic material

Source: The Economist, 23rd January 2020; Nature: “Mystery deepens over animal source of coronavirus” https://www.nature.com/articles/d41586-020-00548-w

The basics about Covid-19: how it works

- Enters through nose, mouth, or eyes. Attaches to ACE2 receptor cell proteins in the respiratory tract
- It fuses with the cell and releases the RNA; the hijacked infected cell will produce proteins based on the "instructions" from the virus' RNA
- Each infected cell can release millions of copies of the virus before dying
- Affects upper respiratory tract (airways from nose to vocal chords), can spread to lungs
- In serious cases, immune system can overreact and attack lung cells; in some cases, the infection leads to acute respiratory distress syndrome and possibly death
- The virus can also end up in droplets that escape the lungs through coughing or sneezing; this leads to contagion directly to other humans, or indirectly through contaminated surfaces
- Soap destroys the virus because its molecules can wedge themselves into the membrane and break it down

Source: The Economist, 23rd January 2020; https://www.bbc.co.uk/news/av/health-51883255/coronavirus-explained-in-60-seconds; https://www.nytimes.com/interactive/2020/03/11/science/how-coronavirus-hijacks-your-cells.html

The basics about Covid-19: characteristics

Virus appears highly transmissible (especially among young without symptoms)

- Average patient infects 1.6 to 2.4 other people
- Men are twice more likely to get infected than women
- At least 50% of cases seem asymptomatic

Disproportionally affects older patients

- Fatality rate in the 70s is 3-4 times larger than the average
- Under 40 seems to be around 0.2%

Many factors unclear:

- What is the extent of undetected cases, due to mild or no symptoms, or lack of testing
- Whether asymptomatic individuals can transmit the virus and how long is the incubation period
- Whether recovery implies immunity, and for how long
- Whether the virus is seasonal and will decrease during spring and summer

Source: McKinsey & Company: Coronavirus COVID-19: Facts and Insight, updated 9th March 2020.

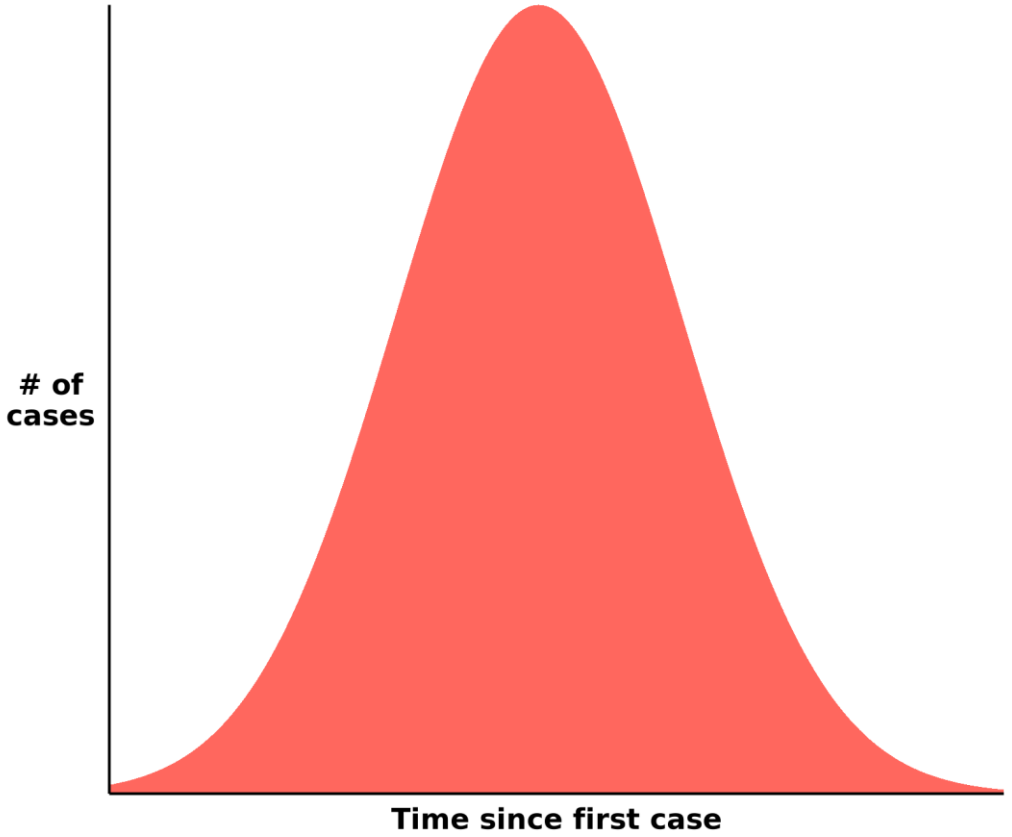
Current drug efforts

What	How	Development	Challenges
Testing *For infection:* Used to identify the presence of the virus	Two possible tests – PCR tests that can identify the virus and serologic tests that can identify antibodies (the body's response to the virus)	• Tests for infection currently available for purchase • Many organizations across nations are developing tests – either independently or with others' research • WHO protocol has been issued for creating tests A variety of test types is critical to spread the risk of any issues, ease supply constraints, better combat mutations, and better target immunology differences by location	• **Accuracy** – do not know sensitivity of test or likelihood of false positives (which increases danger of continued spread) • **Bureaucracy** – striking a balance between providing tests to large populations versus controlling approvals • **Mass production** – supply shortages and allocation are limiting factors and driving prioritization of tests and associated PPE, impacted by potential private profiteering • **Staff training** – to conduct and analyse tests
Testing *For immunity:* Used to identify if antibodies are disease-fighting	Blood tests can confirm whether antibodies present are disease-fighting, providing immunity	• Some tests currently available with results in 15 minutes • Singapore has developed a test with at least 90% accuracy	• **Accuracy** – what is sensitivity or likelihood of false positives • **Duration** – how long immunity lasts (months to a year) • **Contagion** – how infectious is an immune individual • **Strength** – how immune you are (e.g. does it withstand continued, severe exposure like for an ICU worker?)
Vaccine: Used to prevent healthy people from getting infected	Using live vaccine traditional approach, but innovative approaches like recombinant or genetically instructed vaccines	• 35 organizations racing to create a vaccine, 4 have candidates in animal testing, 1 started human trials • Utilizing and repurposing prior Sars candidates, given 80+ % overlap of genetic material with Sars-CoV-19 A diversity of methods and attempts is critical, given the lengthy test phase and high level of attrition	• **Speed vs. Safety** – can take a decade to develop, even 18 months would be extremely fast and without a problem • **Mass production** – facilities developing vaccine do not have capacity and require specialized equipment to manufacture, costly for drugs still in development • **Politics & Economics** – how to get drugs to those who need it – by country? by need? By purchase power?

Treatment:
 	
Used to lessen the effects of the virus
	Antivirals slow the replication of the virus early on, or drugs that stop the cascade of illness	• 69 drugs identified as potentials, 14 under investigation
		• Faster to repurpose current drugs than develop new, but rigorous testing is required. Difficult to obtain significant sample sizes for so many trials
		• Utilizing and repurposing prior Sars candidates, given 80+ % overlap of genetic material with Sars-CoV-19
			• **Speed vs. Safety** – initial scans will indicate that the protein binds, but does not confirm:
			  ○ The effects attributable to the drug
			  ○ That the drug does not cause negative effects
			• **Stock shortages –** publication of early results about potential treatment drugs cause mass buyouts

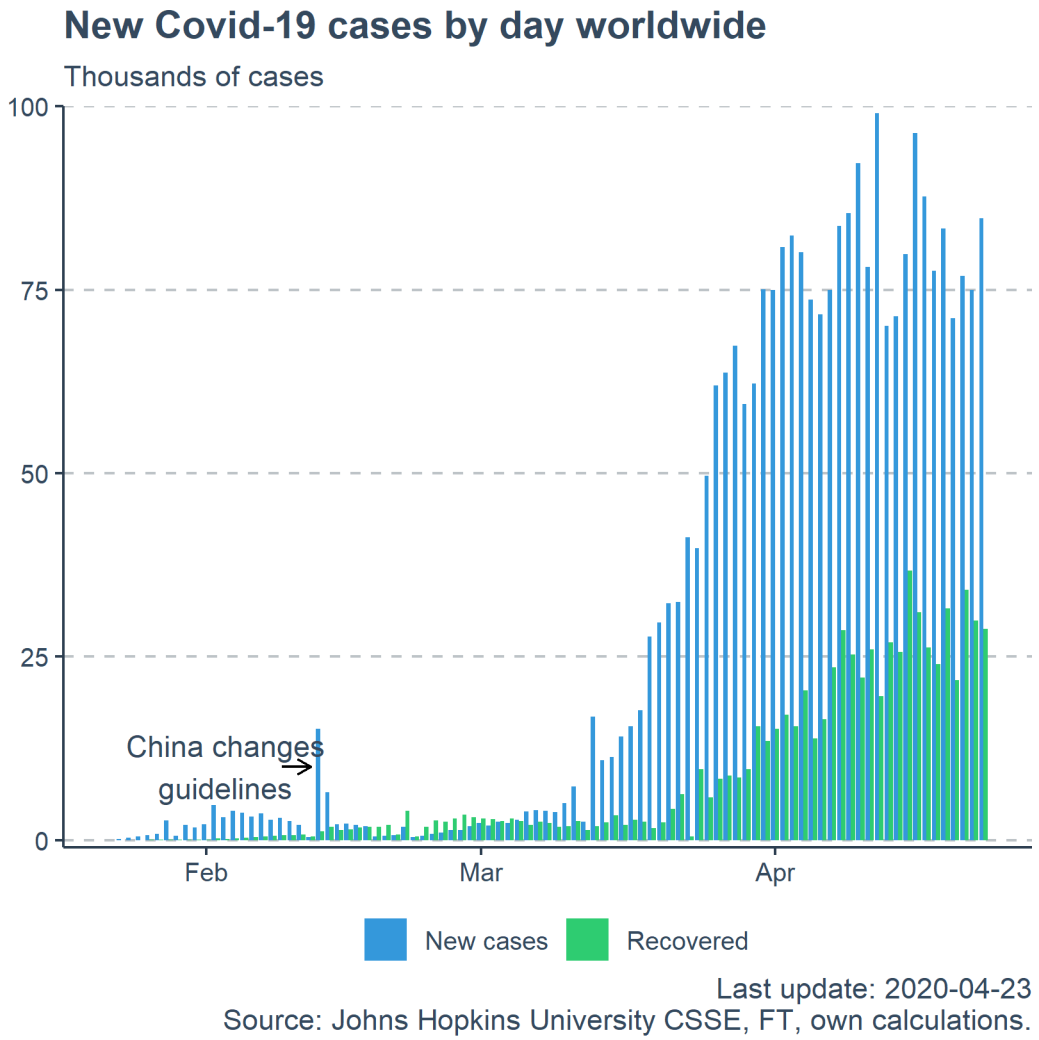
Source: Sonia Longhi, Director of Research CNRS; CNN, 25 Mar; The New Yorker, 24 Mar.; The Guardian, 25 Mar; USA Today, 24 Mar; New York Times, 22 Mar, Economist, 26 Mar; Reuters, 25 Mar)

The theoretical contagion curve

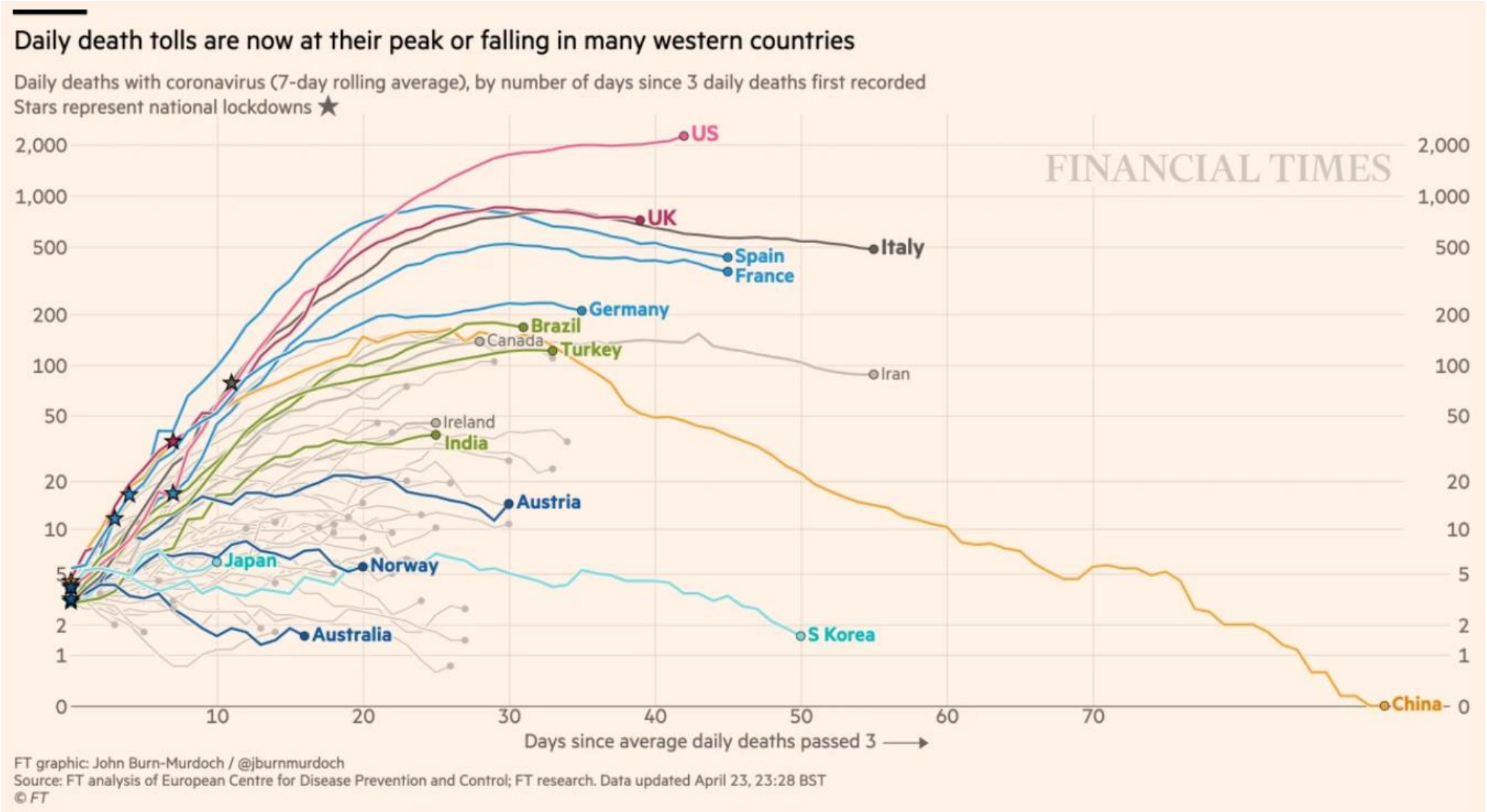


Adapted from the CDC and The Economist
Visit flattenthecurve.com

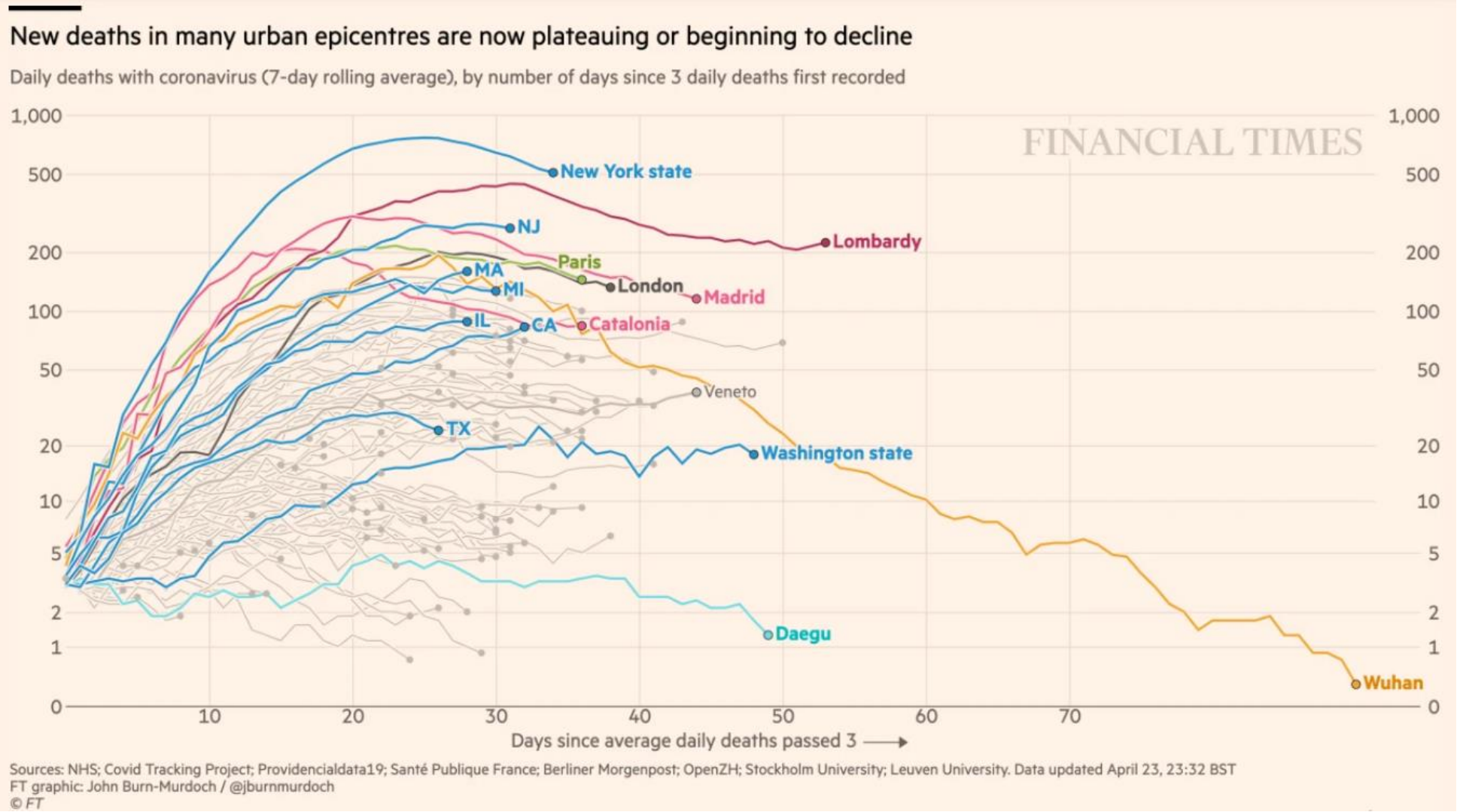
The empirical contagion curve(s)



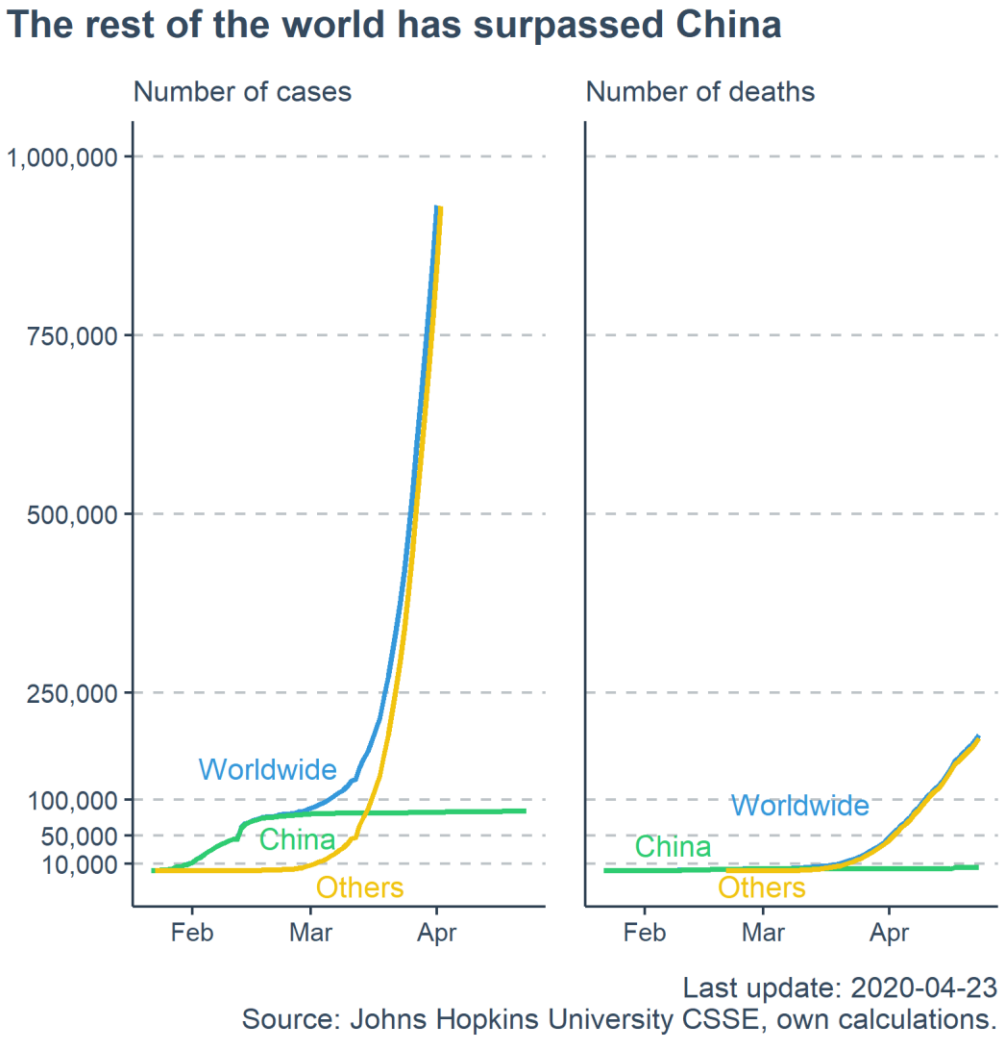
Patterns of fatalities in different countries



Patterns of fatalities in different cities and regions



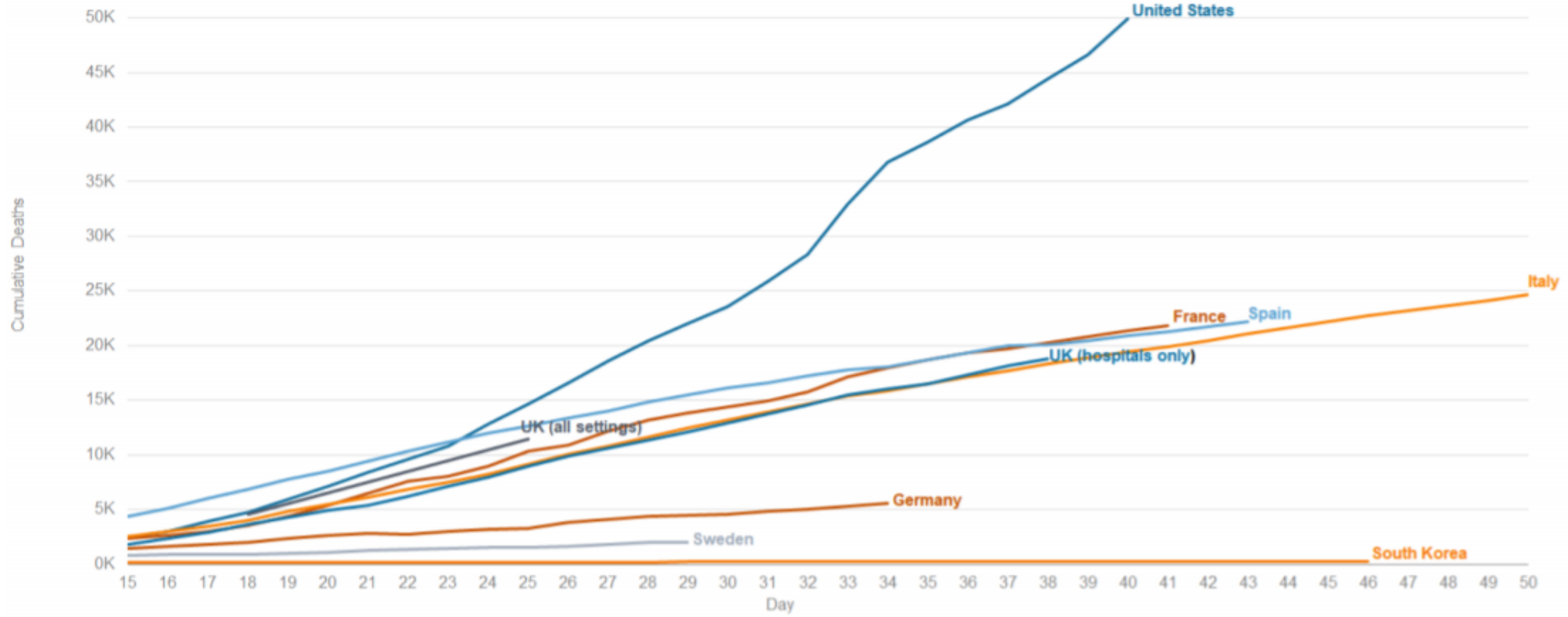
The current situation worldwide



Death tolls by country

Global Death Comparison

Country data is aligned by stage of the outbreak. Day 0 equals the first day 50 cumulative deaths were reported.



Source: ONS, NRS, NISRA, Public Health England, Johns Hopkins University. The figures on deaths relate in almost all cases to patients who have died in hospital and who have tested positive for COVID-19. Slight differences in reporting in devolved administrations may mean that they include a small number of deaths outside hospital. ONS, NRS and NISRA reporting of UK deaths for all settings is based on information from death certificates, and therefore lags daily hospital data. International reporting procedures and lags are unclear, so may not be comparing like-for-like.

Source: UK Government Daily Coronavirus Press Conference, 24 Apr

United States are now the epicentre of the crisis

Source: Johns Hopkins University CSSE (https://coronavirus.jhu.edu/map.html). Click the image to open the page

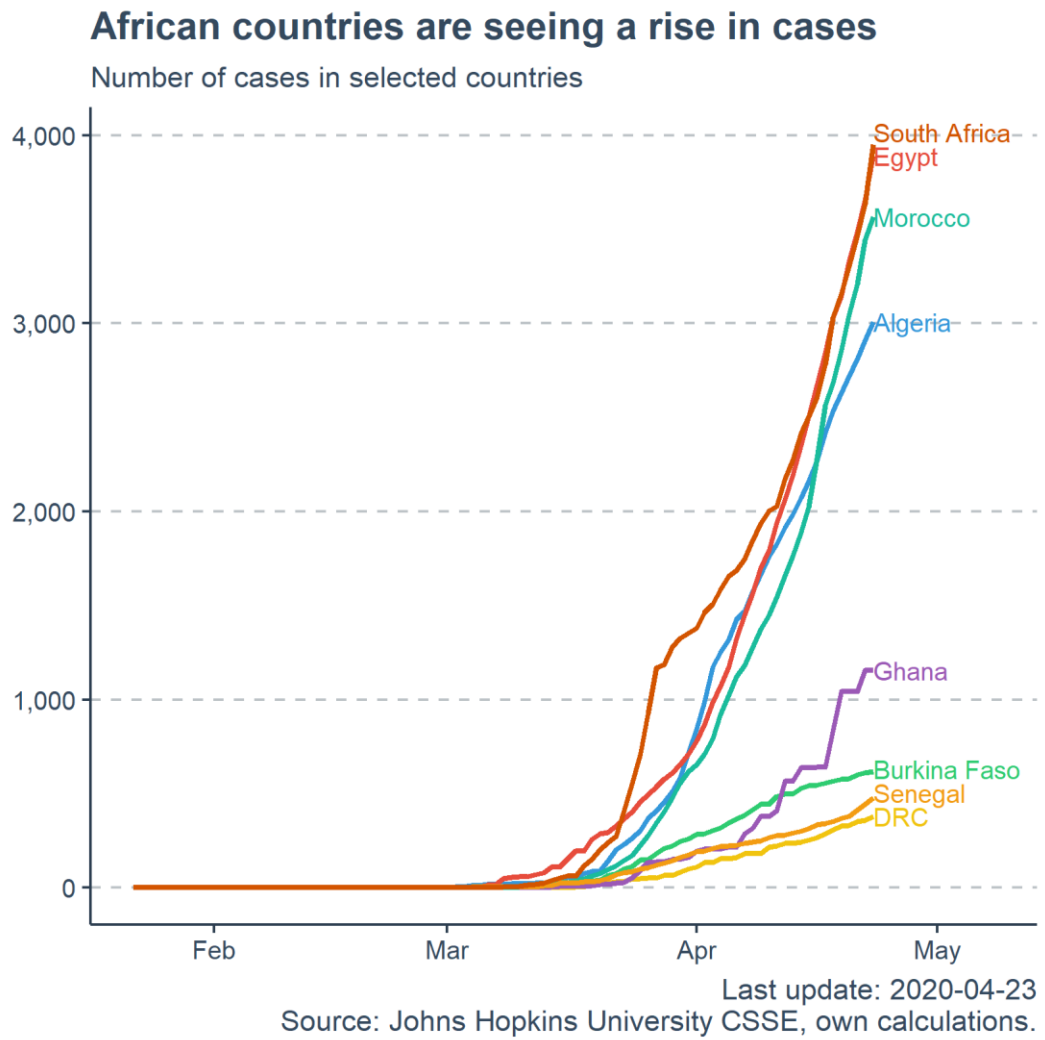
Developing economies face higher risks

In Africa, South Asia and to a lesser extent Latin America:

- Much lower health system capacity (e.g. fewer intensive care units and ventilators).
- People have less possibility to wash their hands with soap frequently.
- Underlying health conditions can pose additional risks (25m + Africans with HIV), or can be exacerbated as attention is drawn from current outbreaks to preventing Covid-19.
- Challenges for governments to enact social distancing in crowded communities where many family members share same room to sleep and staying at home means close quarters and no paycheck
- More exposed to the world trade cycle because their goods (and services) are highly dependent on advanced economies demand and thus more vulnerable to the crisis.
- Limited buying power as scarce pandemic-fighting supplies are rerouted or priced at a premium
- Far less access to the internet and therefore working from home will have far more disruptions and unprecedented economic costs than the already very large and heterogeneous costs that it will have in advanced economies (more later).

Source: The Economist “Africa is woefully ill-equipped to cope with covid-19”, 26 March

The contagion curve in the developing world



Pandemic

World Health Organization declared a pandemic on 11 March

- WHO definition: “A pandemic is the worldwide spread of a new disease. An influenza pandemic occurs when a new influenza virus emerges and spreads around the world, and most people do not have immunity.”
- US CDC definition: “Pandemic refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people.”

Declaration about geographic spread, not about the severity of the disease

Source: WHO; Washington Post “WHO declares a pandemic of coronavirus disease covid-19”

A historical perspective on contagious diseases

- 14th century Europe: bubonic plague. 25 million (pop. 100 million)
- 1918-1920 Worldwide Influenza epidemic. 50 million or higher
- 1981-currently AIDS: >25 million lives + 33 million living with HIV
- Recent smaller outbreaks:
  - 2002-04 SARS: 8k cases, 774 death
  - 2009 Avian flu: 151k-575k deaths
  - 2014-16 Ebola: >11k deaths

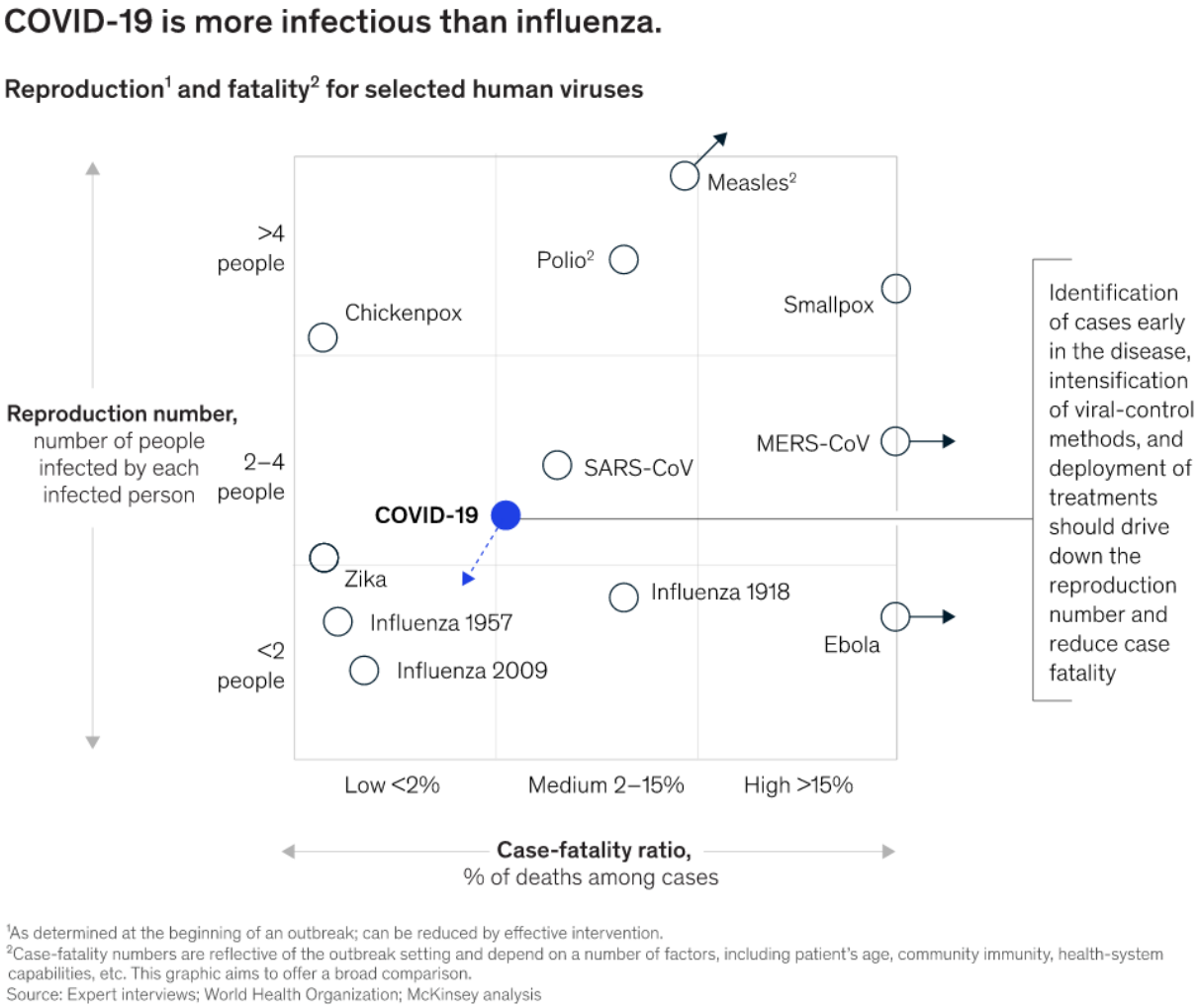
Source: Notes by Flavio Toxvaraed; Baldwin and Weder di Mauro (2020), “Economics in the Time of COVID-19”

Comparison with other contagious diseases

Covid-19 appears both more deadly and contagious than other well known influenzas: a main cause though is the lack of a vaccine

but

HUGE measurement errors!!!



Source: McKinsey & Company: Coronavirus COVID-19: Facts and Insight, updated 16th March 2020.

Far more cases among the young!

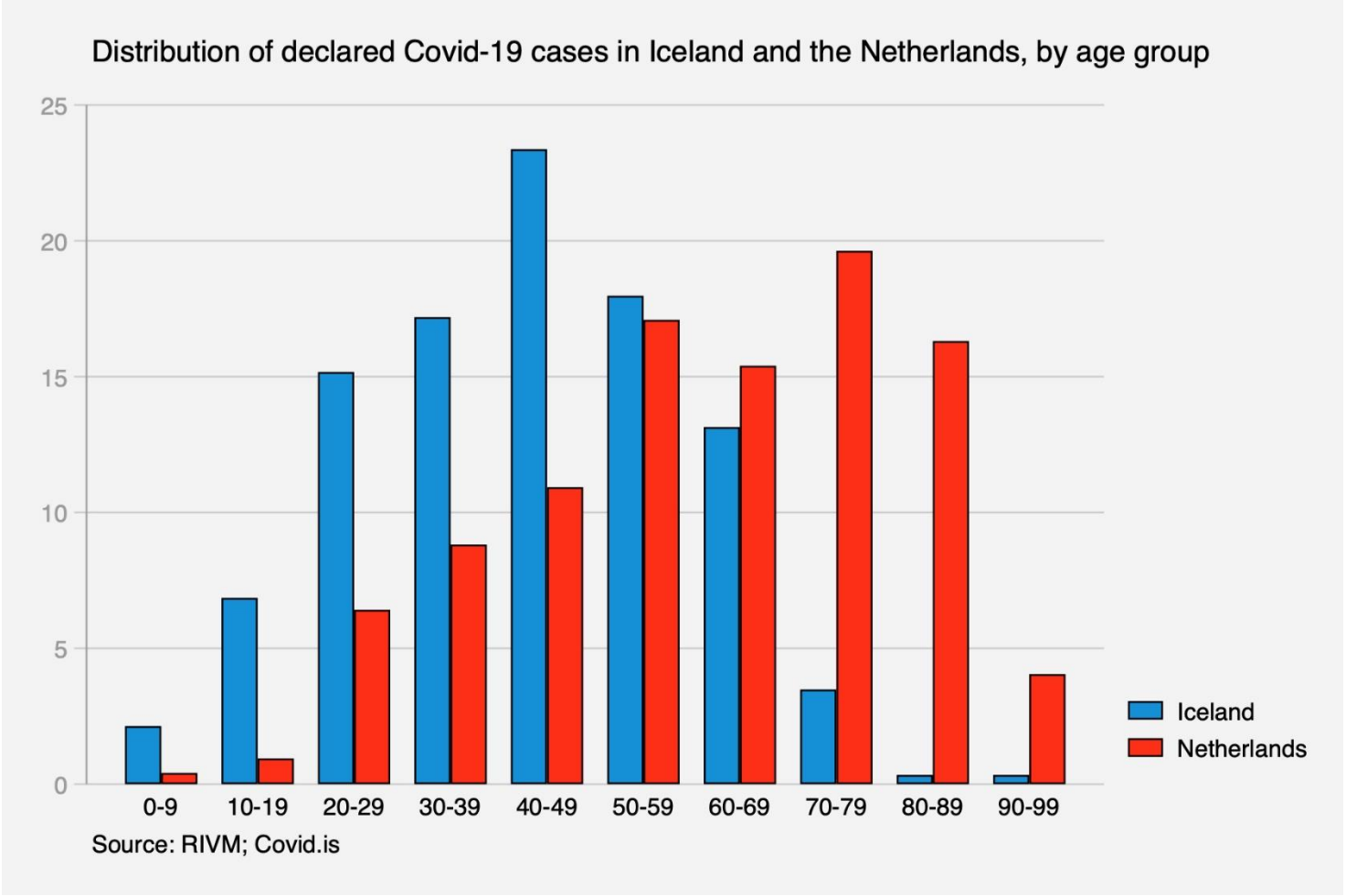
KEY DIFFERENCE

Iceland tested large share of the population, at ‘random’, even asymptomatics

BUT

Netherlands tested only severe symptomatics

ICELAND: 50% of cases were asymptomatic!



Source: National Institute for Public Health and the Environment Ministry of Health, Welfare and Sport (RIVM, Netherlands); Islandic Directorate of Health (Covid)

Far more cases among the young (cont'ed)

KEY DIFFERENCE

Korea has tested large share of the population, quasi 'at random'

BUT

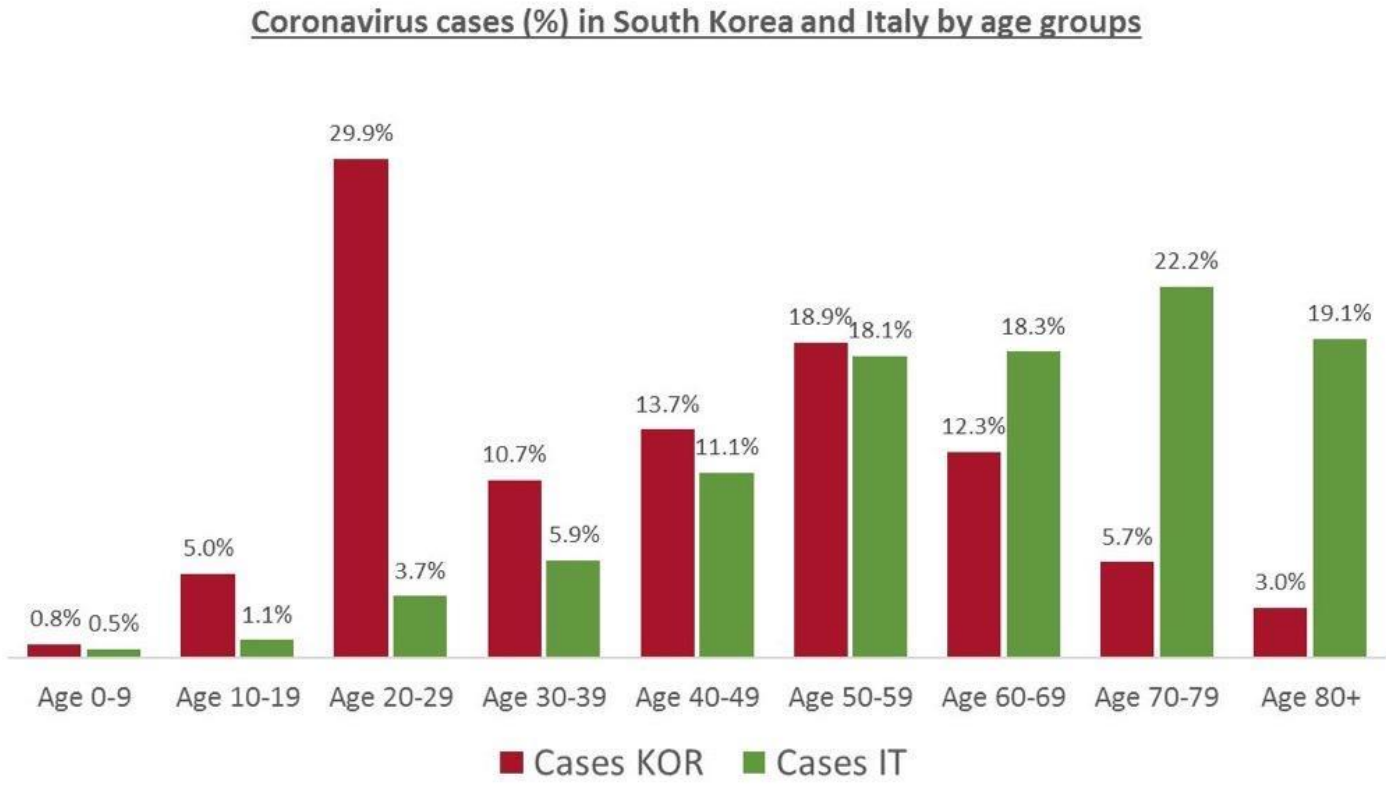
Italy has tested only (worst) symptomatic cases.

External validity

is the Korean evidence driven by the followers of the Shincheonji Church of Jesus?

A quasi-natural experiment

The town of Vo' (Veneto, Italy). Tested all 3300 inhabitants. Most cases among young asymptomatic



Source: Backhaus (13 Mar, Medium.com)

Far more cases among the young (cont'ed)

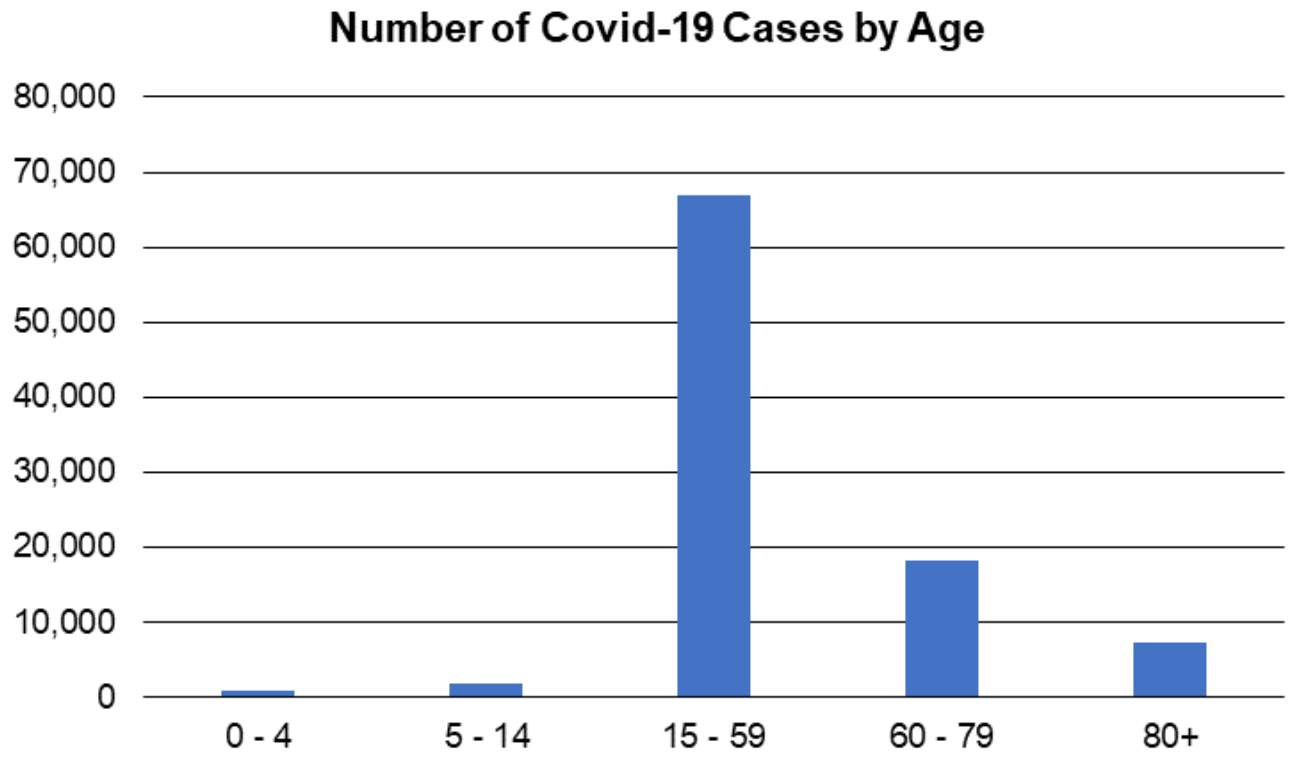
Similar Case

GERMANY

Germany has one of the oldest populations in Europe (21% age 65 or older), similar to Italy (22% age 65 or older)

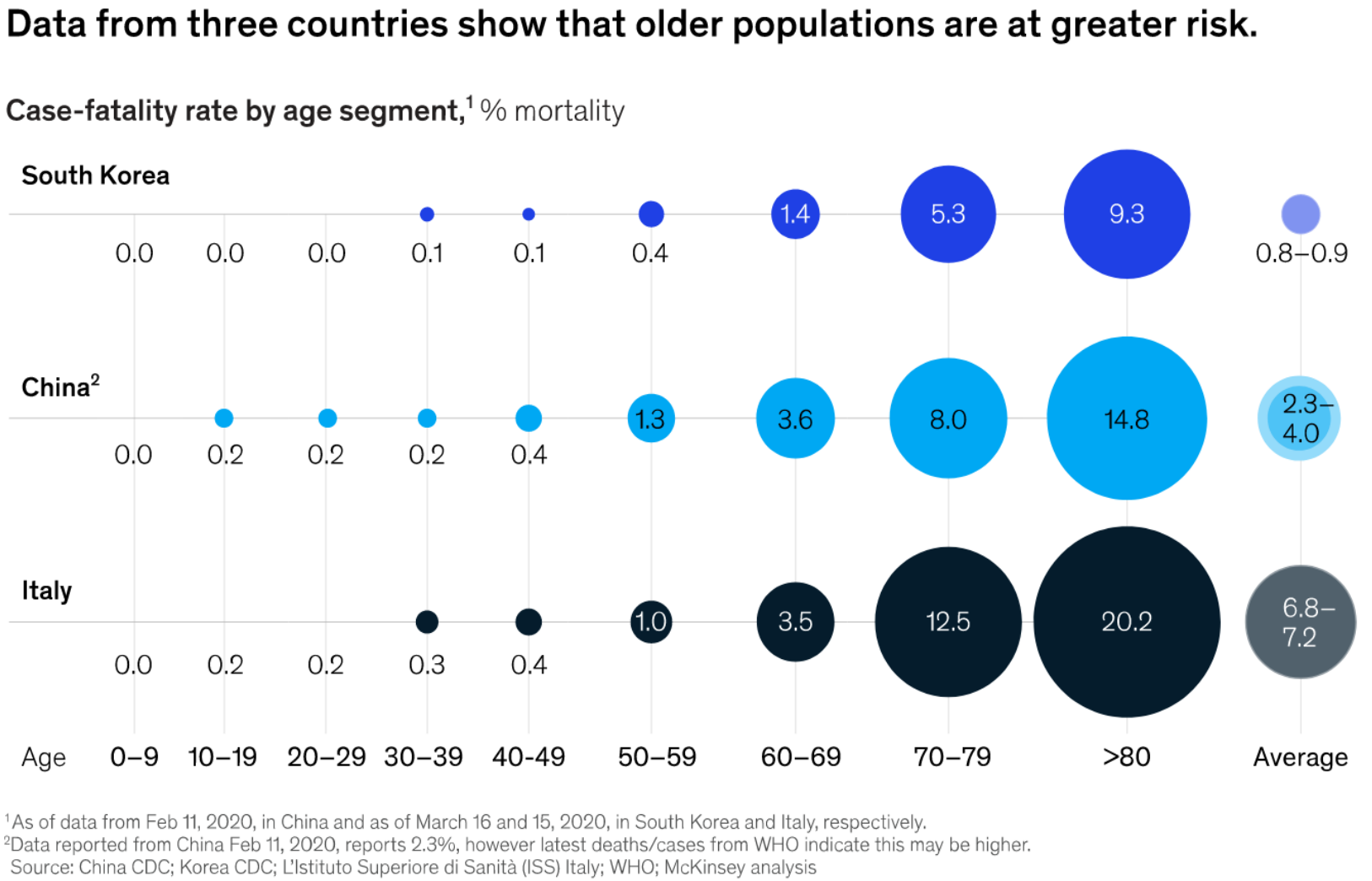
Conducting 160,000 tests weekly, more than many European countries in total!, Germany has one of the highest number of reported cases but a much lower fatality rate (0.5%)

Mass testing shows a much larger percent of cases presenting in the young (over 80% younger than 60)



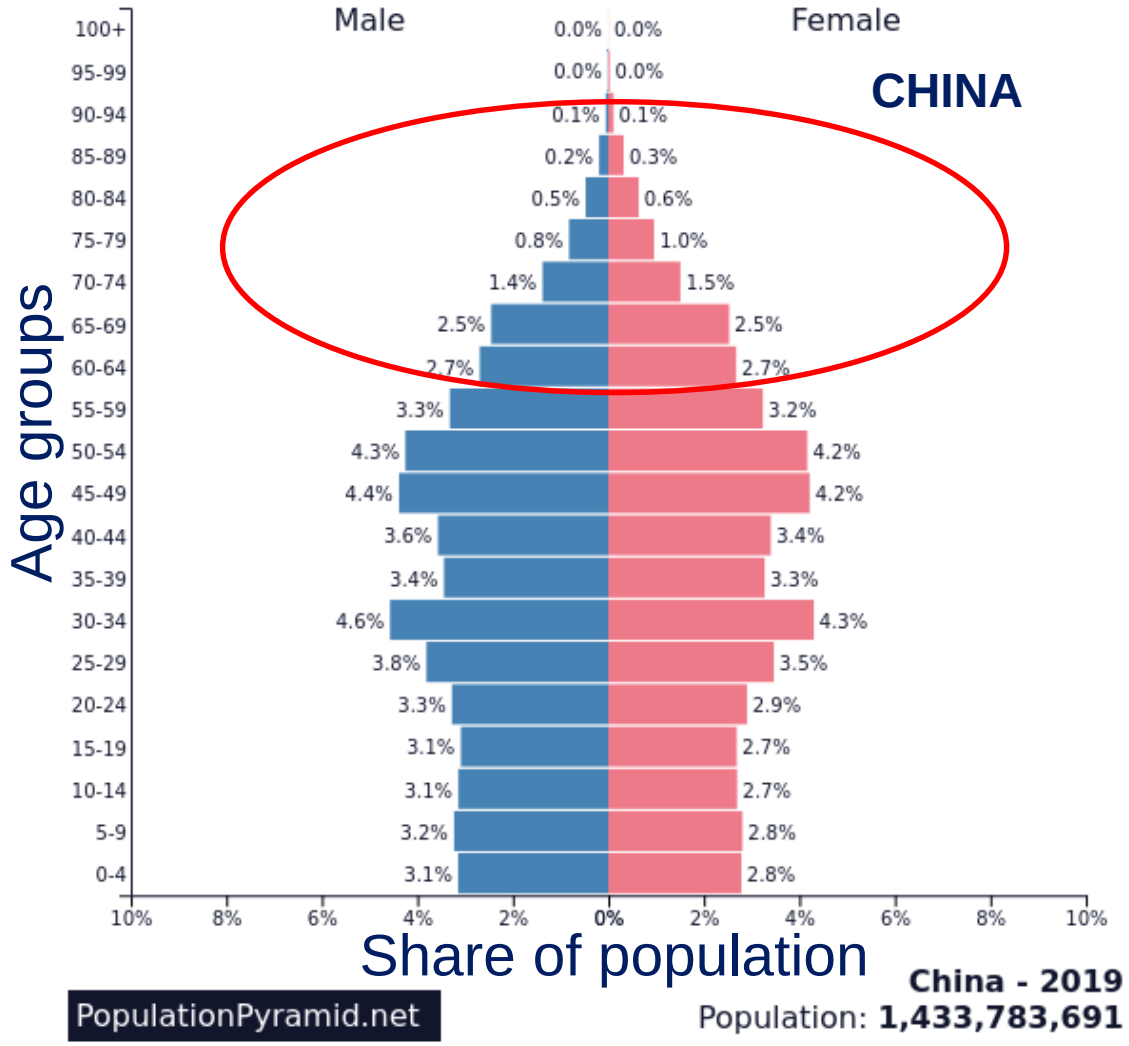
Source: Mai (27 March, Vox.com), Scommegna (25 September, Population Reference Bureau), Buck (20 March, ft.com), Daily Situation Report of the Robert Koch Institute (6 Apr)

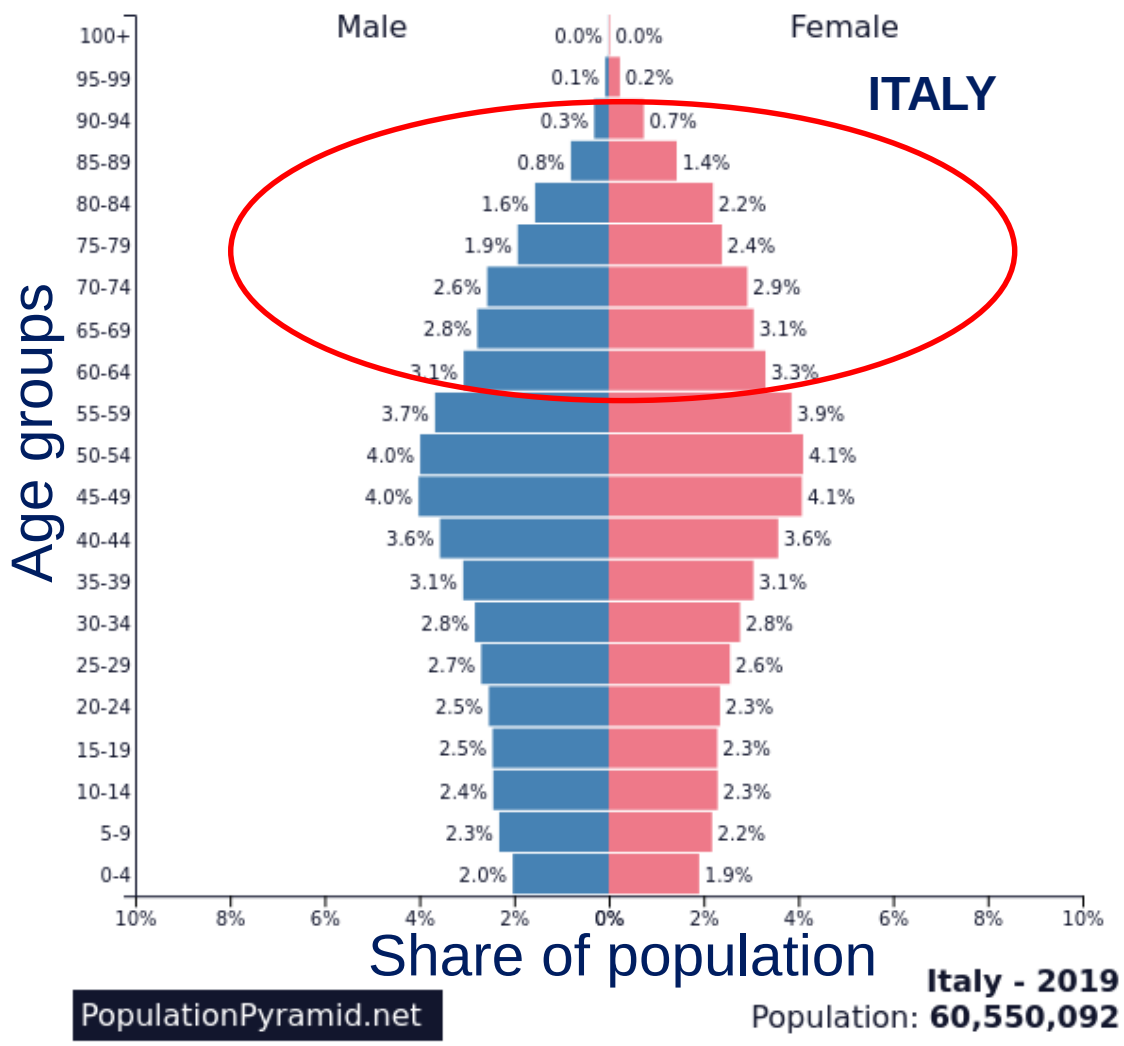
…but far more fatalities among the old



Source: McKinsey & Company: Coronavirus COVID-19: Facts and Insight, updated 16th March 2020.

Italians are older

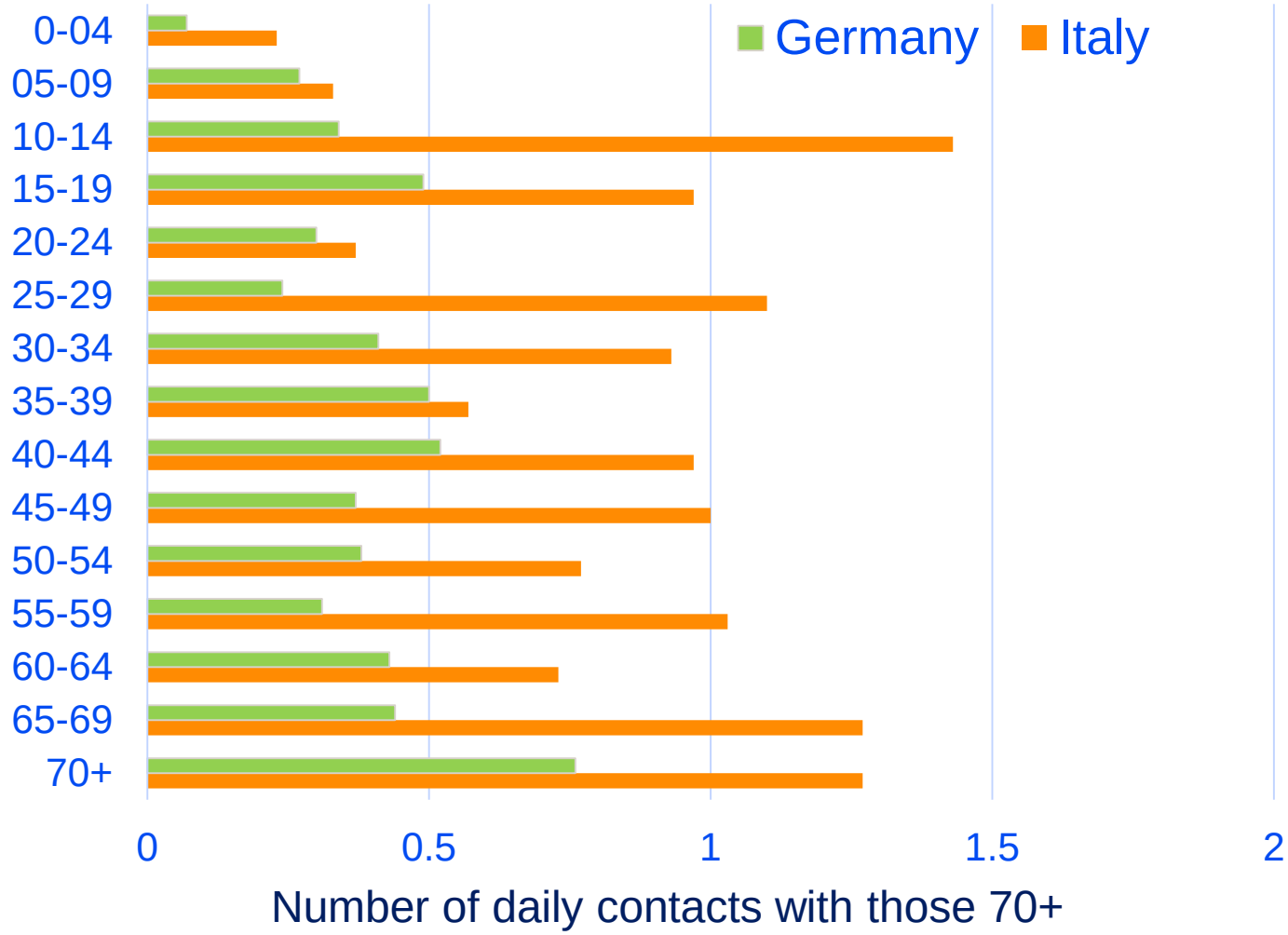




Source: https://www.populationpyramid.net/, based on United Nations Data

Old Italians are more connected to the young

Average daily contacts with those 70+ by age group



Source: Mossong et al. (2008, PLoS Med), “Social Contacts and Mixing Patterns Relevant to the Spread of Infectious Diseases”

How accurate is the fatality rate?

- Mortality rate = (Death / Population)
- Fatality rate = (Death / Cases)
  - Measuring fatality rate is very hard because in most (but not all) countries, the majority of tests are done on sick patients and thus is hard to estimate the number of total cases because of undetected infections (e.g. asymptomatic).
  - Measured fatality rates are thus likely to overstate grossly the actual fatality rate, which also makes the estimates of infected people very imprecise.
- But also the number of officially recorded deaths could be inaccurate!

CAVEAT on the number of officially reported deaths

- The number of officially recorded deaths by Covid-19 may under-estimate the actual number of cases.

- A simple “rule-of-thumb” to estimate the size of this under-reporting is to compare the cumulated number of deaths by day or week of 2020 with a counterfactual scenario of *what the 2020 would have looked like IF its cumulated number of deaths evolved at the same pace as it did in the previous years*.
- How to build a “naïve” counterfactual series of 2020 deaths? (i) Compute the week-on-week growth rate of the number of deaths for each week of the previous five years. (ii) For each week, average these weekly growth rates across the earlier years. (iii) Apply this historical average growth rate forward, to the number of deaths recorded in 2020 on the day that the first covid-19 death was reported.

- The difference between the actual and the counterfactual time series of cumulated deaths in 2020 is an estimate of the likely total number of Covid-19 deaths.

The “excess” deaths rule-of-thumb at work

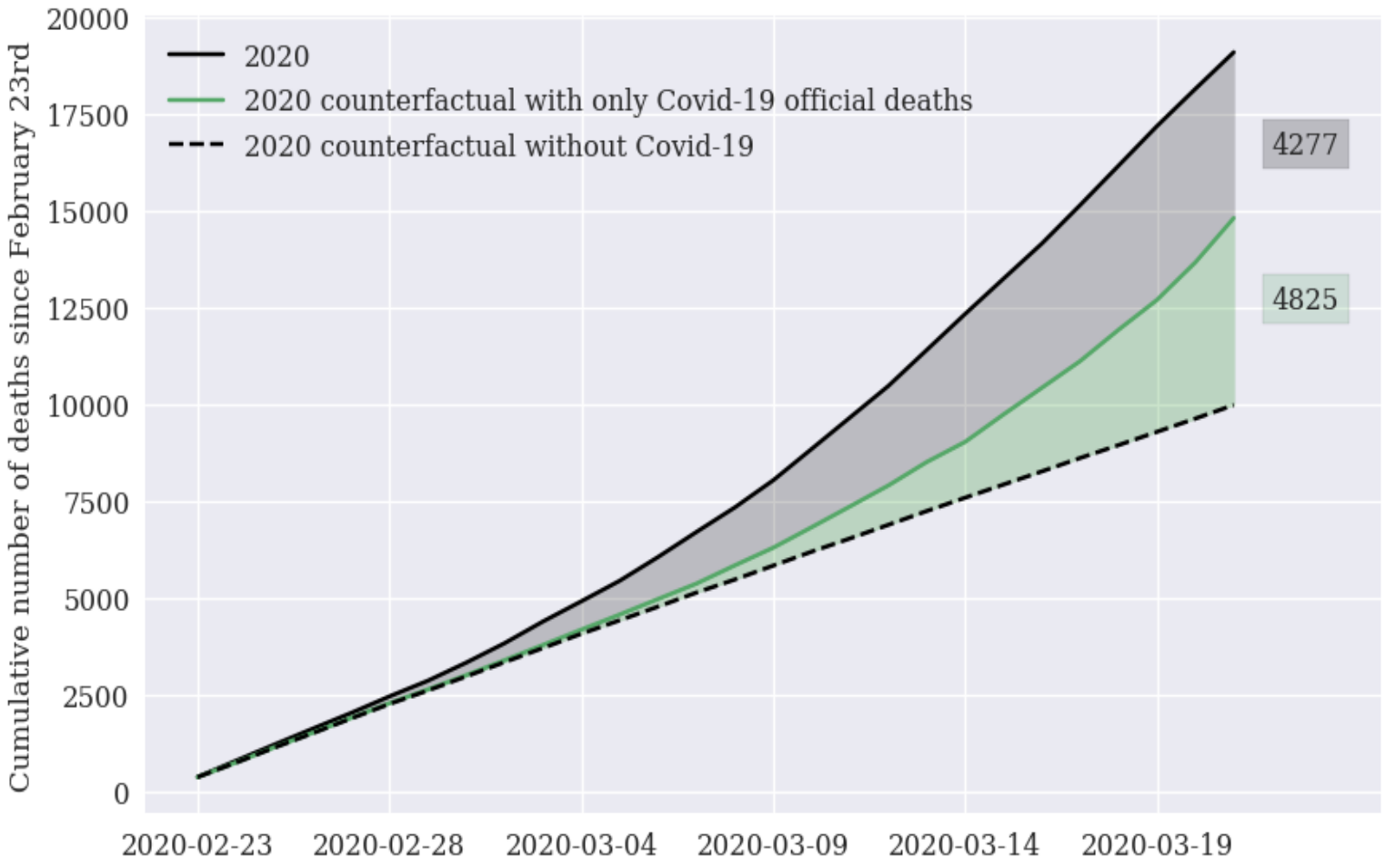
Officially recorded Covid-19 deaths = 4825

Unexplained deaths = 4282

Accounting for unexplained deaths

1. Covid-19 undetected cases (e.g., died home or in nursing homes)
2. Indirect cases because of lower responses of the health system (e.g., hearth attacks and work-related accident)

The case of Italy (as of March 21st)



England and Wales (as of April 3rd)

Officially recorded Covid-19 deaths = 4122

Unexplained deaths = 3472

Greater London (as of April 3rd)

Officially recorded Covid-19 deaths = 1451

Unexplained deaths = 636

Source: Andrea Galeotti, Sebastian Hohmann and Paolo Surico (05 April 2020) based on ISTAT and ONS data

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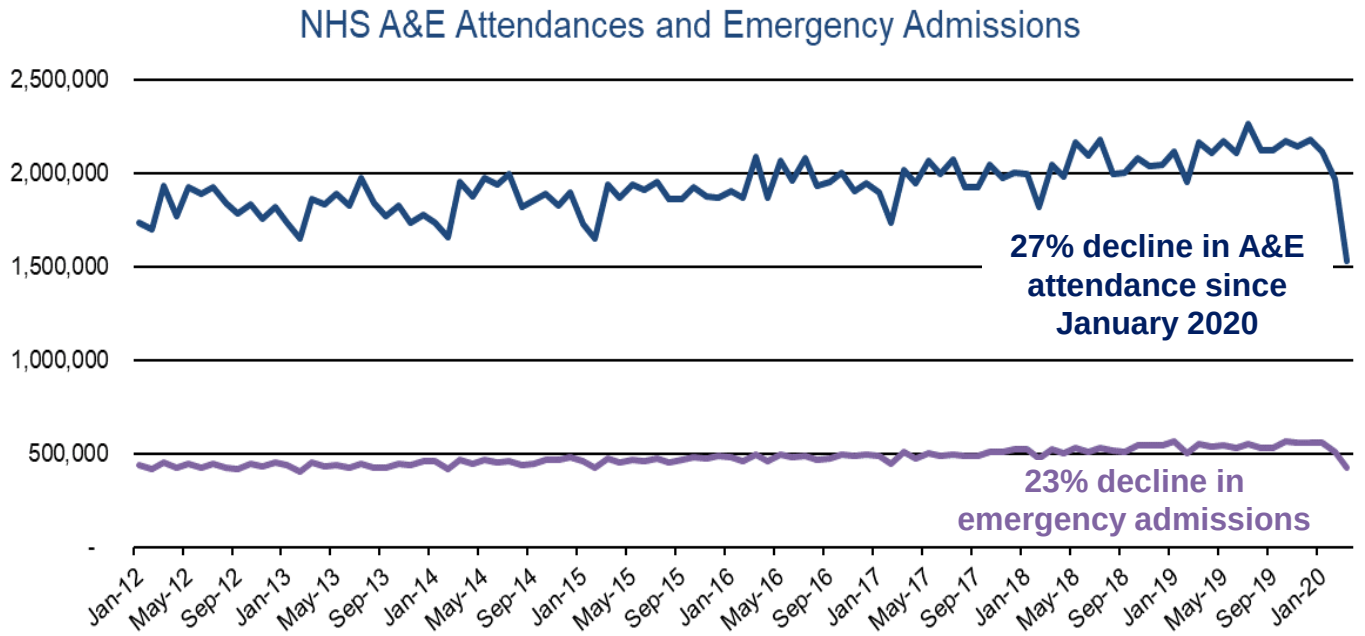
Declining A&E visits may explain some excess deaths

Medical leaders are worried that critically ill patients are avoiding hospitals due to the coronavirus

- NHS recorded a 29% drop in A&E visits YoY, with a 50% drop in heart attack attendances
- Potential decline comes from fewer activities such as sports or car accidents
- But fear is that unhealthy persons are staying away for fear of burdening the hospital or contracting the virus
- Compounding this is an worsened ambulance response time in March
- The decline accompanies an increase in calls to NHS 111, indicating patients may be seeking help through other means

Scotland also marked a significant increase in non-coronavirus deaths compared to previous five years coupled with reports from doctors that NHS is 'eerily quiet' outside of coronavirus cases



Source: NHS Monthly A&E Time Series (9 Apr), Bodkin (9 Apr, telegraph.co.uk), Johnson (8 Apr, telegraph.co.uk), Pieters (27 Mar, NL Times)

A simple formula to estimate the numbers of infected

- Assume a fatality rate of 1%
- Assume that for every officially recorded deaths, there may be another one undetected
- Then, the estimated number of infected in a country is:
  number of Covid-19 fatalities multiplied by a factor of 200

ILLUSTRATIVE EXAMPLE BASED ON NUMBER OF OFFICIALLY REPORTED DEATHS as of 6th APRIL 2020

	Number of reported deaths in Italy	Number of reported deaths in UK
	16523	5373
Assumption on true fatality rate	Prediction for total infected in Italy	Prediction for total infected in UK
1%	**3.30ML**	**1.07ML**
[1.5% , 0.5%]	[2.20ML. , 6.60ML]	[716328 , 2.14ML]

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Estimating the total number of infected cases

Imperial College Covid-19 team estimates the impact of interventions in the replication number in 11 European countries

Methodology: use observed death rates over time as an input in a model of contagion to infer changes in the time series of the replication number

Results indicate preliminary numbers

- Interventions have decreased the replication number (on average across countries) by 64% of the pre-intervention value. The average replication number across countries is estimated to be 1.43.
- Across 11 EU countries, **between 7 million and 43 million people have been infected** [1.9% - 11.4% of the population]. E.g., United Kingdom 2.7% [1.2%-5.4%], Italy 9.8% [3.2%-26%], Spain 15% of the population [3.7%-41%]
- An estimated **59,000 deaths have been averted** based on the interventions applied. This is comprised of 38,000 and 16,000 in Italy and Spain alone

Caveats

Limited data – officially recorded death rates over time is taken at face value and it is a crucial input of the analysis. (see previous slide for an example of the inaccuracy of officially recorded death rates)

Delicate assumption – similar interventions in different countries have the same effect in reducing the replication numbers in the two countries.

Early results – The time since infections have been reported and interventions been implemented only offers preliminary results.

Combined forces – Inability to differentiate effectiveness of distinct interventions based on rapid implementation

Source: Seth Flaxman, Swapnil Mishra, Axel Gandy et al. Estimating the number of infections and the impact of nonpharmaceutical interventions on COVID-19 in 11 European countries. Imperial College London (2020) doi: 30 March

Predicted infections are still far from herd immunity

Estimated percent of population infected as of March 28th

Country	% of total population infected (mean [95% credible interval])
Austria	1.1% [0.36%-3.1%]
Belgium	3.7% [1.3%-9.7%]
Denmark	1.1% [0.40%-3.1%]
France	3.0% [1.1%-7.4%]
Germany	0.72% [0.28%-1.8%]
Italy	9.8% [3.2%-26%]
Norway	0.41% [0.09%-1.2%]
Spain	15% [3.7%-41%]
Sweden	3.1% [0.85%-8.4%]
Switzerland	3.2% [1.3%-7.6%]
United Kingdom	2.7% [1.2%-5.4%]

Source: Seth Flaxman, Swapnil Mishra, Axel Gandy et al. Estimating the number of infections and the impact of nonpharmaceutical interventions on COVID-19 in 11 European countries. Imperial College London (2020) doi: 30 March

Summary of part 1 (science)

- Covid-19 is the worst health crisis of our times
- Young far more likely to be infected (the carrier) but old more likely to die
- As young people tend to develop mild or no symptom, they are less contagious. But there are so many of them infected that young are responsible for the majority of infections in the population.
- Case fatality rate is probably much lower than currently reported because of the large number of asymptomatic cases.
- Infected case is probably an order of magnitude larger than recorded.
- Italy has a higher fatality rate in a combination of older population and older being more in contact with young than most of the other countries

Full set of slides available at https://sites.google.com/site/paolosurico/covid-19

Next video: A user guide to Covid-19. Part ii – epidemiology for dummies

This Lecture

1. Science
2. **Health policies**
3. Economics
4. Macroeconomic policies

The consensus: flattening the curve

How to minimize fatalities?

A. Expand intensive care capacity

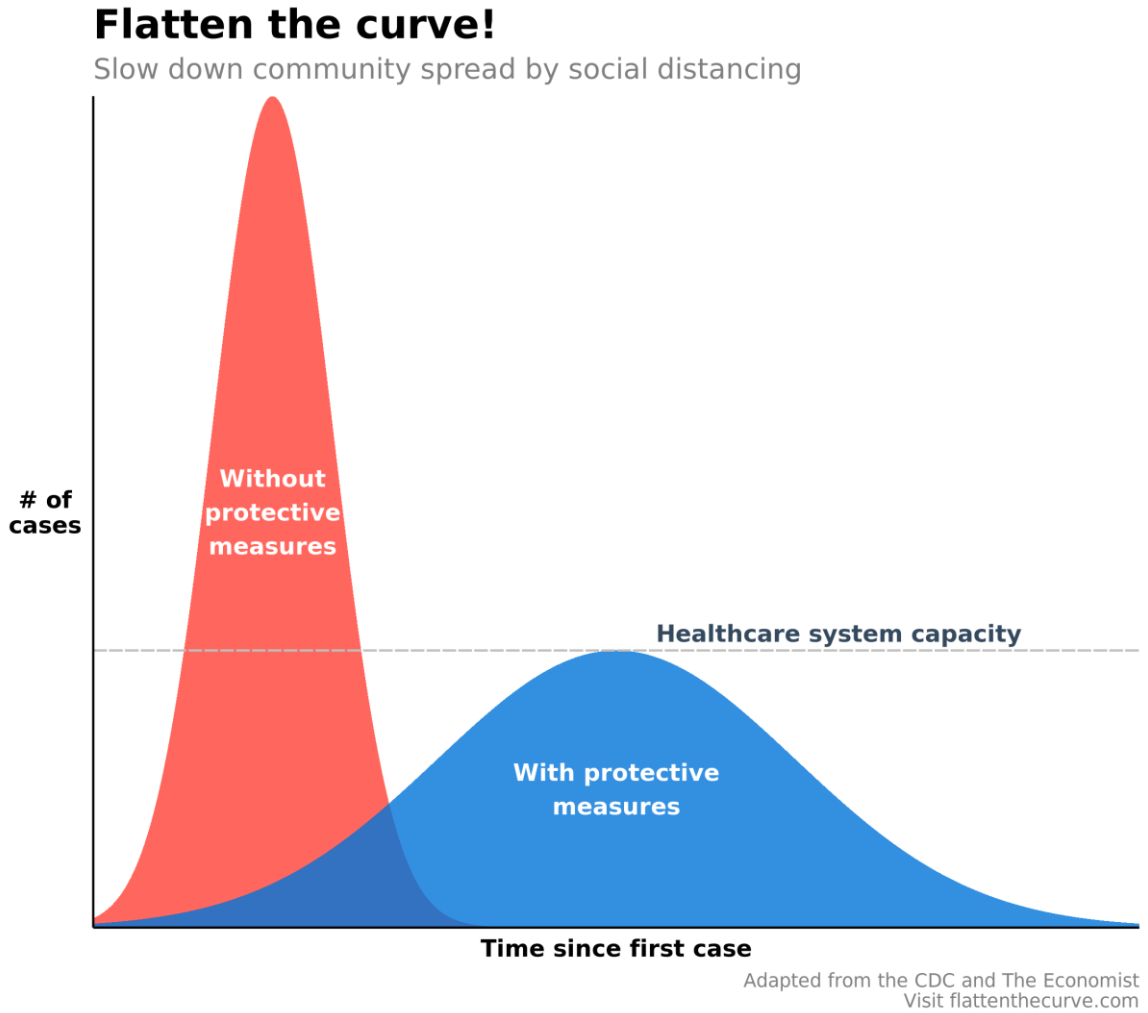
(expand supply of health care)

B. Slowdown the speed of contagion

(contract demand for health care)

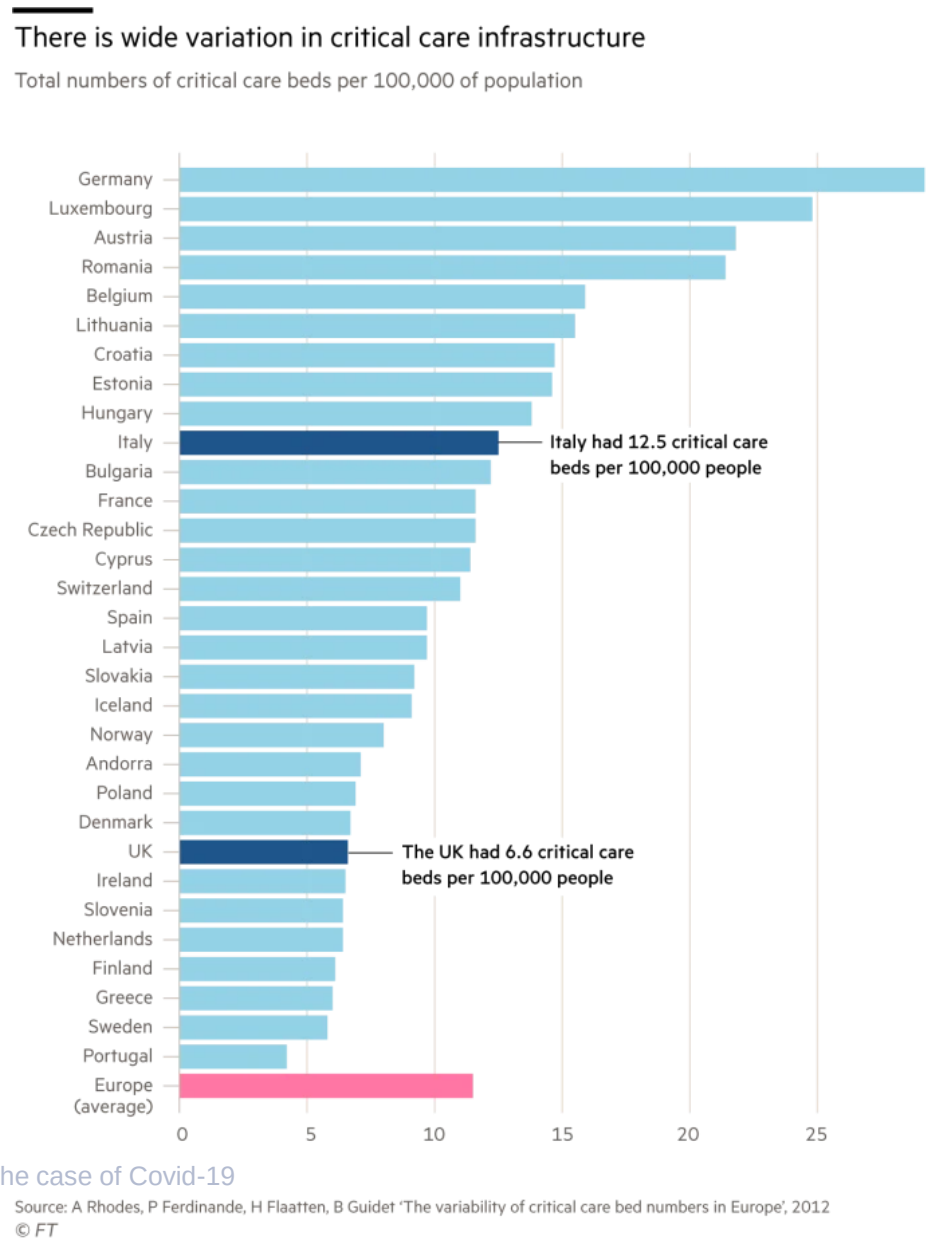
Goal: avoid excess of demand

How to achieve this more effectively?



Health system capacity (at the start of the crisis)

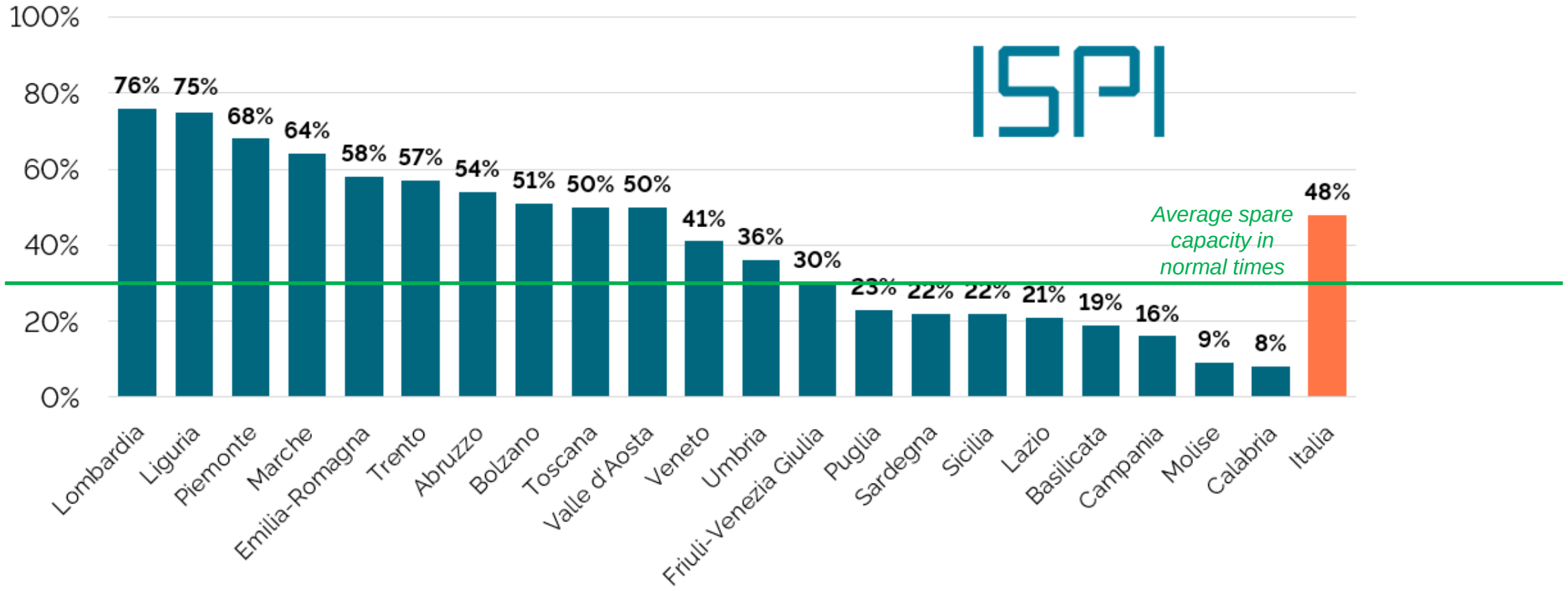
- Danger in the lack of capacity of health systems
- Number of ICU beds in most countries cannot cope with the spread of disease if peak is high
- Lack of ventilators:
  - Italy asked its only domestic manufacturer to quadruple supply from 125 a month to 500 (each costs €17k)
  - Germany has ordered 10,000
  - VentilatorChallengeUK consortium including Airbus, BAE Systems, Ford, Rolls-Royce and Siemens partnered to produce ventilators for the NHS
  - UCLH and Mercedes formula one formed joint venture to produce CPAP machines



Source: Buck et al (15 March, ft.com), Walsh (30 March, bbc.co.uk)

Health system capacity constraints across Italian regions

Share of Intensive Care Units used for Covid-19 patients



Dati: elaborazioni ISPI su dati Protezione Civile, Ministero della Salute, Regioni.

Source: Matteo Villa (Istituto per gli studi di politica internazionale)

The short-run elasticity of health care supply

Whenever possible, use hotels, class rooms and barracks as Intensive Care Units (ICU).

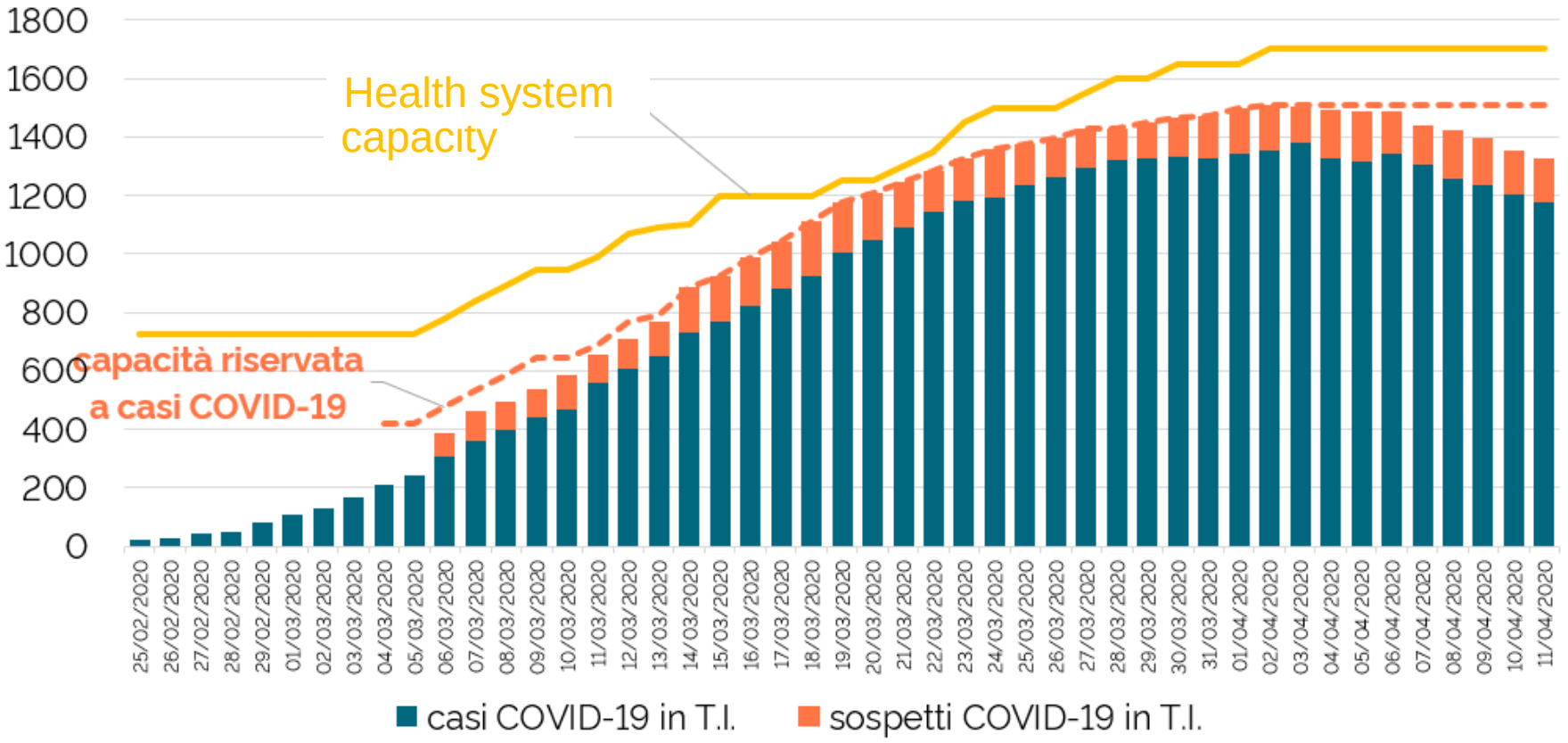
Turn to manufacturing industry to produce or convert intensive care equipment (e.g. ventilators).

Pay for independent sector facilities: UK NHS deal added 8,000 beds, 1,200 ventilators, and 20,000 staff.

Even if the elasticity of supply for beds and equipment is high, how quickly can we train new medical personnel? Recall retired workers.

If cases regionally concentrated, spread non-contagious intensive care cases to other regions.

Number of Intensive Care Units in Lombardy



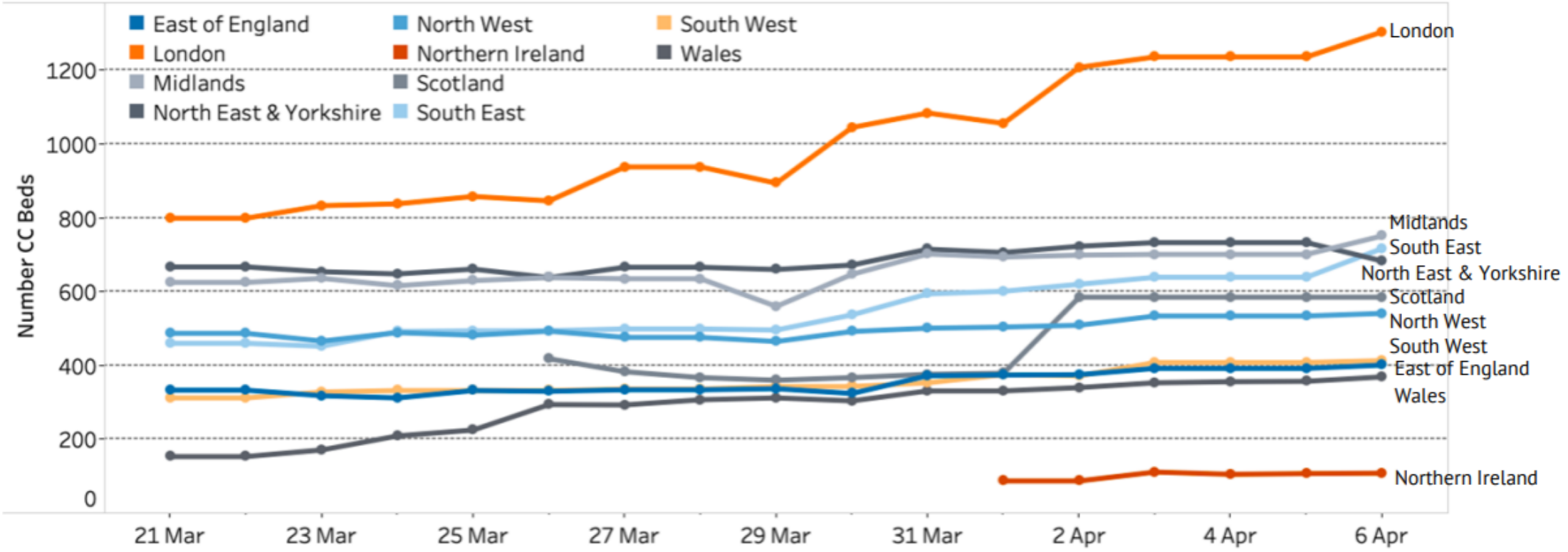
Dati: Protezione Civile e Regione Lombardia.

Source: Matteo Villa (Istituto per gli studi di politica internazionale)

Growth in ICU beds in the UK

Total UK Critical Care Beds

Number of CC beds in England has increased by 30% in the last two weeks; the new Nightingale hospitals in London, Birmingham, Manchester, Bristol and Harrogate will further increase capacity across England and additional capacity is also being brought online in Scotland, Wales and NI (Confidence: Variable quality - usually high but challenged by weekend staffing levels)



Source: NHSE, Welsh Gov., Scotland Gov., Northern Ireland Executive

Source: UK Government Daily Coronavirus Press Conference, 7 Apr

A typical epidemiology model

S(usceptible)**I**(nfected)**R**(ecovered)

Susceptible → **Infected** → **Recovered**

Key parameter: R_0 value (Replication number)
Average number of infected people per one contagious person

R_0 <1 : the speed of recovery is higher than the speed of contagion.
Therefore, the virus dies out

R_0 >1 : first phase, virus spread fast and rate of infection grows exponentially; second phase, as people recover the population becomes immune, thereby pushing R_0 <1 and the virus dies out

Very important channel. Very simplistic for the moment. More later

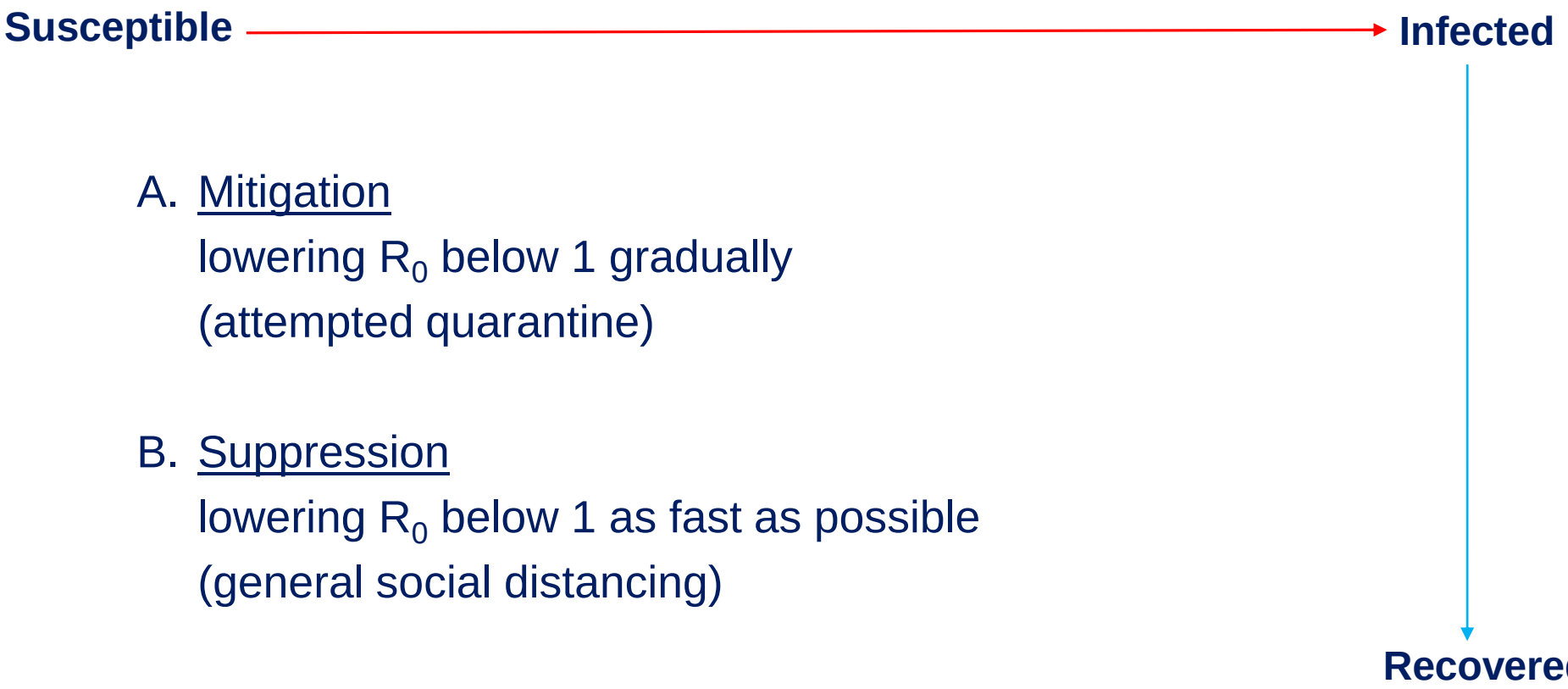
What are the determinants of R_0?

Susceptible → **Infected** → **Recovered**

	sign	Covid-19
1. Virus characteristics		
a. infectious period	+	high
b. easiness of transmission	+	high
2. Social interaction/ meeting rates	+	
3. Fraction of immune population		
a. vaccination	-	not yet available
b. recovered with immunity	-	still unknown

Very important channel. Very simplistic for the moment. More later

What policies can influence R_0?

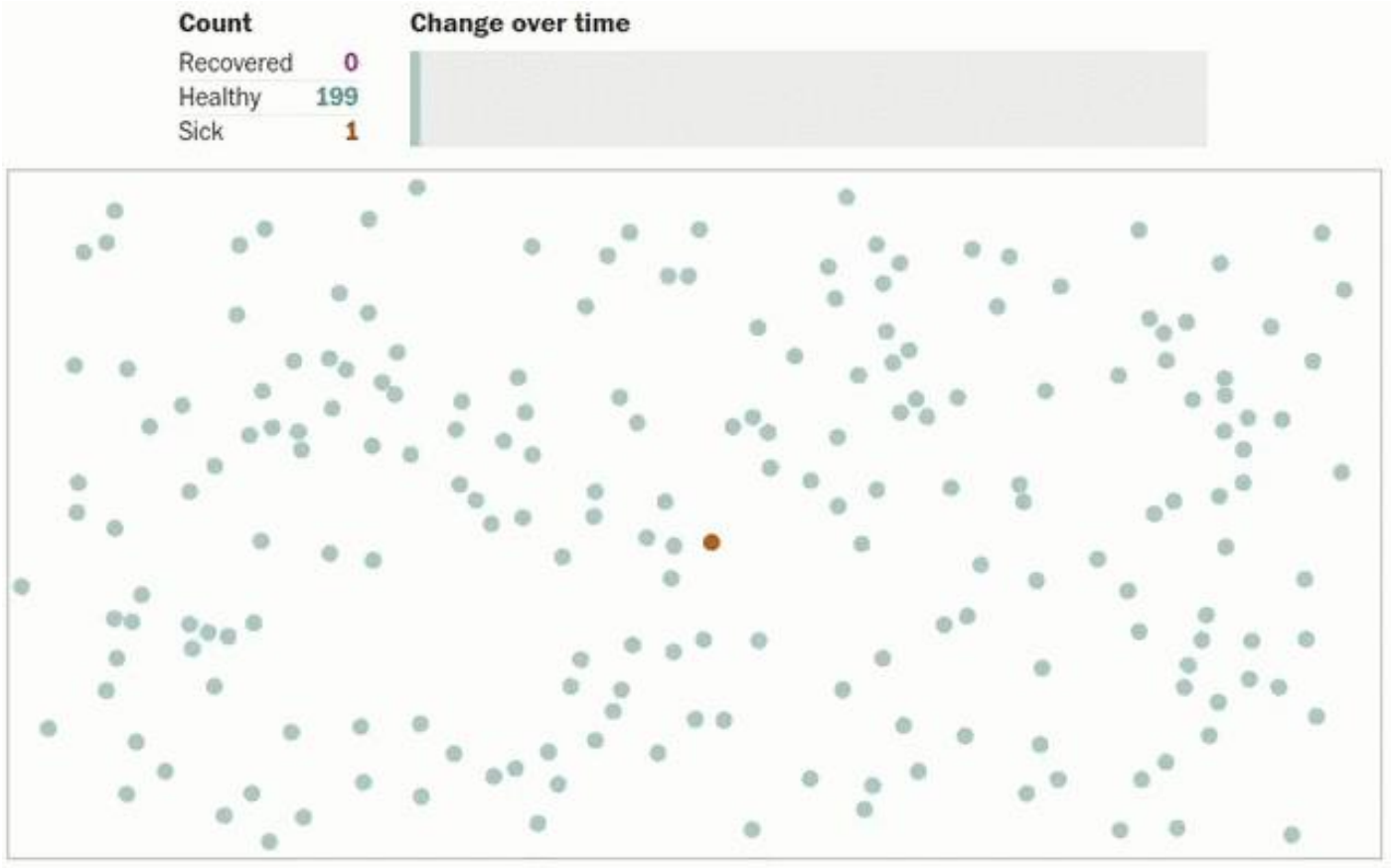


A. Mitigation
lowering R_0 below 1 gradually
(attempted quarantine)

B. Suppression
lowering R_0 below 1 as fast as possible
(general social distancing)

Very important channel. Very simplistic for the moment. More later

Contagion under laissez-faire



Source: Harry Stevens, Washington Post (https://www.washingtonpost.com/graphics/2020/world/corona-simulator/)

Mitigation vs suppression in theory…

U.K. style of approach (until mid-march)

China/Italy style of approach

Source: Harry Stevens, Washington Post (https://www.washingtonpost.com/graphics/2020/world/corona-simulator/)

…and in practice!

- 1918 Influenza Pandemic:
  - Philadelphia:
    - First cases reported in 17 September
    - Authorities downplayed significance; city-wide parade on 28 September
    - Social distancing measures implemented in 3 October
  - St. Louis:
    - First cases in October 5
    - Social distancing measures in October 7

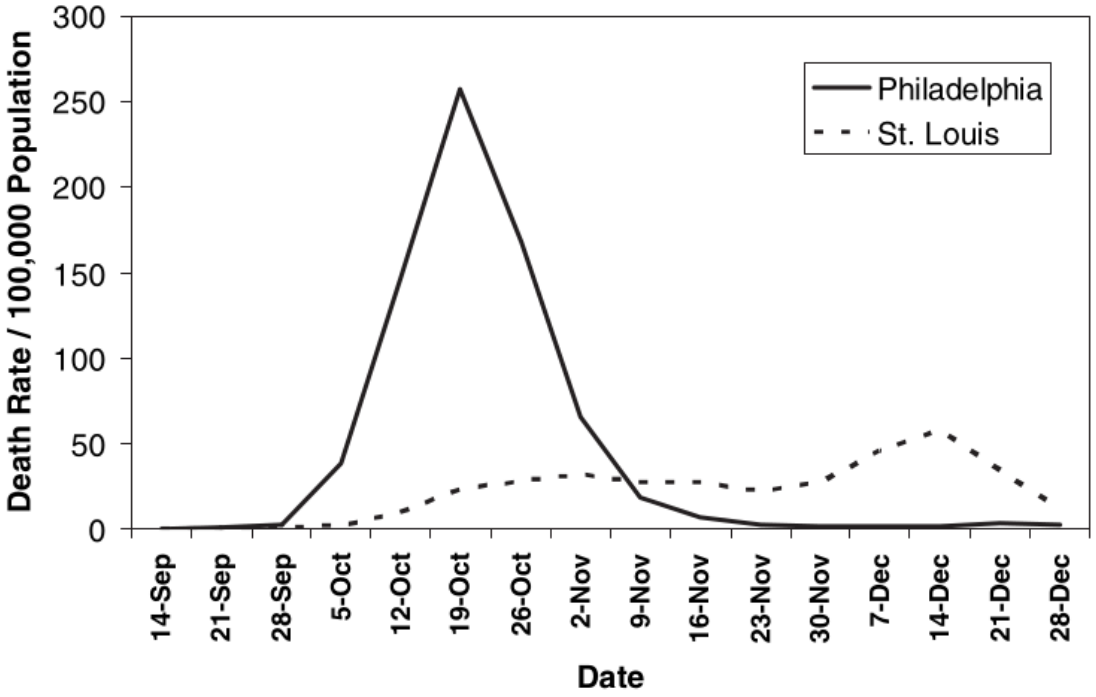


Fig. 1. Excess P&I mortality over 1913–1917 baseline in Philadelphia and St. Louis, September 8–December 28, 1918. Data are derived from ref. 10.

Source: Hatchett, Mecher and Lipsitch. Proceedings of the National Academy of Sciences May 2007, 104 (18) 7582-7587; DOI: 10.1073/pnas.0610941104

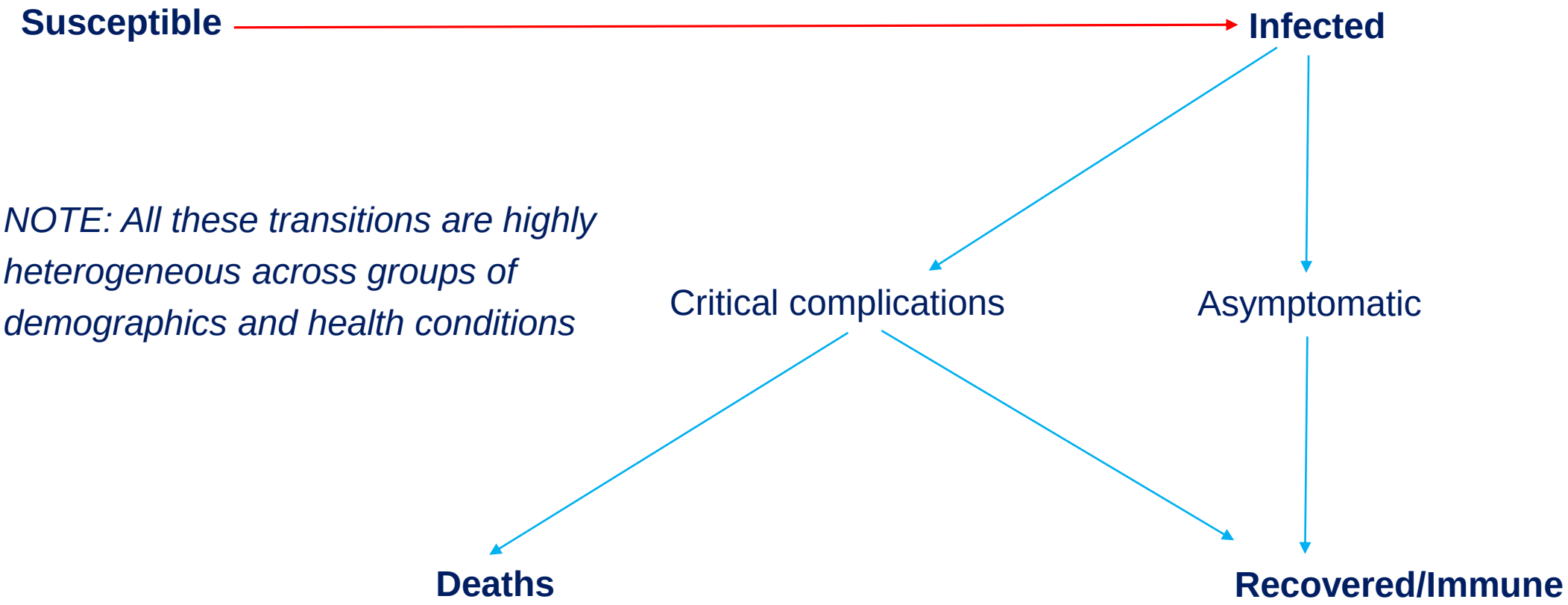
But the trade-off is draconian!

- Policies to **mitigate** the virus (i.e. lowering replication number gradually)
  much less effective in flattening the curve,
  possible strong repercussion in the **short-run** because of limited health system capacity,
  immunity builds up faster and so population becomes less vulnerable in the medium term.

- Policies to **suppress** the virus (i.e. lowering replication number as fast as possible)
  effective in delay the spread of the virus in the short-run,
  but slow-down the build-up of herd immunity,
  population is vulnerable to new outbreaks in the **medium term**,
  not a problem if vaccination is soon available; if not, buys time to expand health system capacity.

The role of critical complications

S(usceptible)**I**(nfected)**R**(ecovered)



NOTE: All these transitions are highly heterogeneous across groups of demographics and health conditions

Health care policies

Table 2: Summary of NPI interventions considered.

Label	Policy	Description
CI	Case isolation in the home	Symptomatic cases stay at home for 7 days, reducing non-household contacts by 75% for this period. Household contacts remain unchanged. Assume 70% of household comply with the policy.
HQ	Voluntary home quarantine	Following identification of a symptomatic case in the household, all household members remain at home for 14 days. Household contact rates double during this quarantine period, contacts in the community reduce by 75%. Assume 50% of household comply with the policy.
SDO	Social distancing of those over 70 years of age	Reduce contacts by 50% in workplaces, increase household contacts by 25% and reduce other contacts by 75%. Assume 75% compliance with policy.
SD	Social distancing of entire population	All households reduce contact outside household, school or workplace by 75%. School contact rates unchanged, workplace contact rates reduced by 25%. Household contact rates assumed to increase by 25%.
PC	Closure of schools and universities	Closure of all schools, 25% of universities remain open. Household contact rates for student families increase by 50% during closure. Contacts in the community increase by 25% during closure.

Source: Ferguson et al. (2020), Impact of non-pharmaceutical interventions (NPIs) to reduce COVID- 19 mortality and healthcare demand. Imperial College COVID-19 Response Team.

A. Policies to mitigate the virus

Table 2: Summary of NPI interventions considered.

Label	Policy	Description
CI	Case isolation in the home	Symptomatic cases stay at home for 7 days, reducing non-household contacts by 75% for this period. Household contacts remain unchanged. Assume 70% of household comply with the policy.
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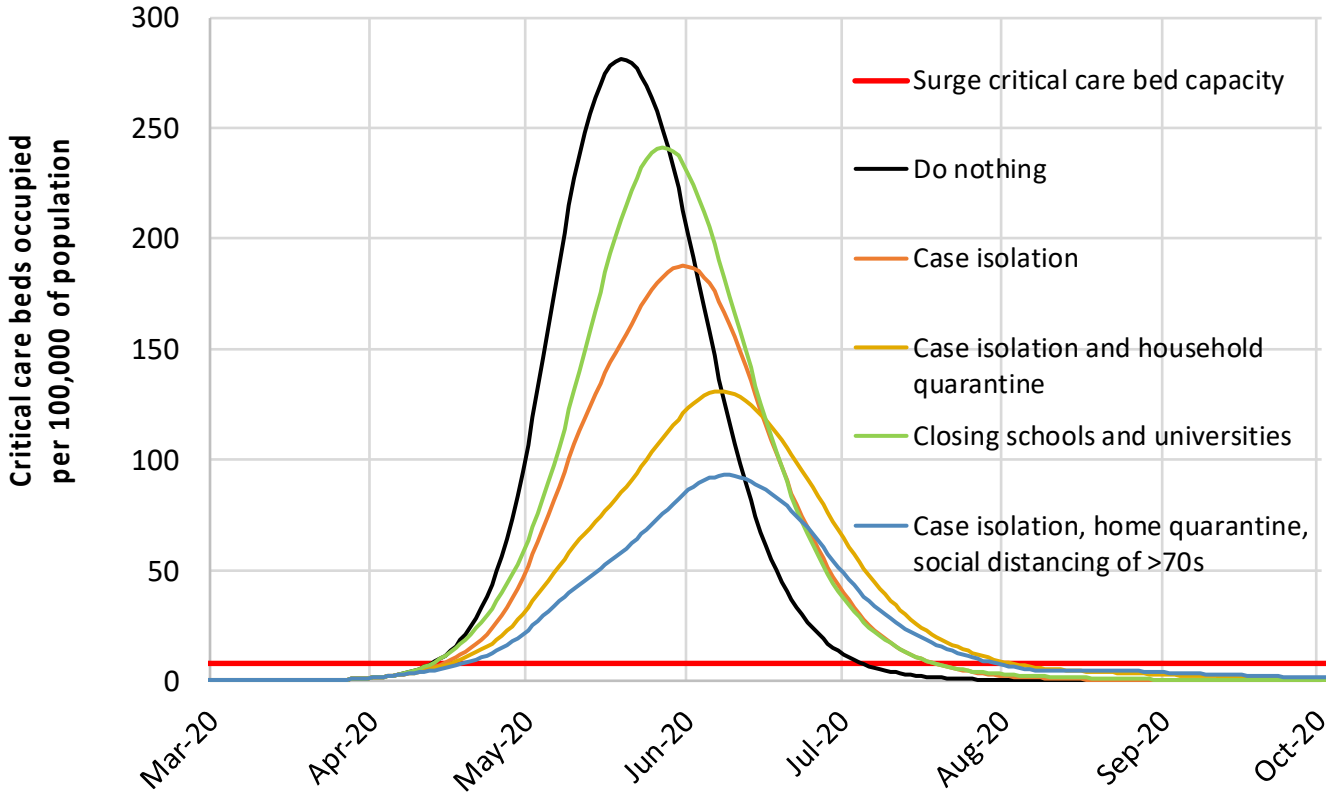

Figure 2: Mitigation strategy scenarios for GB showing critical care (ICU) bed requirements. The black line shows the unmitigated epidemic. The green line shows a mitigation strategy incorporating closure of schools and universities; orange line shows case isolation; yellow line shows case isolation and household quarantine; and the blue line shows case isolation, home quarantine and social distancing of those aged over 70. The blue shading shows the 3-month period in which these interventions are assumed to remain in place.

Source: Ferguson et al. (2020), Impact of non-pharmaceutical interventions (NPIs) to reduce COVID- 19 mortality and healthcare demand. Imperial College COVID-19 Response Team.

B. Policies to suppress the virus

Table 2: Summary of NPI interventions considered.

Label	Policy	Description
CI	Case isolation in the home	Symptomatic cases stay at home for 7 days, reducing non-household contacts by 75% for this period. Household contacts remain unchanged. Assume 70% of household comply with the policy.
HQ	Voluntary home quarantine	Following identification of a symptomatic case in the household, all household members remain at home for 14 days. Household contact rates double during this quarantine period, contacts in the community reduce by 75%. Assume 50% of household comply with the policy.
SDO	Social distancing of those over 70 years of age	Reduce contacts by 50% in workplaces, increase household contacts by 25% and reduce other contacts by 75%. Assume 75% compliance with policy.
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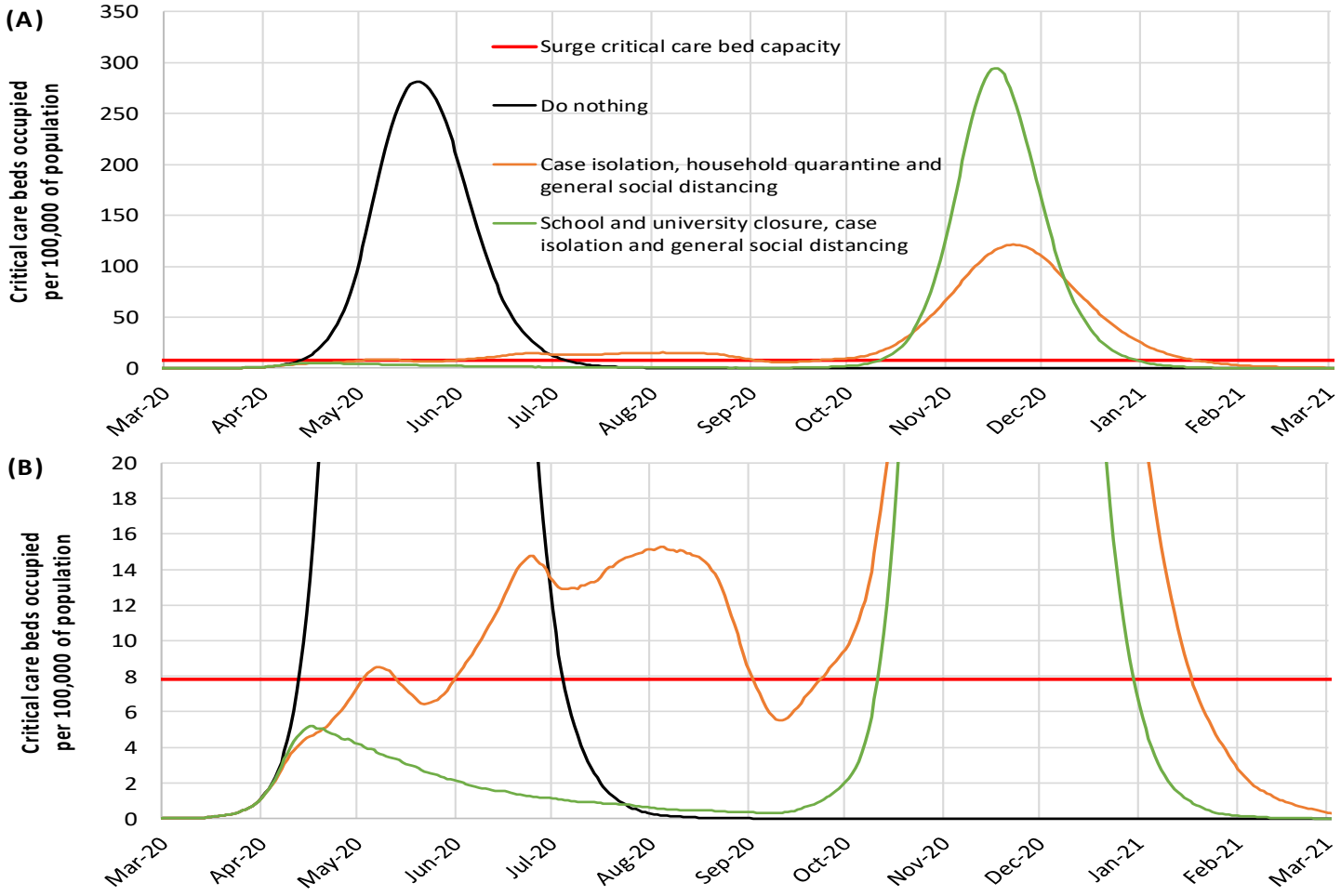
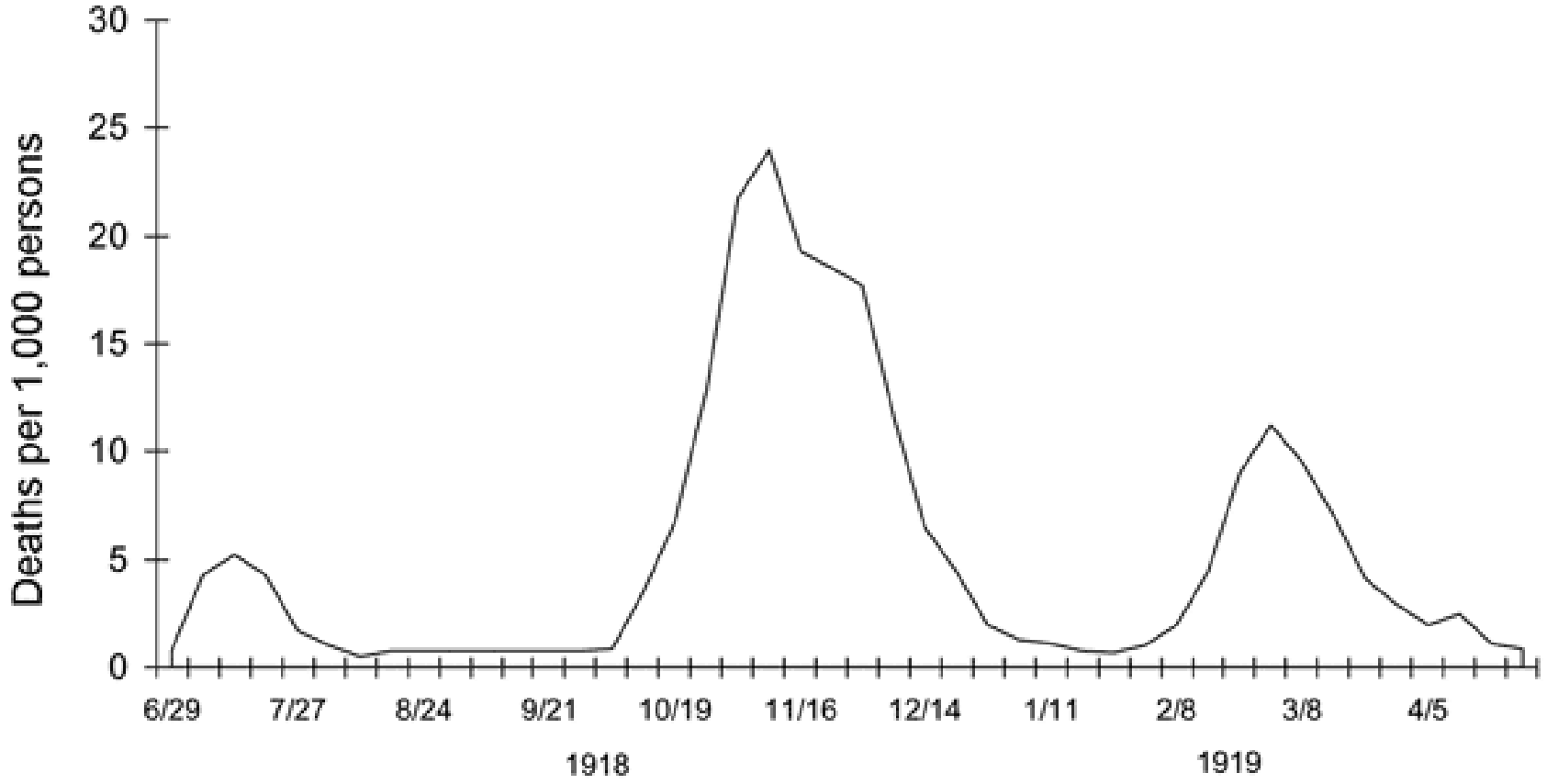


Figure 3: Suppression strategy scenarios for GB showing ICU bed requirements. The black line shows the unmitigated epidemic. Green shows a suppression strategy incorporating closure of schools and universities, case isolation and population-wide social distancing beginning in late March 2020. The orange line shows a containment strategy incorporating case isolation, household quarantine and population-wide social distancing. The red line is the estimated surge ICU bed capacity in GB. The blue shading shows the 5-month period in which these interventions are assumed to remain in place. (B) shows the same data as in panel (A) but zoomed in on the lower levels of the graph. An equivalent figure for the US is shown in the Appendix.

Source: Ferguson et al. (2020), Impact of non-pharmaceutical interventions (NPIs) to reduce COVID- 19 mortality and healthcare demand. Imperial College COVID-19 Response Team.

The mortality curve during the 1918 influenza



Three weekly combined influenza and pneumonia mortality, United Kingdom, 1918–1919

Source: Taubengerger and Morens (2006), **1918 Influenza: the Mother of All Pandemics**. Emerging Infectious Diseases, vol. 12, issue 1.

A critique to Ferguson et al. (2020)

Imperial College report predicts that, under no policy measures or behavioural changes, 510k deaths in the UK, 2.2m in the US

- Suppression would still lead to >40k ICU beds needed at peak (vs actual capacity at ~5k);
  Expect second wave in the Fall when toughest restrictions are lifted.
- Summary: no great choices, but some worse than others

Shen, Taleb and Bar-Yam criticize some of the modelling assumptions in the previous simulations:

- Lack of additional transmission mechanisms or policy options:
  - Contact tracing and door-to-door monitoring (potentially useful for the second wave)
  - Geographical barriers and travel restrictions (helps contain localized outbreaks)
  - Super-spreader events (fat tail of infections per person; could lead to banning of large events)
- Summary: these aspects could lead to worse outcomes in case of no policy, but also a role for more effective policy.

Source: Ferguson et al. (2020), On behalf of the Imperial College COVID-19 Response Team.
Shen, Taleb and Bar-Yam (2020), “Review of Ferguson et al (...)”. https://www.ft.com/content/16764a22-69ca-11ea-a3c9-1fe6fedcca75

The key role of the asymptomatic

"We estimate 86% of all infections were undocumented prior to 23 January 2020 travel restrictions. Per person, the transmission rate of undocumented infections was 55% of documented infections, yet, due to their greater numbers, undocumented infections were the infection source for 79% of documented cases."

Source: Ruiyun Li et al. (2020), Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV2), Science, 16 March 2020, DOI: 10.1126/science.abb3221

A few consequences:

1. Good news: existing estimates of case-fatality rates and alike might be over-estimated
2. Good news: some immunity already in the system (consistent with the trend in China where the virus did not pick up after restrictions have been relaxed)
3. Bad news: it is likely that when interventions started in Europe and USA the virus was widely spread. The estimates from simulation on how measures of suppression will flatten the curve in the short run may be over-optimistic

Bottom line: we are designing policies based on highly incomplete evidence/information

A simple policy proposal

Random testing, statistical analysis and surveillance

1. Test a representative sample of the population (independently of symptoms), recording socio, economical, demographic and locational characteristics at the household level

2. Use standard statistical methods to infer the household characteristics most likely to predict whether someone is infected or not in the whole population

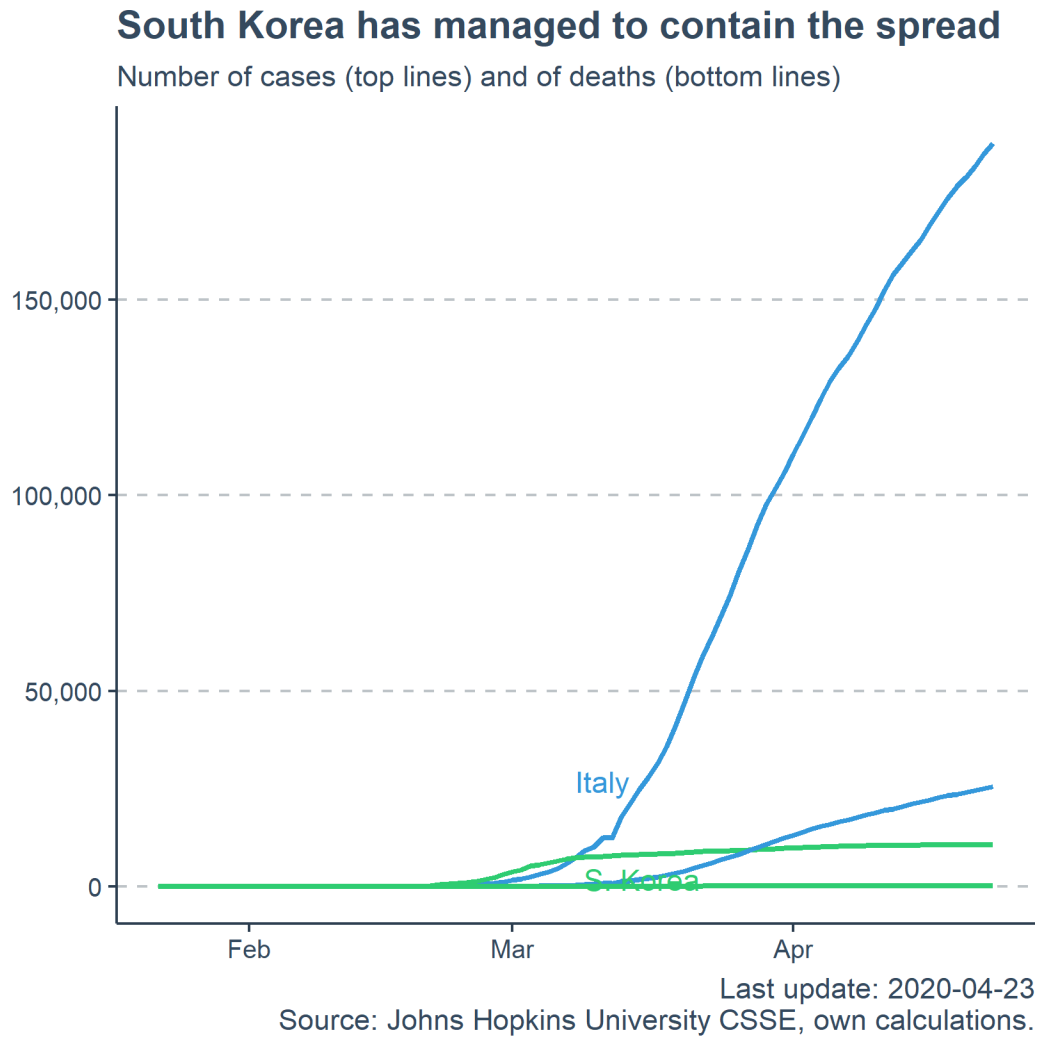
3. Develop surveillance strategies based on the information revealed in (2): nation-wide contact tracing, targeted social distancing.

Collecting the right data and conducting extensive statistical analysis can save MANY lives!!!
Goal: prevent a 2nd peak and flatten the contagion curve that may spike again in the Fall 2020.

An early success: the case of South Korea

- South Korea had a sharp increase in cases during February but has managed to slow the spread in March
- In addition the death rate as of April 23rd has been particularly low: 2.2% (vs 13.4% in Italy)

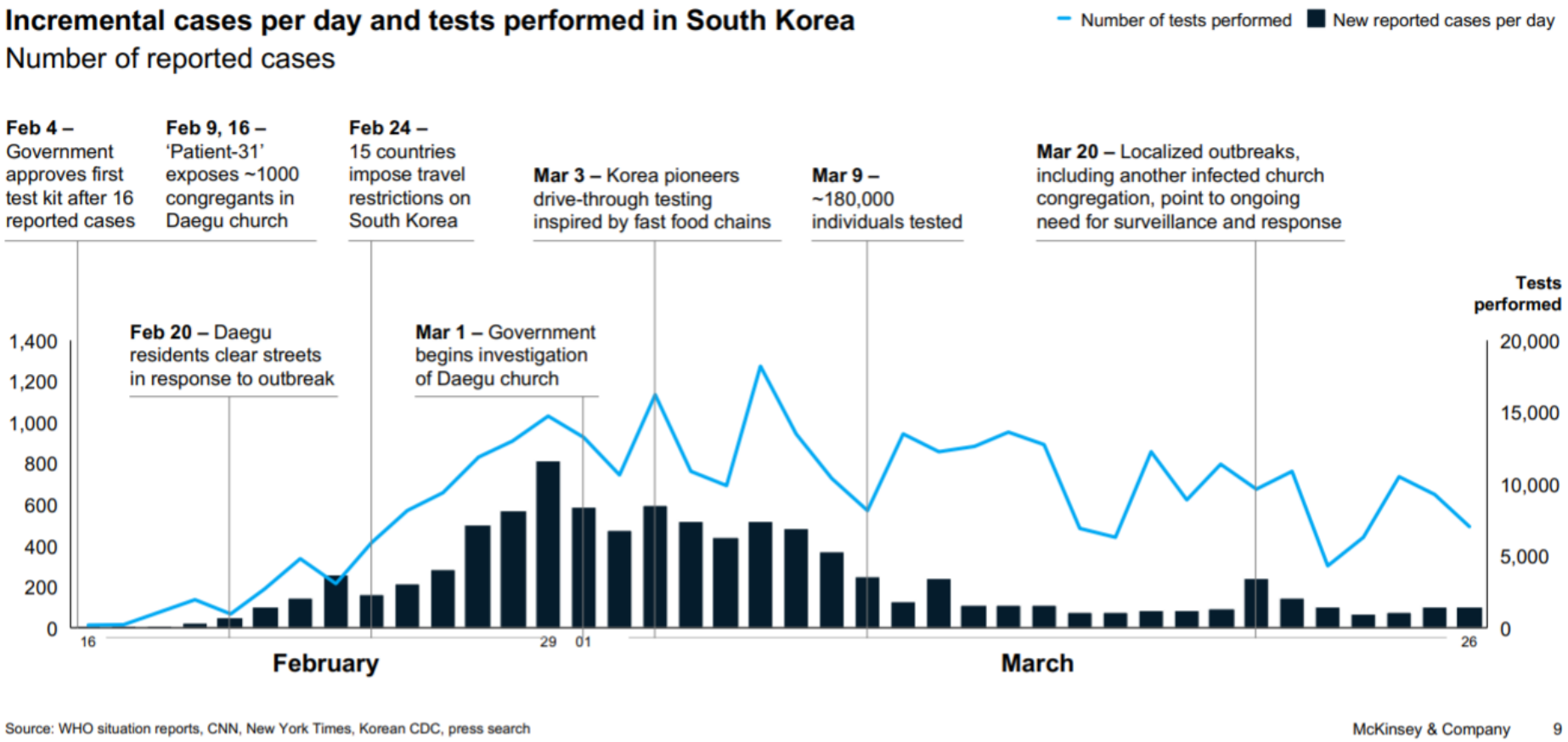
- Additional measures in South Korea:
  - Rapid scaling of testing, (e.g., 5,500 test for every one million people; U.K.: 750 for every one million people)
  - Readily available tests (e.g., free with doctor prescription, available privately, but reimbursed by the government is positive)
  - Contact tracing, targeted testing and monitoring infected (e.g., government app to locate people)



Source: Cowling et al (13 March, nytimes.com)

Testing in South Korea

South Korea: Rigorous investigation of outbreak clusters and rapidly scaled testing capabilities limited spread

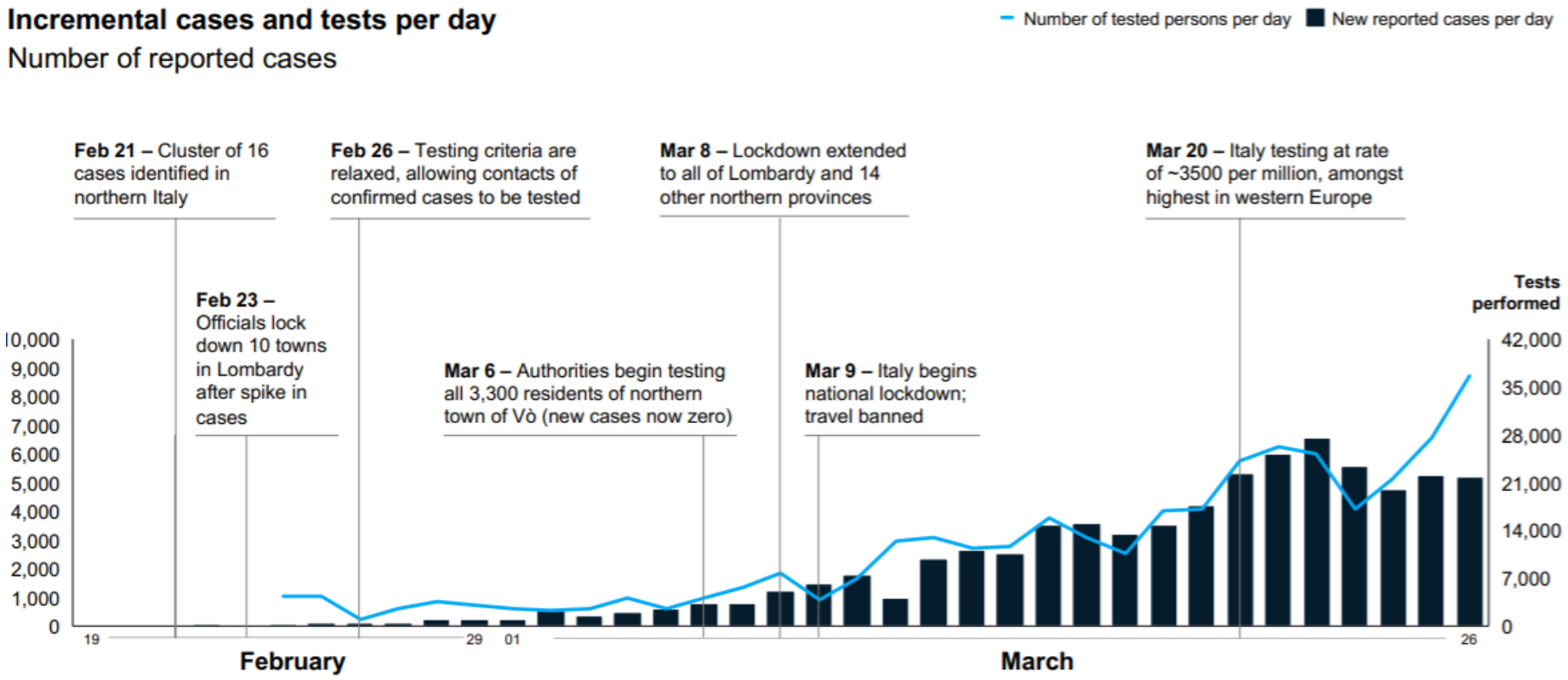


Source: McKinsey Global report (26th March 2020)

Testing in Italy

Italy: The effects of national lockdown on viral transmission are beginning to show as new case growth flattens

Incremental cases and tests per day
Number of reported cases

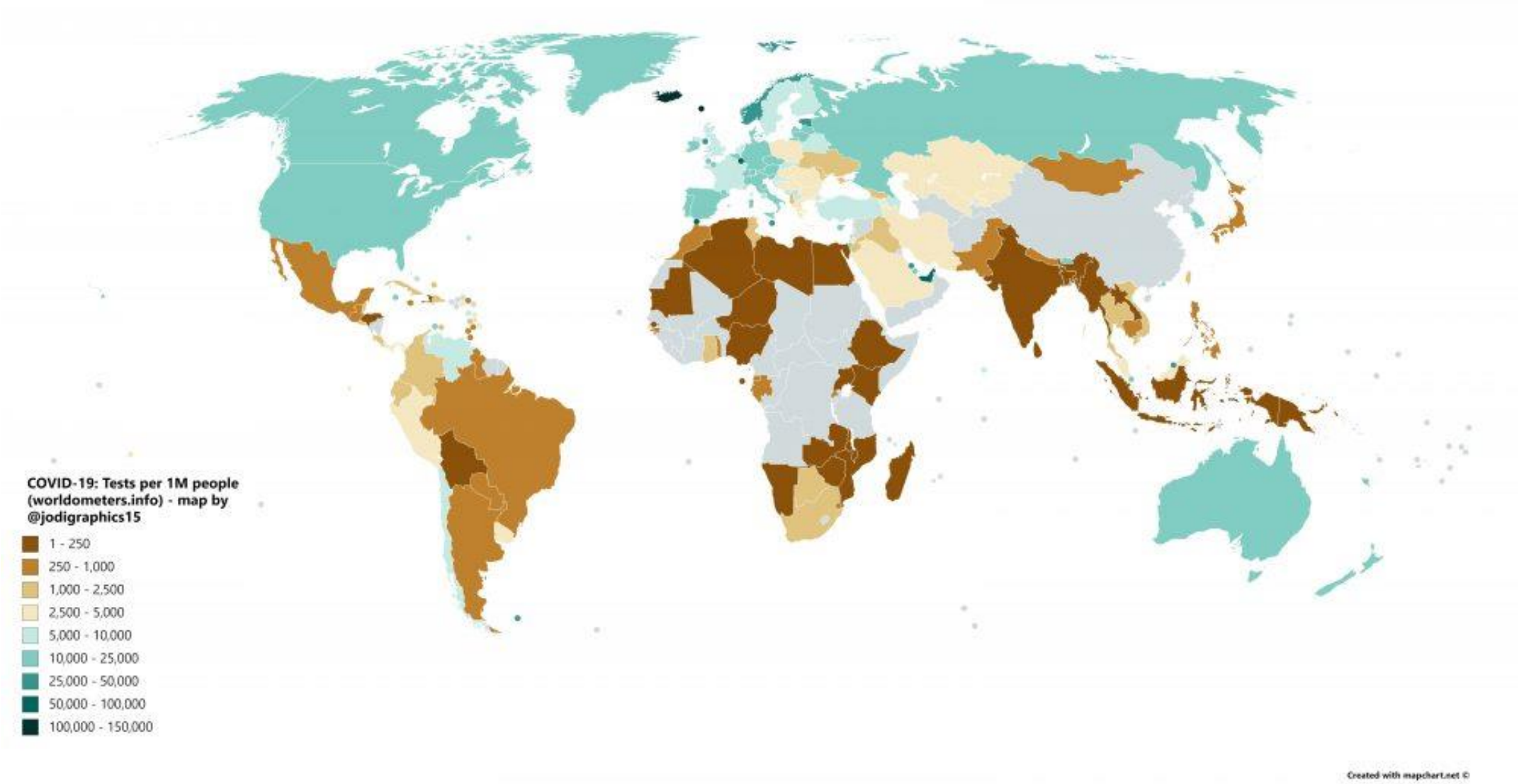


Source: WHO situation reports, CNN, New York Times, press search

McKinsey & Company 11

Source: McKinsey Global report (26th March 2020)

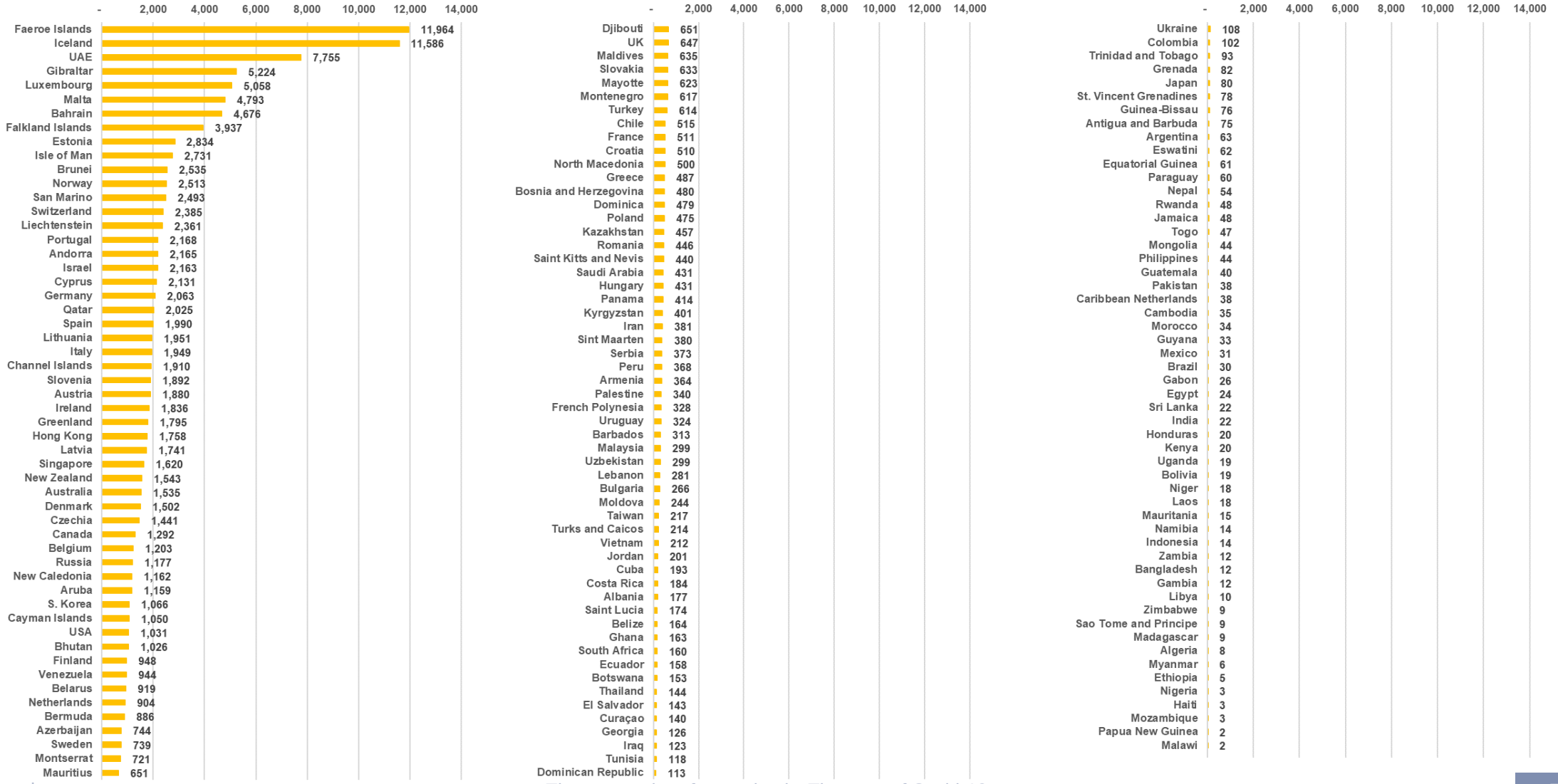
Testing efforts vary widely



Source: Jo Di Graphics, 17th April

Testing efforts vary widely (cont'ed)

Tests performed per 100,000 people by country



Source: Jo Di, Covid-19 graphs & maps, 17 Apr

What tactics have been used across countries

Different strategies and associated policies have been devised across nations, with varying effects. It can be argued that there is some flexibility in the policies put in place, but there is a consistent call for more policies, more measures, and more severe suppression tactics

Everybody needs to do more, “Not testing alone. Not contact tracing alone. Not quarantine alone. Not social distancing alone. Do it all.” says WHO Director General Tedros Adhanom Ghebreyesus

“At this point 100% of nations that got it under control did so based on testing and tracing, isolation, quarantining” Marcel Slaathe, epidemiologist at the Federal Institute of Technology of Lausanne

Mitigation: More relaxed measures. May allow for the less vulnerable to get sick to build up immunity → **Suppression:** Deploying all available tactics. May allow for relaxing and re-strengthening measures over time

SOCIAL DISTANCING

Slow response to barring large gatherings (UK, US) → Shutting theatres, restaurants, cinemas, and gyms → Closing schools → Lockdown except essential trips with police enforcement (China, Italy)

Flexible policies such as:

- *Keeping schools open for students of vital workers (Austria, Netherlands)*
- *Halving capacities in schools and increasing cleaning procedures (Singapore)*
- *Closing non-essential stores, extending market hours to reduce congestion (Germany)*

TESTING & ISOLATION

Dispersed responsibility creating a variable response 74 tests / million (US) → Scaled up testing → Drive-through testing, separated sick and well centres → Testing program, isolation of infected, contact tracing and quarantining 5200 tests / million (SK)

Flexible policies such as:

- *Engaging and activating the public to report cases, self-isolate, and inform contacts to get tested*

Source: Cohen et al (20 March, ScienceMag.org)

Managing a heterogeneous population

- Goal: to avoid binding health system capacity and thus flatten the curve **for high risk individuals**
- Homogenous interventions are likely to be sub-optimal. If supply of tests is limited: who should we target these tests to in order to implement most efficiently the suppression/containment policy?
- At the moment, tests are primarily be given to:
  all patients in critical care for pneumonia, acute respiratory distress syndrome (ARDS) or flu like illness
  all other patients requiring admission to hospital for pneumonia, ARDS or flu like illness
  where an outbreak has occurred in a residential or care setting, for example long-term care facility or prisons
- The value to distribute some of those tests to asymptomatic population is very large.
  In Korea, testing the asymptomatic proved key to limit very significantly the death toll.

Externalities

Each individual choice affects the whole system: contagious diseases are rife with “negative externalities”

Low-risk category individuals have low incentives to self-isolate or take precautionary measures

Is it enough **to tell** people to self-isolate?

Taiwan strict fines up to 33k USD for non-compliants of home-quarantine

16th of March, 8 thousand Italian people reported by police for non-compliants of social-distance law

See Rowthorn and Toxvaerd (2018) for theoretical analysis

Social distance for high-risk individuals requires providing services to them: food, medicine, and alike.

Will the market provide these services efficiently? Congestion problem for online food delivery services

Similar problems for any services related to bandwidth. Most sectors will suffer (see later), but for services like digital services and home-delivery, this phase will spike demand and make it very inelastic. Are those services provided competitively? If not, market power will destroy surplus. Should companies offering those services (and benefitting by the virus) subsidize who will suffer most from the incoming recession? Goal is to avoid social unrest!

Non-Covid-19 patients will be crowded out in intensive care unit

Source: The Economist, 14th March 2020

WARNING ON INTERPRETATIONS

If a vaccine **can be** found in the next six months (and the scientific community seems to agree this looks very unlikely), then suppression (i.e. countries lock down) is a dominant strategy

If six months are **NOT** enough, there will be a very significant death toll, either way:

- **Containment** fronts load causalities: the curve does not flatten but people develop immunity
  (big unknown: will recovered cases be actually immune from being infected again?)
- **Suppression** backs load causalities: the curve flattens but people exposed when policy ends
  (big unknown: will be a vaccine developed sufficiently fast? Strategy buys time to expand health system capacity)

Alternative is **Conditional Suppression**, until a vaccine for mass production is ready. Not a free lunch, though, as likely to generate pervasive social unrest if the policy lasts over prolonged period

DISCLAIMER: we take no view on which policy is (second)-best. Our analysis is meant to highlight the social and economic trade-offs inherently involved with <u>any</u> policy option

Summary of part 2 (health policies)

- All Covid-19 health policies have one objective: decreasing the replication number of the disease
- Given existing health system capacity, suppression policies are the only one that can help us in the **short-run. Please, do follow government guidelines.**
- Health system capacity can be expanded in the short-run relying on the private sector (e.g. ICU beds, ventilator parts) and retired medical workers.
- Let's use the time bought by suppression policies effectively:
  - Test a representative sample of the population to gather reliable and unbiased information about the prevalence of Covid-19
  - Extensive statistical analysis within and across countries (that are in different phases)
  - Develop surveillance strategies based on this reliable information

Full set of slides available at https://sites.google.com/site/paolosurico/covid-19

Next video: A user guide to Covid-19. Part iii – economics for dummies

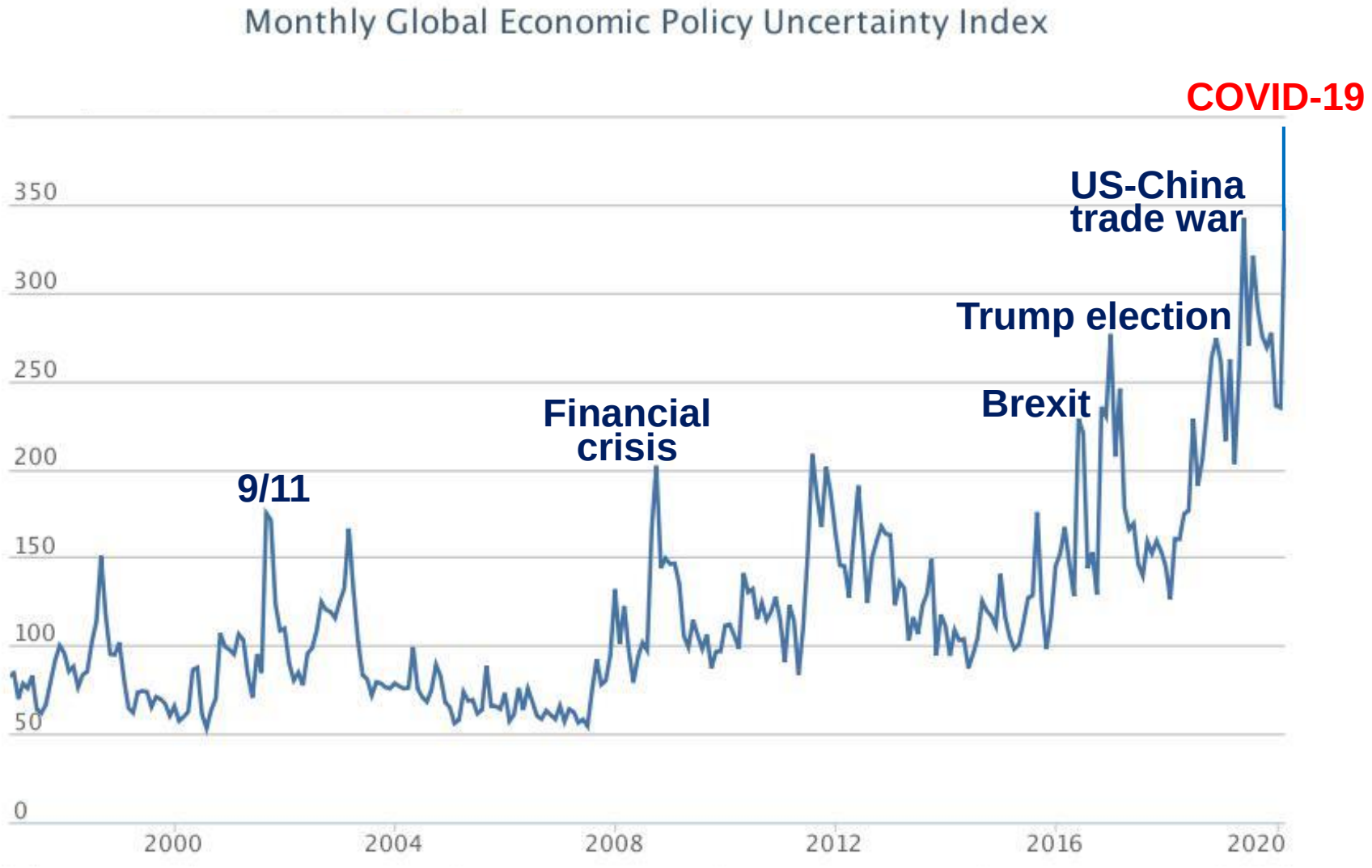
This Lecture

1. Science
2. Health policies
3. **Economics**
4. Macroeconomic policies

The “cash-flows spiral”

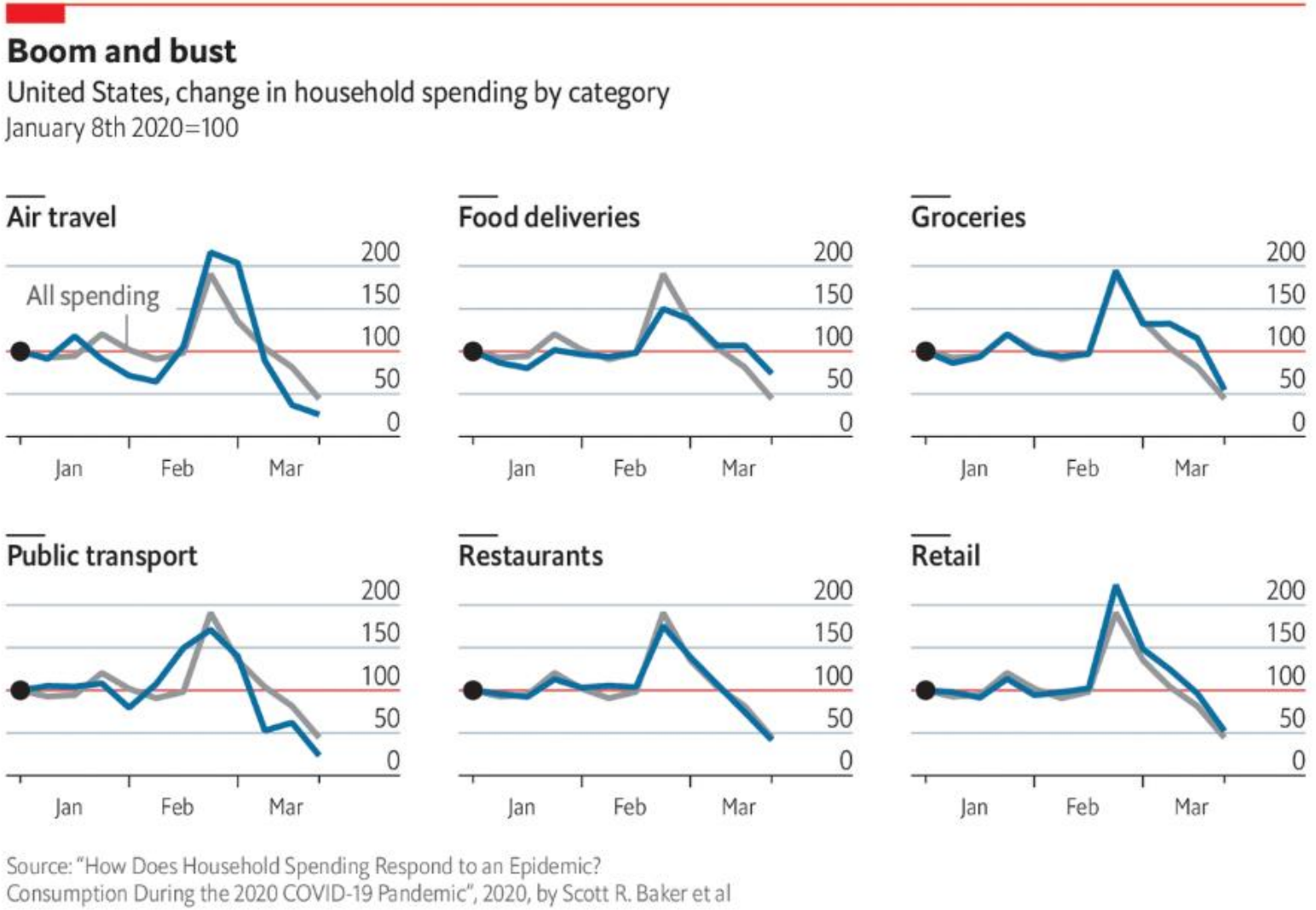
1. Uncertainty spikes

Based on the frequency of newspaper articles with one or more terms about “economics,” “policy” and “uncertainty” in roughly 2,000 U.S. newspapers.



Source: Baker, Bloom and Davis (2020)

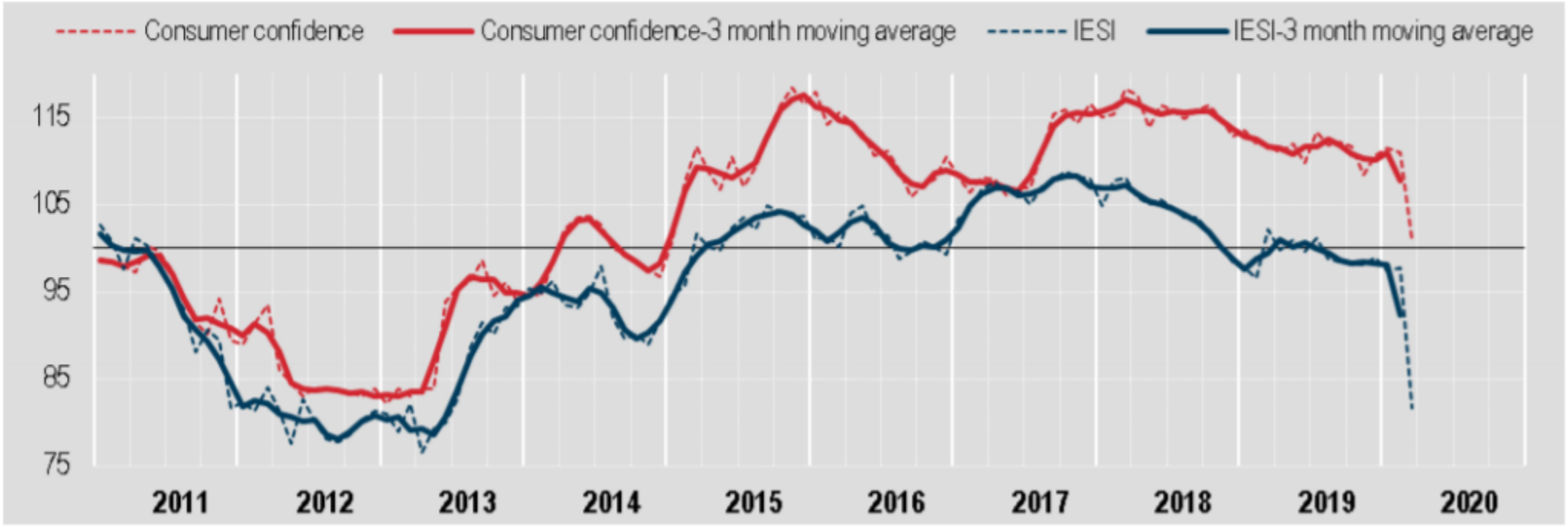
2. Consumption rises and then drop sharply



Source: How the covid-19 pandemic is changing Americans' spending habits (9th Apr, The Economist)

Business and consumer confidence fall in Italy

Seasonally Adjusted Consumer and Business Confidence Climate Indices

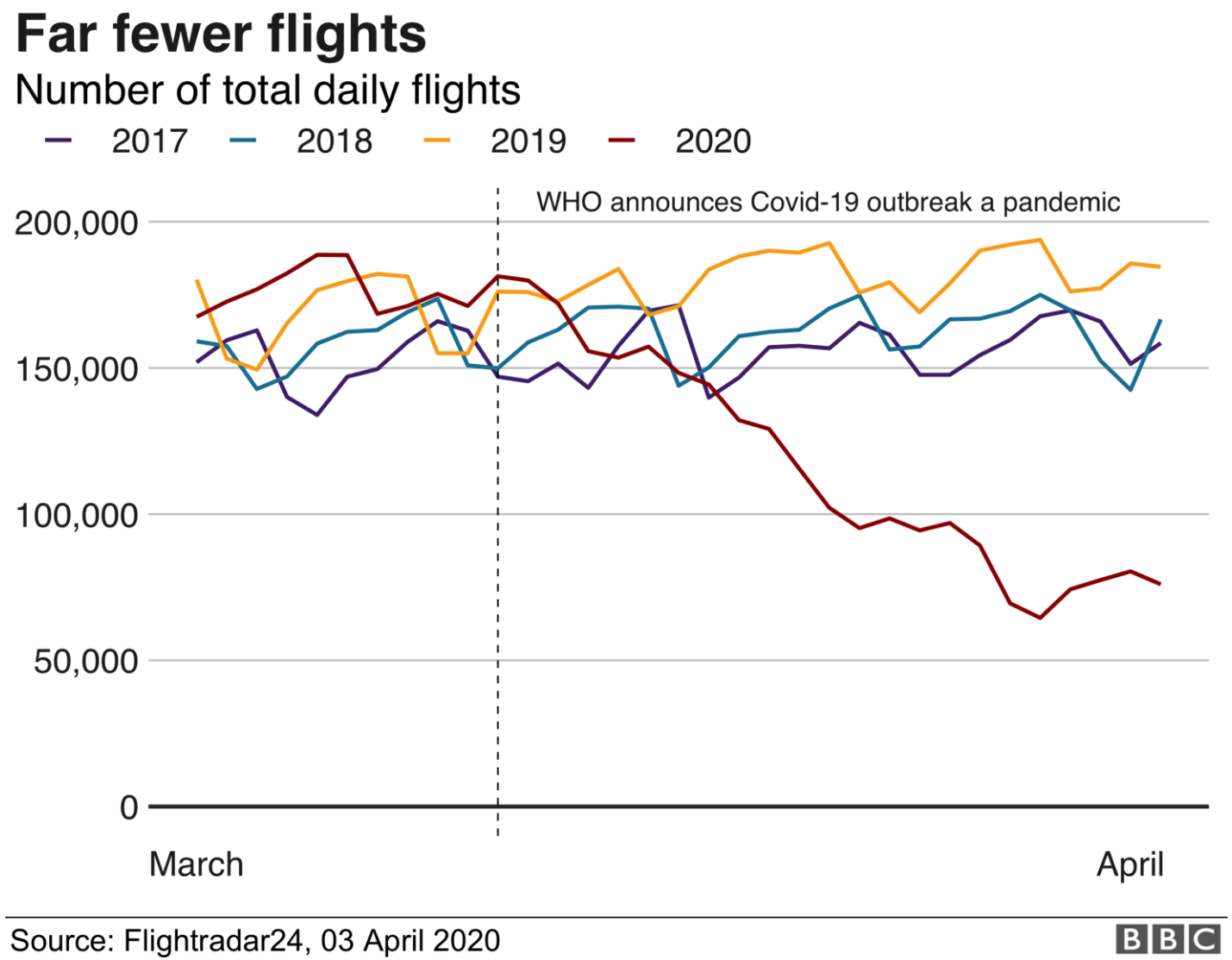


IESE (Istat Economic Sentiment Indicator) index used to represent business confidence climate

Source: Istat Consumer and Business Confidence March 2020, 27th March

Impact on stock markets

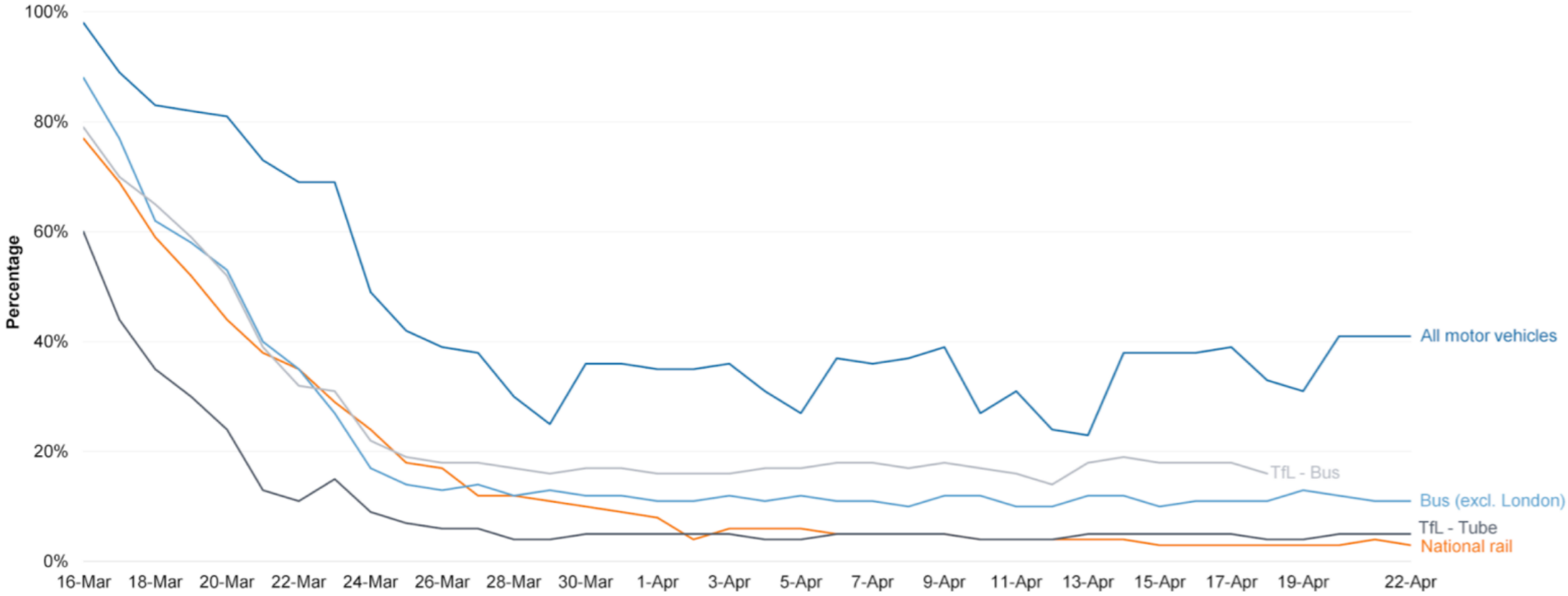
Impact on travel services



Impact on public transport services

Transport use change (Great Britain)

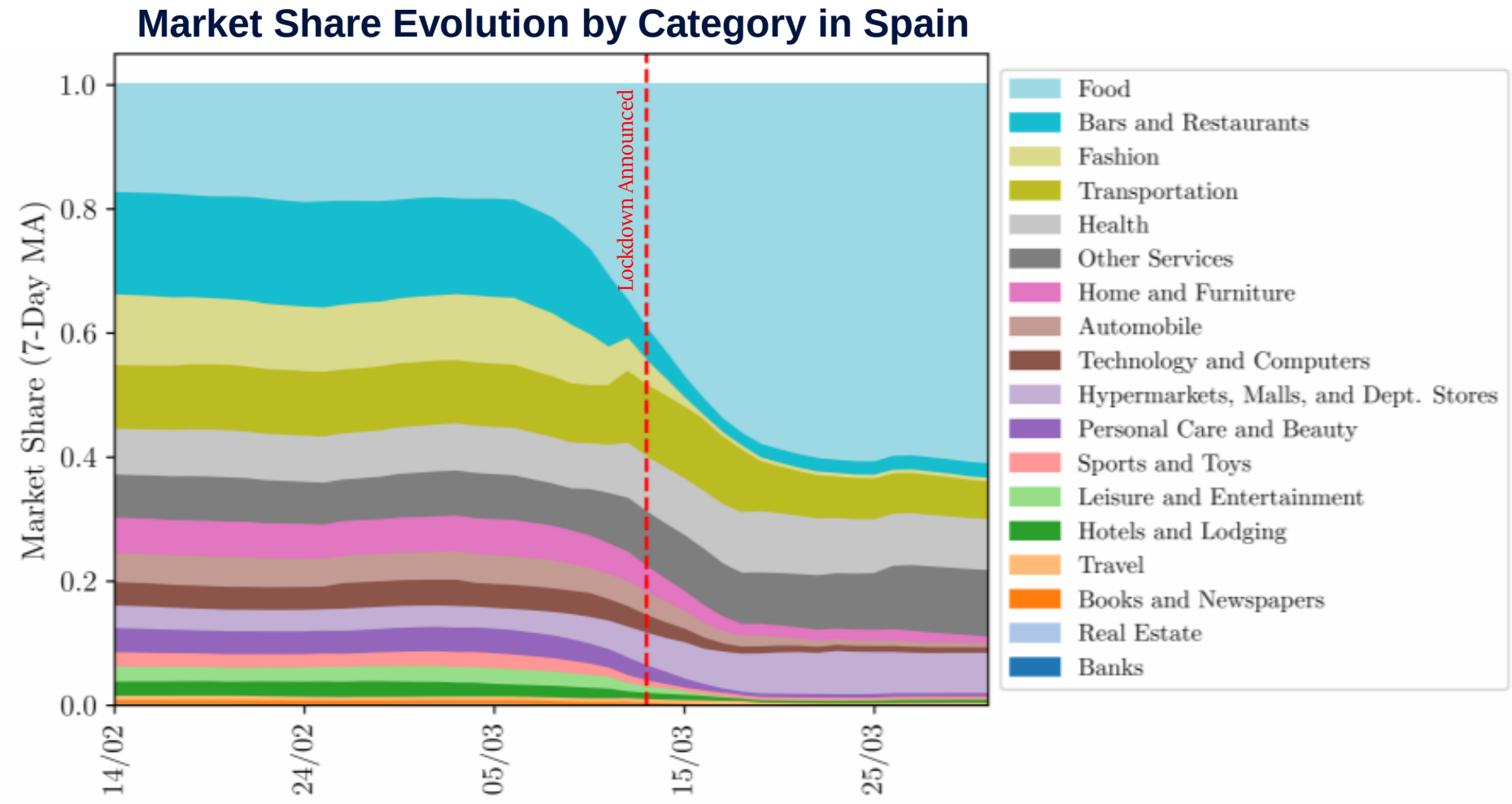
Current traffic volumes are now 59% lower than the first week of February. This week's traffic volumes have shown a small increase compared to the previous weekday volumes seen after the restrictions started (which showed falls of around 62%). Rail and Tube use are down by more than 95%.



Source: Department for Transport. Bus (exc London), TFL tube and Bus data has been adjusted to compare against typical usage for the Easter break, whereas motor vehicles and national rail have not. Data on TfL Buses is not available from Sunday 19th April due to the change in boarding policy.

Source: UK Government Daily Coronavirus Press Conference, 24 Apr

Impact on spending habits (cont'ed)



Source: Carvalho et al, 14 Apr 2020, Tracking the COVID-19 Crisis with High-Resolution Transaction Data

Impact on spending habits (cont'ed)

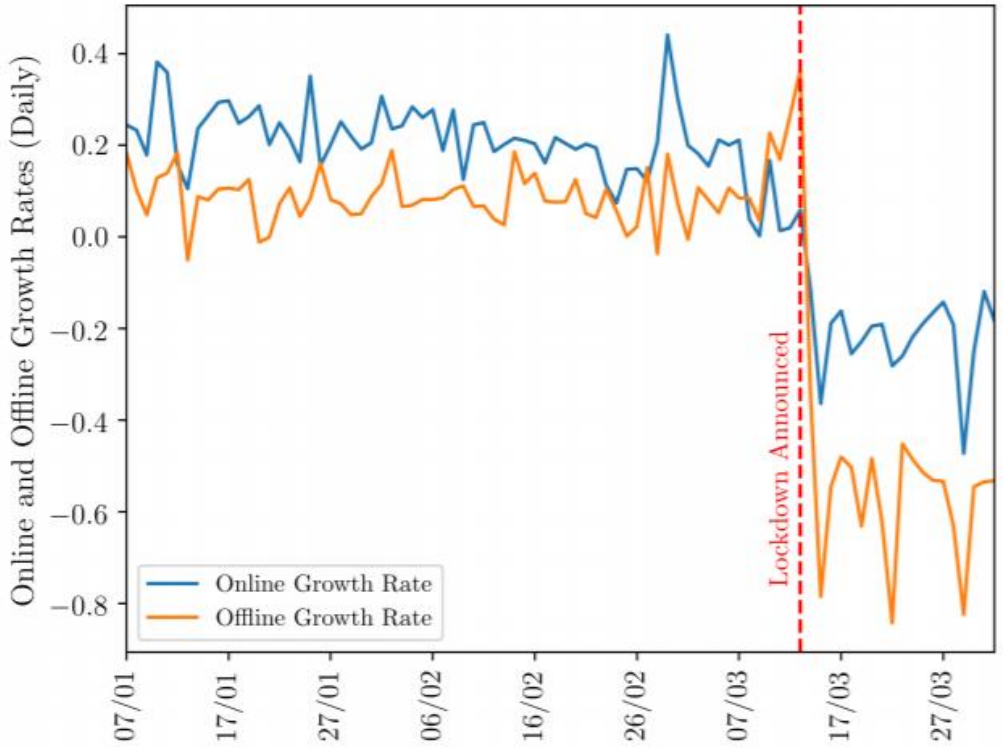
Spain's best and worst performing categories post-lockdown

Category	Market Share Growth
Food: Small Stores	2.249
Tobacco Store	2.224
Mobile Phone Credit	2.068
Supermarkets	1.984
Hypermarkets	1.673
Pharmacy and Parapharmacy	1.530
Gifts and Donations	1.128
Insurance	0.836
Veterinary and Pets	0.719
Automotive Inspection (ITV)	-0.872
Restaurants	-0.884
Fashion: small shops	-0.893
Massage and Personal Care	-0.895
Toys: Chains	-0.921
Shoe Shops	-0.929
Leather Shops	-0.931
Furniture and Decoration Chains	-0.933
Pubs and Disco Clubs	-0.935

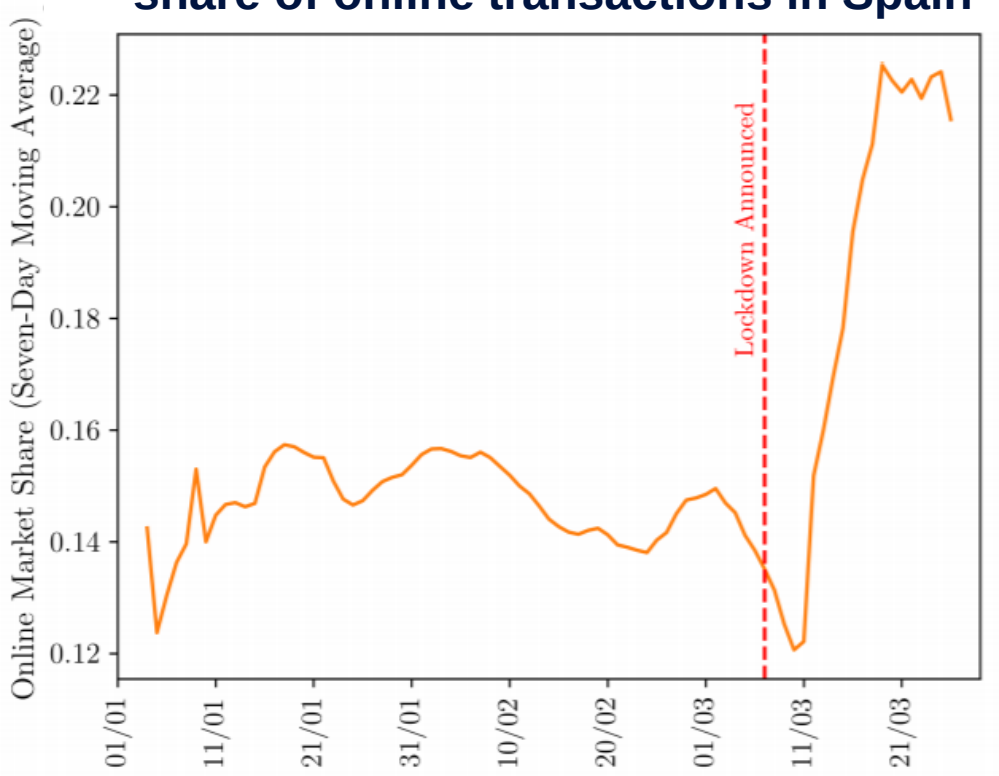
Source: Carvalho et al, 14 Apr 2020, Tracking the COVID-19 Crisis with High-Resolution Transaction Data

Consumers shift online

YoY growth rate of online and offline expenditures in Spain

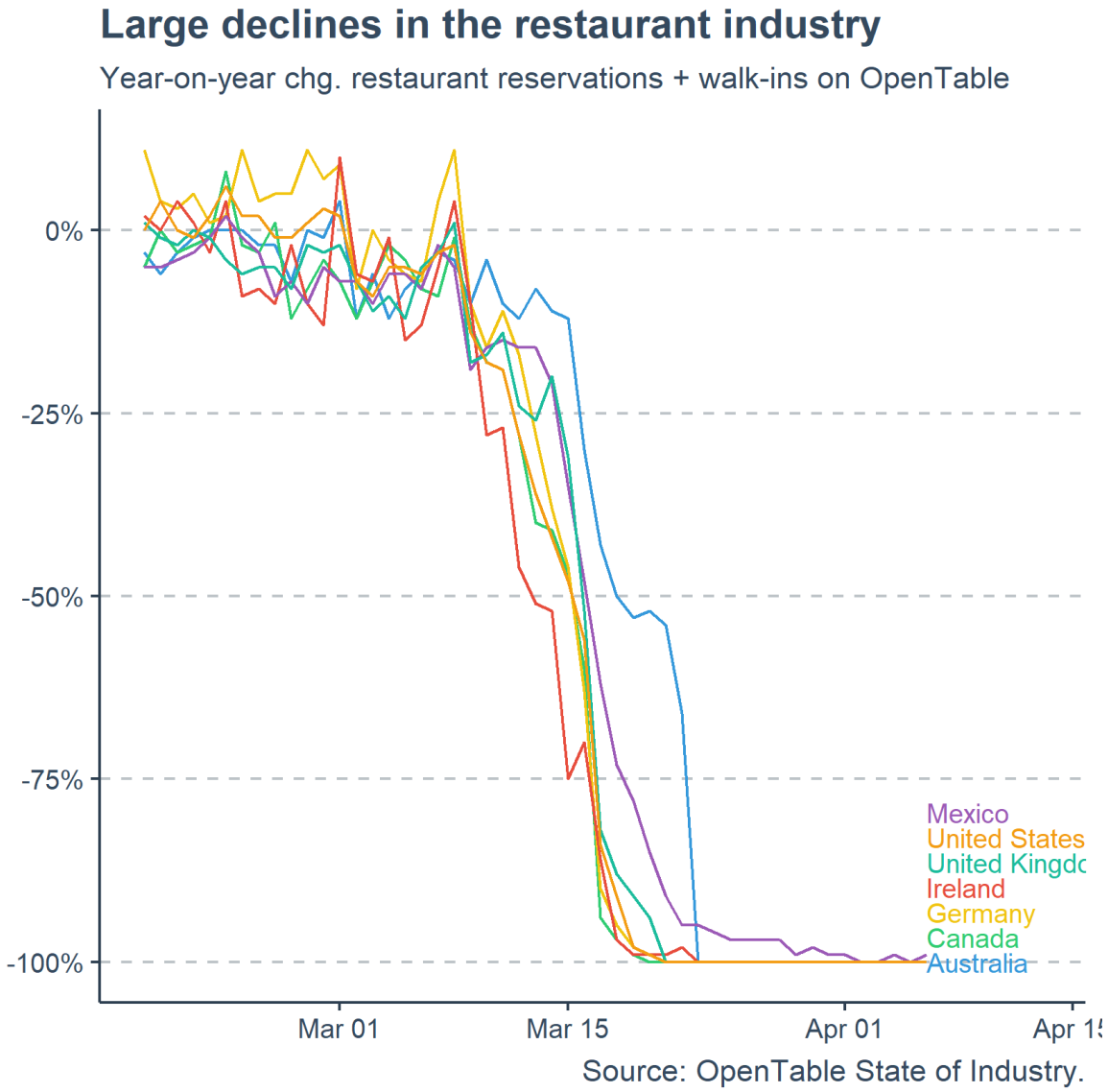


7 day moving average of daily market share of online transactions in Spain



Source: Carvalho et al, 14 Apr 2020, Tracking the COVID-19 Crisis with High-Resolution Transaction Data

Impact on restaurants



Impact on durables expenditure

In face of negative income shocks, one of the first and strongest response of households with high marginal propensity to consume is to postpone vehicle purchases. Increase in uncertainty is likely to have a similar effect that works via a precautionary motive.

Evidence (from projects funded by ERC grants):
U.S. - Misra-Surico (2014, AEJM),
Italy - Surico-Trezzi (2019, JEEA),
U.K. - Cloyne-Ferreira-Surico (2020, ReStud)

Data on China suggests overall impact will be extraordinary large! Unfortunately, this is only the direct effect. More on this later.

With effects seen in the earliest hit countries

The impact of the coronavirus and the associated lockdowns can be seen in the economic output in China.

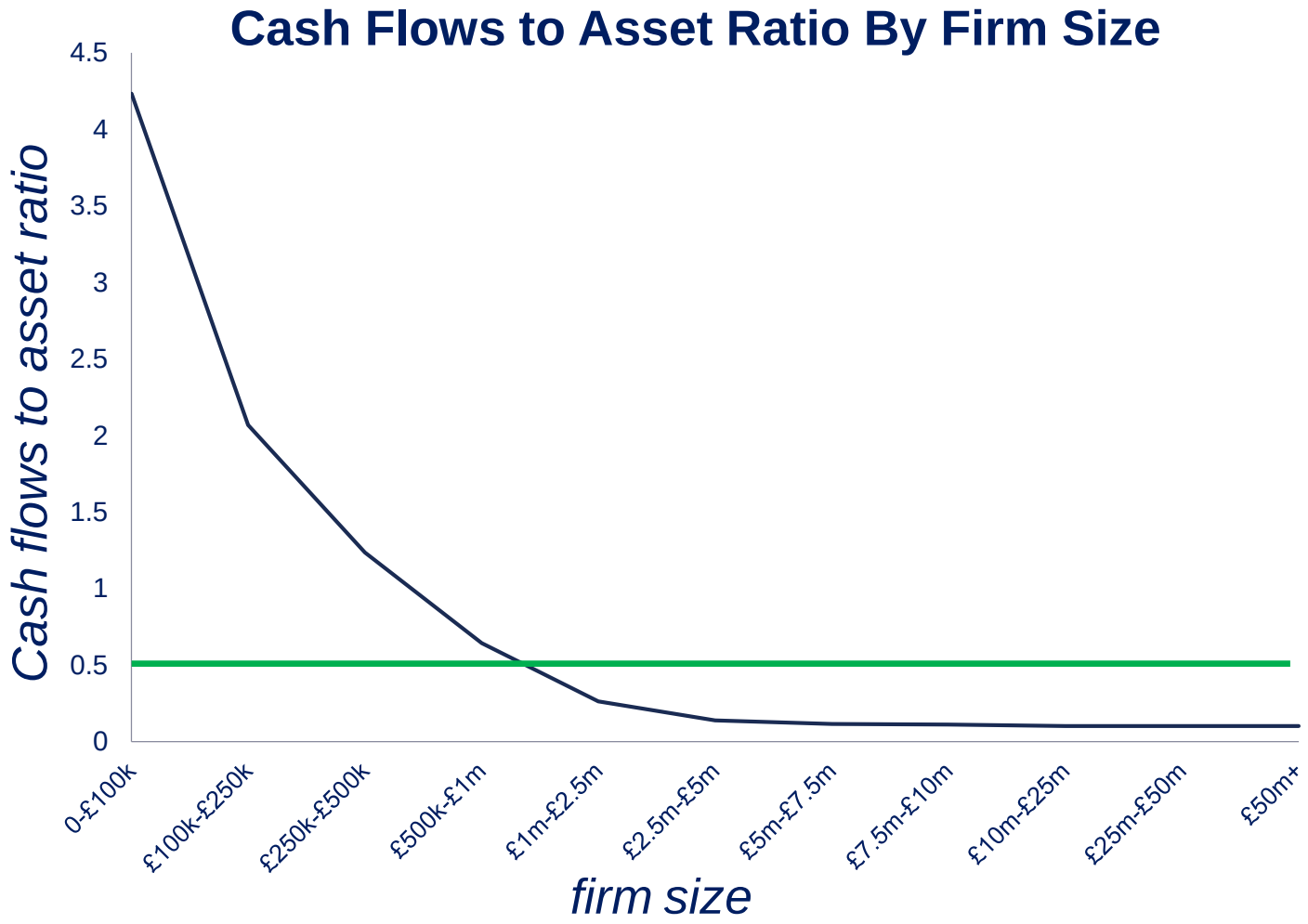
The National Bureau of Statistics reported a month-on-month growth decline in February of 26.6% and a year-on-year growth decline of 25.9%. This is following a year-on-year decline of 4.3% in January and compared to an average growth of 5.7% in 2019.

Source: National Bureau of Statistics of China, Industrial Production Operation in the First Two Months of 2020 (17th March); WIND

3. Many small businesses rely on cash flows

- **Firms with cash flows to asset ratio above 0.5** account for about 10% of employment among private businesses

- All private businesses account for more than 60% of total employment. So (small) firms with cash flows to assets > 0.5 **account for some 6% of total employment in the economy**



Source: based on calculations from Bahaj, Foulis, Pinter and Surico (2019) on the universe of private non-financial firms in the U.K.

The research in this paper has been funded by an ERC Consolidation Grant, whose support is gratefully acknowledged.

3. Many small businesses already struggling

A survey of US businesses with fewer than 500 employees impacted by the coronavirus finds:

- 43% are temporarily closed due to Covid-19, citing lack of demand or employee health
- On average, workforces have been reduced by 40% since January
- Three quarters report only having enough cash on hand to cover expenses for the next two months or less
- 70% are interested in a government-subsidized aid program, but worry about bureaucratic hassles or challenges proving eligibility

Reported Likelihood of Being still Open in December 2020 by Hypothetical Crisis Duration

Industry	1 Month	4 Months	6 Months
Professional Services	79%	63%	54%
Banking / Finance	78%	63%	59%
Real Estate	74%	56%	56%
Construction	72%	43%	45%
Healthcare	79%	47%	35%
Other	76%	48%	38%
Tourism / Lodging	66%	48%	27%
Art / Entertainment	65%	45%	35%
Retail (excl. grocery)	69%	35%	33%
Restaruant / Bar / Catering	72%	30%	15%
Personal Services	57%	40%	22%
Average	72%	47%	38%

Source: Bartik et al, April 2020, “How are Small Businesses Adjusting to Covid-19? Early Evidence from a survey”

The most affected sectors

The hardest hit sectors may not see restart until 2021

Preliminary views on some of hardest hit sectors based on partially effective scenario—subject to change

	Commercial aerospace	Air & travel	Insurance carriers	Oil and gas	Automotive	Apparel/fashion/ luxury
Estimated degree of impact, in terms of duration	Longest					
Estimated global restart	Q3/Q4 2021	Q1 / Q2 2021	Q4 2020	Q3 2020	Q3 2020	Late Q2/Q3 2020
Average change in stock price	-44%	-44%	-33%	-48%	-32%	-28%
Industry specific examples	Preexisting industry challenges, a quick drop in possible revenue, and high fixed costs cause **near-term cash flow and long-term growth uncertainty** It may take years to recover from production and supply chain stoppages, due to critical vendors located in areas impacted by the virus Long order backlogs mitigate some concerns, though rapid adoption of remote work technologies may put a dent in high-profitability business travel	Deep, immediate demand shock 5–6x greater than Sept 11; ~70–80% near-term demand erosion due to international travel bans and quarantines now prevalent in 130+ nations Northern hemisphere summer travel peak season deeply impacted since pandemic fears coincide with peak booking period Recovery pace faster for **domestic travel** (~2–3 quarters); slower for **long-haul and internationall travel** (6+ quarters)	**US insurers have been strongly affected**, especially reinsurers and life and health insurers **Reduced interest rates** and investment performance **impacting returns—especially for longer-tail lines** **Disruptions expected in new business and underwriting processes** due to dependence on paper applications and medical underwriting	**Oil price decline** driven by both short-term demand impact and supply overhang from OPEC+ decision to increase production **Oversupply expected to remain in the market even after demand recovery**, and post 2020, unless OPEC+ decides to cut production	**Existing vulnerabilities** (e.g., trade tensions, declining sales) **amplified by acute decline in Chinese demand**, continued supply chain and production disruption (in China, rest of Asia, EU) to amplify impact despite ongoing Chinese economic restart Headwinds to persist into Q3 given **tight inventories** (<6 weeks), **supply chain complexity** (therefore, minimal ability to shift)	**Overall decline** in private consumption and exports of services **Demand** for apparel categories **down sharply overall** and expected to take longer to return than economic restart; **online** growth exists (though hampered by labor shortage) Retail **stores temporarily closed** in many parts of the world—high regional variation

Source: IHS Market, McKinsey Global Institute, Subject matter experts, press reports, Corporate Performance Analytics, S&CF Insights, S&P Capital IQ

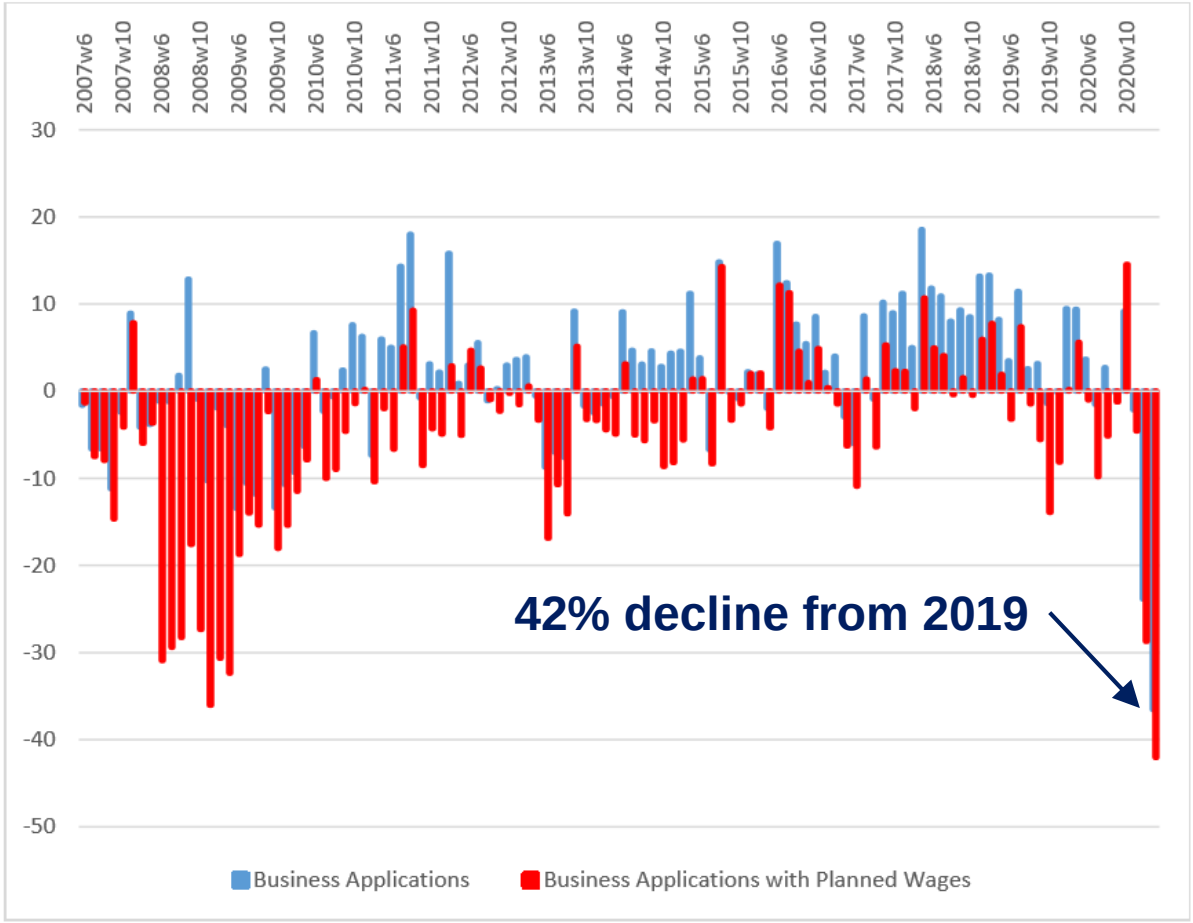
McKinsey & Company 23

Source: McKinsey Global report (25th March 2020)

3. Many new businesses will not start up

- Start ups account for the majority of job creation in the economy
- Experimental new data indicates a sharp decline in applications for new businesses in the last two weeks of March, among both firms planning to hire workers (red) and self-employed (blue)
- These businesses applications have shown high likelihood of becoming an employer business within four quarters, indicating both near-term and longer-term consequences

US YoY Growth in New Business Applications for Weeks 6-13 (February-March), 2007-2020 (%)



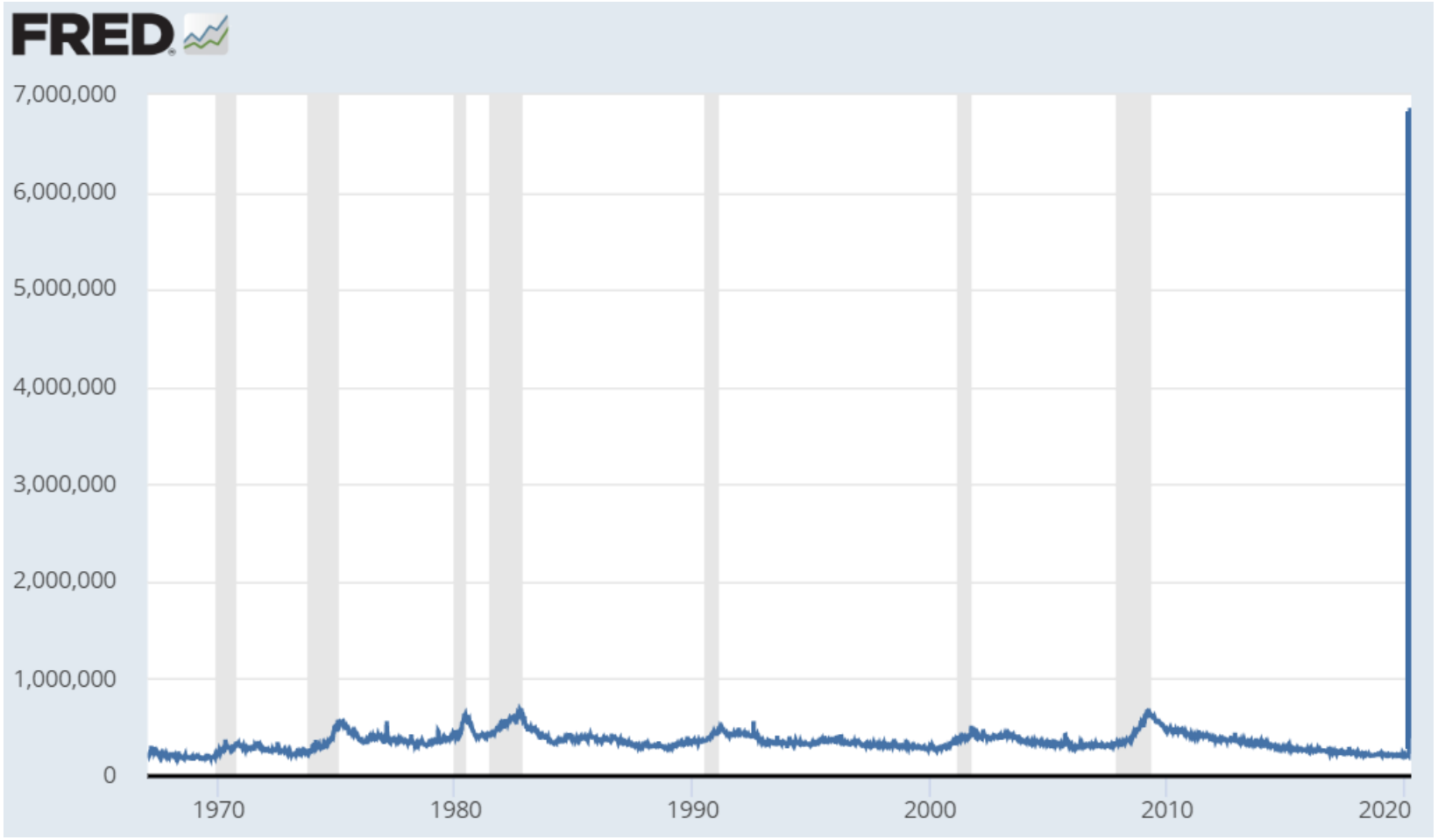
Source: BFS weekly.

Source: Haltiwanger, Applications for New Businesses Contract Sharply in Recent Weeks: A First Look at the Weekly Business Formation Statistics (8 Apr)

4. Over 26 million US unemployment claims

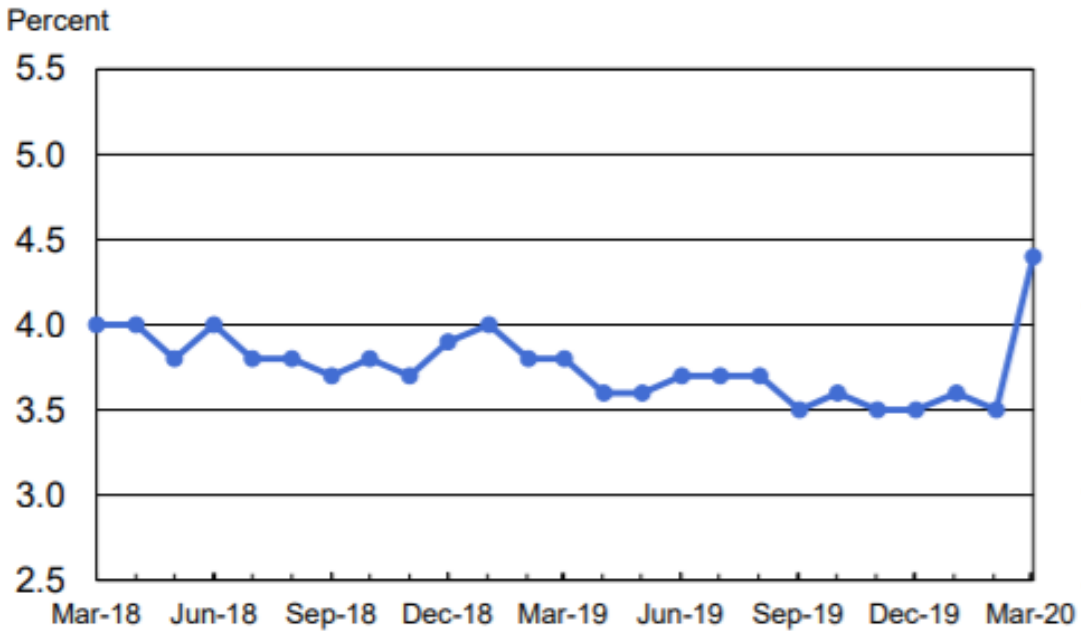
Unprecedented number of unemployment claims filed 5 weeks in a row

- **3,307,000** week ending 21 Mar
- **6,867,000** week ending 28 Mar
- **6,615,000** week ending 4 Apr
- **5,237,000** week ending 11 Apr
- **4,427,000** week ending 18 Apr

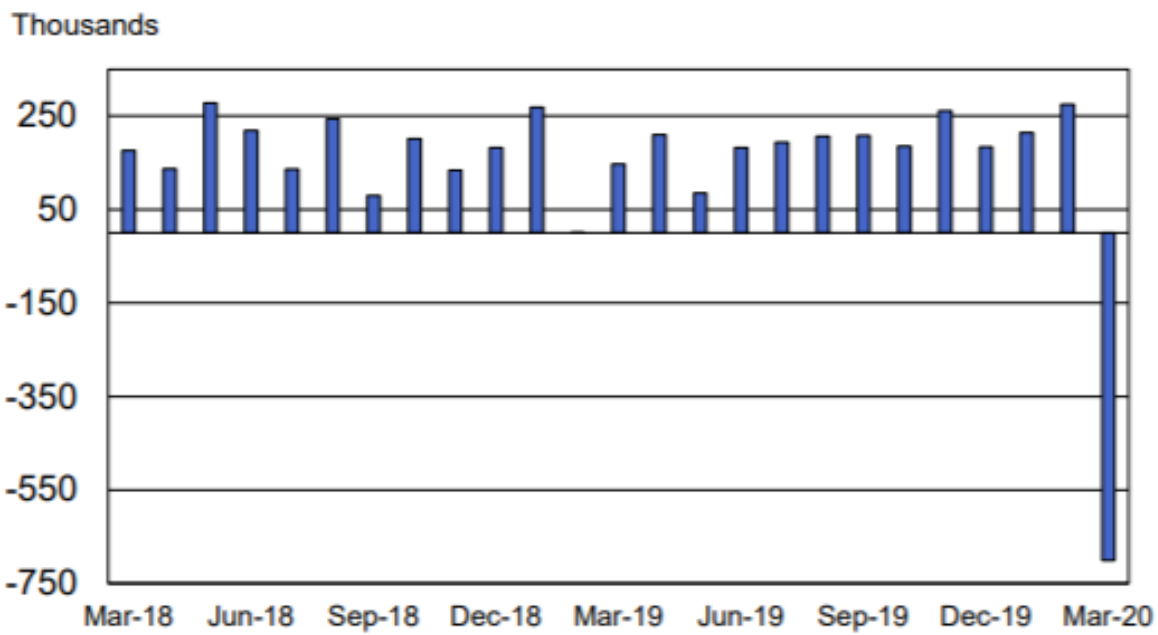


4. US unemployment jumps to 4.4% in March

Unemployment rate, seasonally adjusted

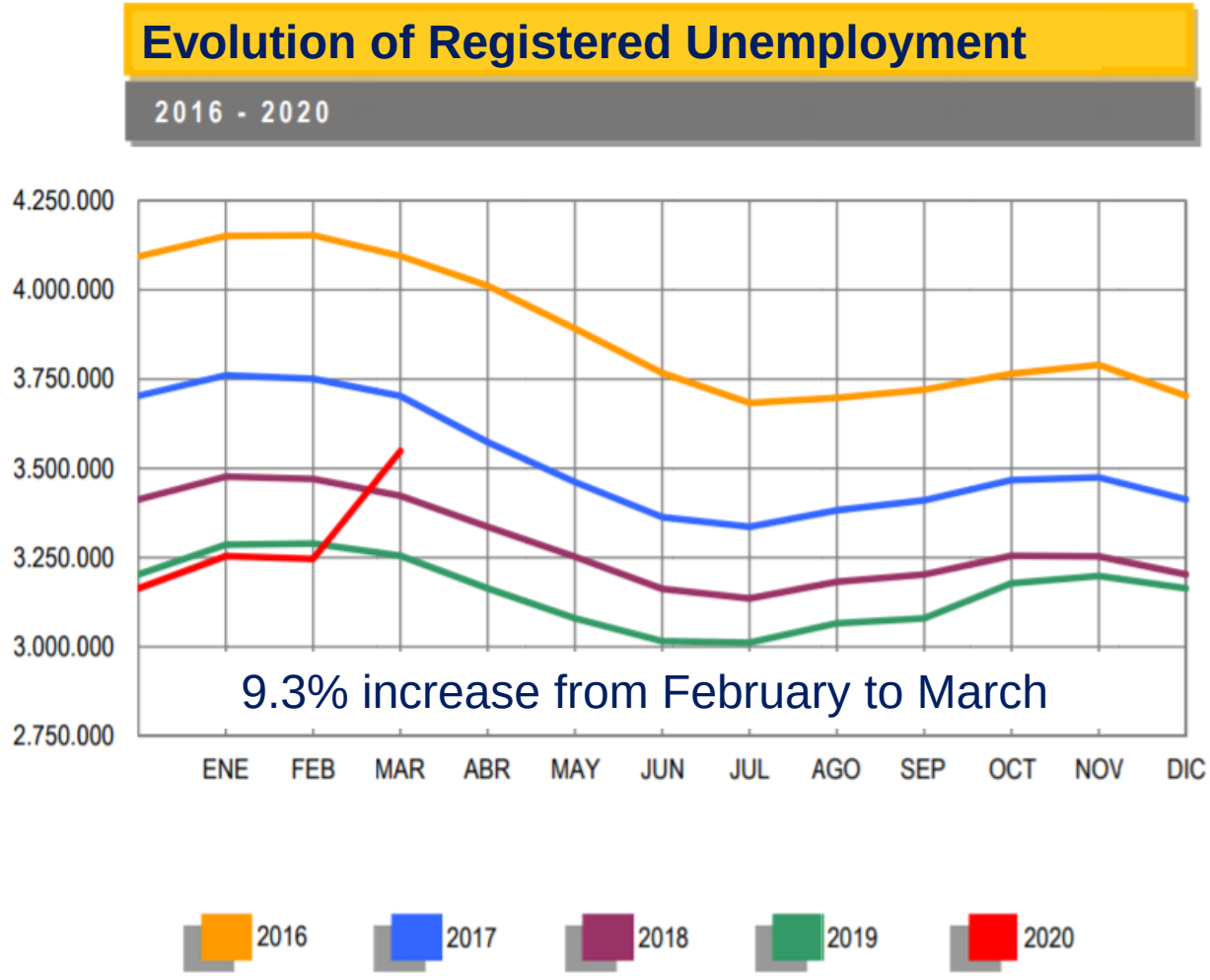


Nonfarm payroll employment over-the-month change, seasonally adjusted



Source: U.S. Bureau of Labor Statistics, Employment Situation, 3rd April

4. Spain saw largest ever monthly jobless increase



Source: Servicio Publico di Empleo Estatal, Registered Unemployment Data, 2nd April

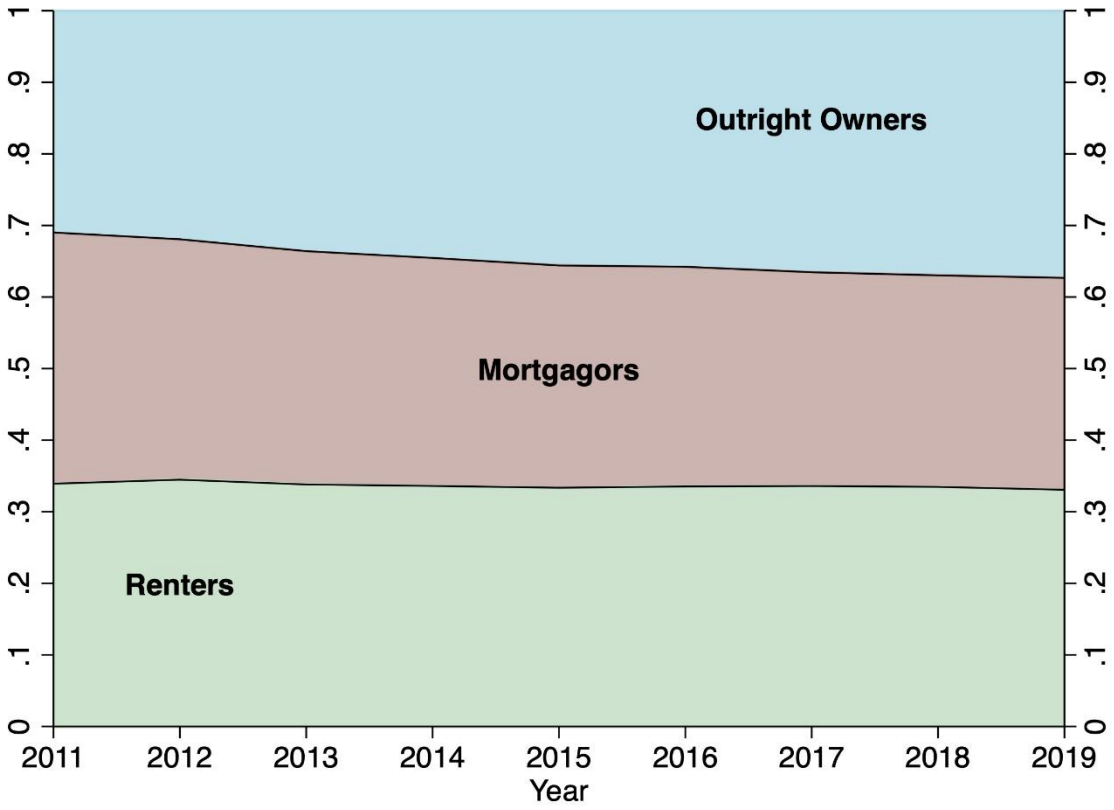
London Business School

Back to square 1! The household balance sheet

UK Understanding Society: 2016 - 2018

	Median	[p25 , p75]
Net Liquid wealth		
Outright owners	20,000	[0 , 93,000]
Mortgagors	230	[-4,870 , 17,710]
Renters	0	[-1,250 , 620]
Net Housing wealth		
Outright owners	209,000	[125,000 , 350,000]
Mortgagors	128,000	[60,000 , 240,000]
Renters	0	0

Figures in the table refer to £pounds value at 2017 prices



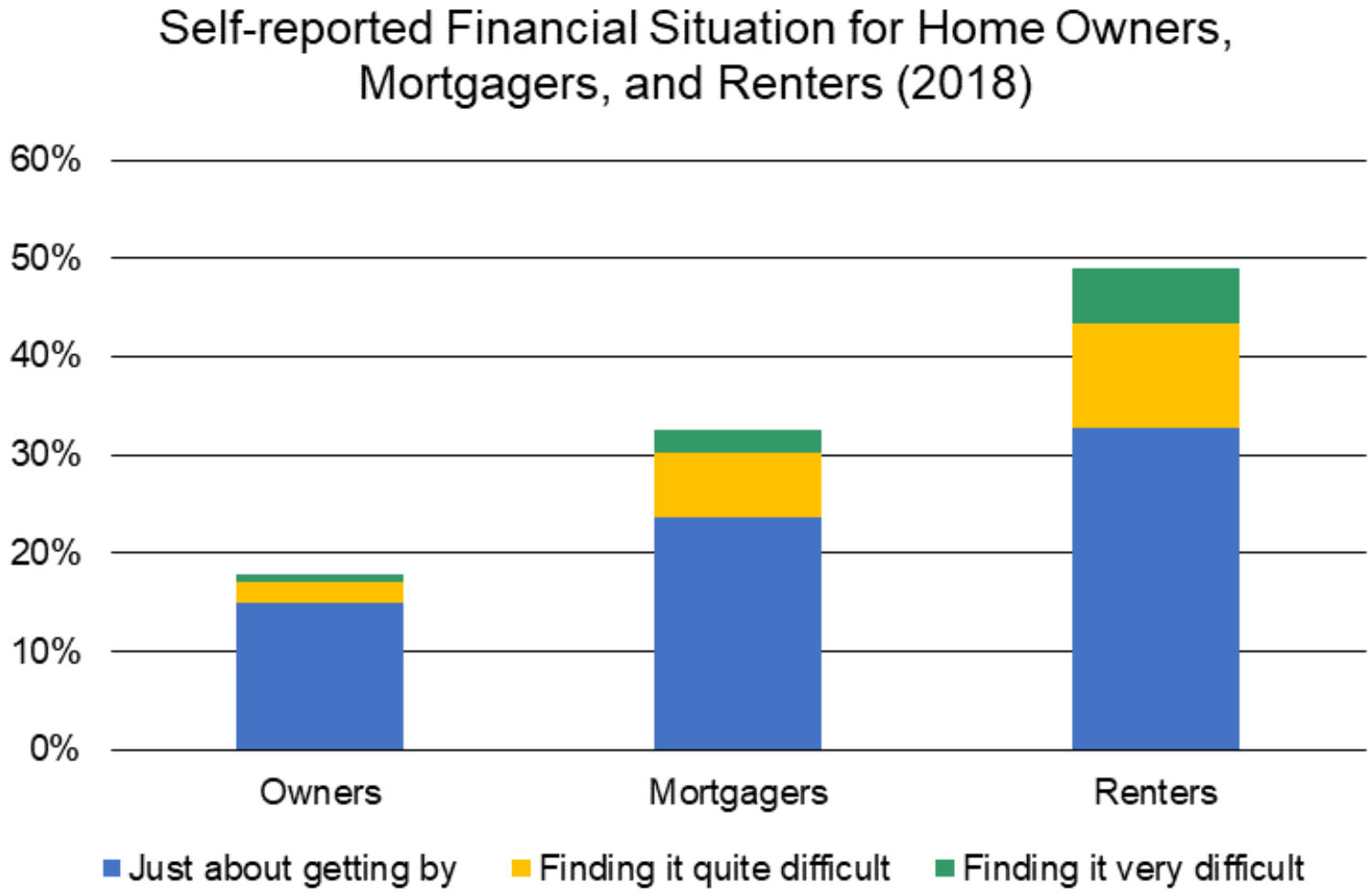
About one third of the population spend most of the cash flows they receive

Source: Authors' calculations based on Cloyne, Ferreira and Surico (2020) using the U.K. household data "Understanding Society"

The research in this paper has been funded by an ERC Consolidation Grant, whose support is gratefully acknowledged.

Back to square 1! Many mortgagors & renters have little cash-on-hands

- One third of the British population self-report their financial situation as “finding it difficult” or “just about getting by”.
- 48% of renters, 32% of mortgagors and 18% of outright homeowners appear on the verge of financial troubles



Source: Authors’ calculations based on Cloyne, Ferreira and Surico (2020) using the U.K. household data “Understanding Society”

The research in this paper has been funded by an ERC Consolidation Grant, whose support is gratefully acknowledged.

The race between supply and demand

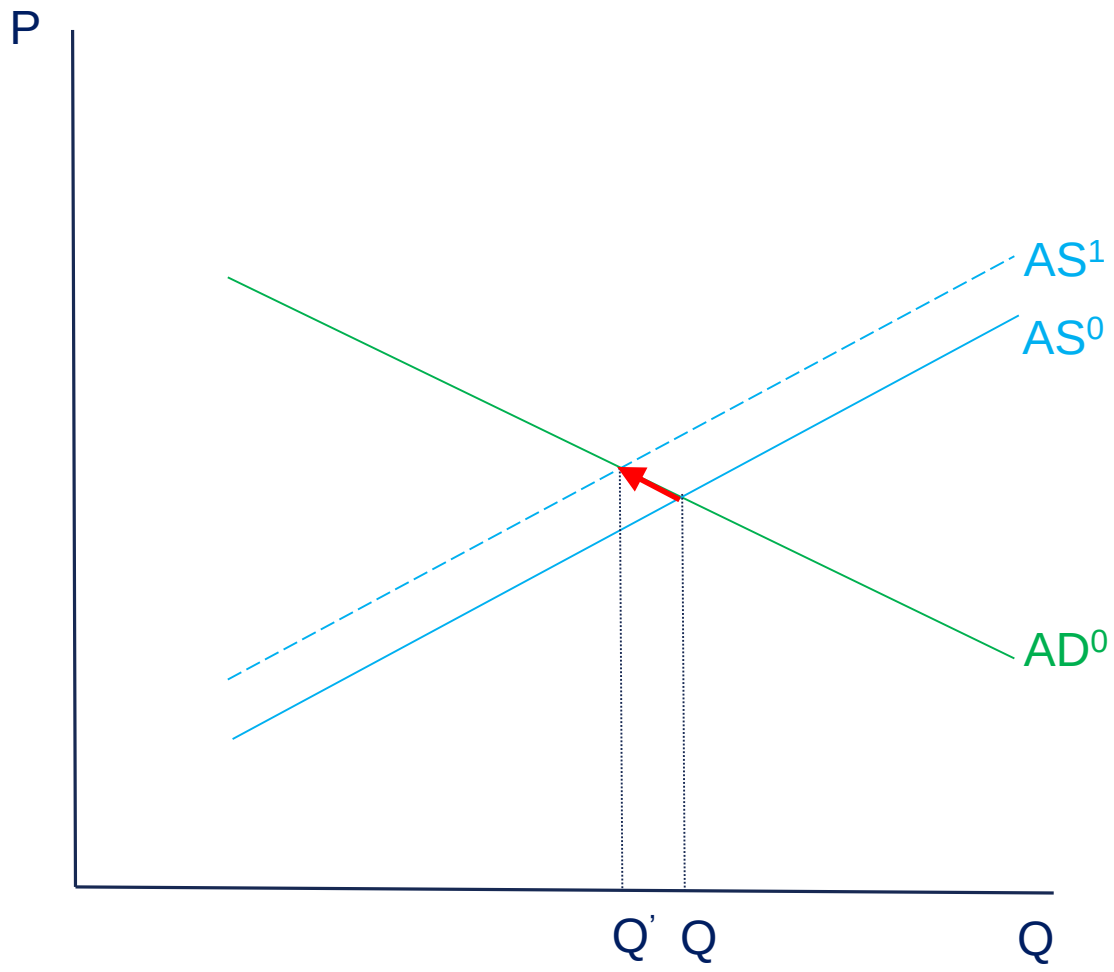
At first, covid-19 may look like a supply shock:

- Disruption in global supply chains
- Quarantine and social distancing decrease the number of hours worked

Aggregate Supply (AS) move from AS^0 to AS^1

Different from previous crises:

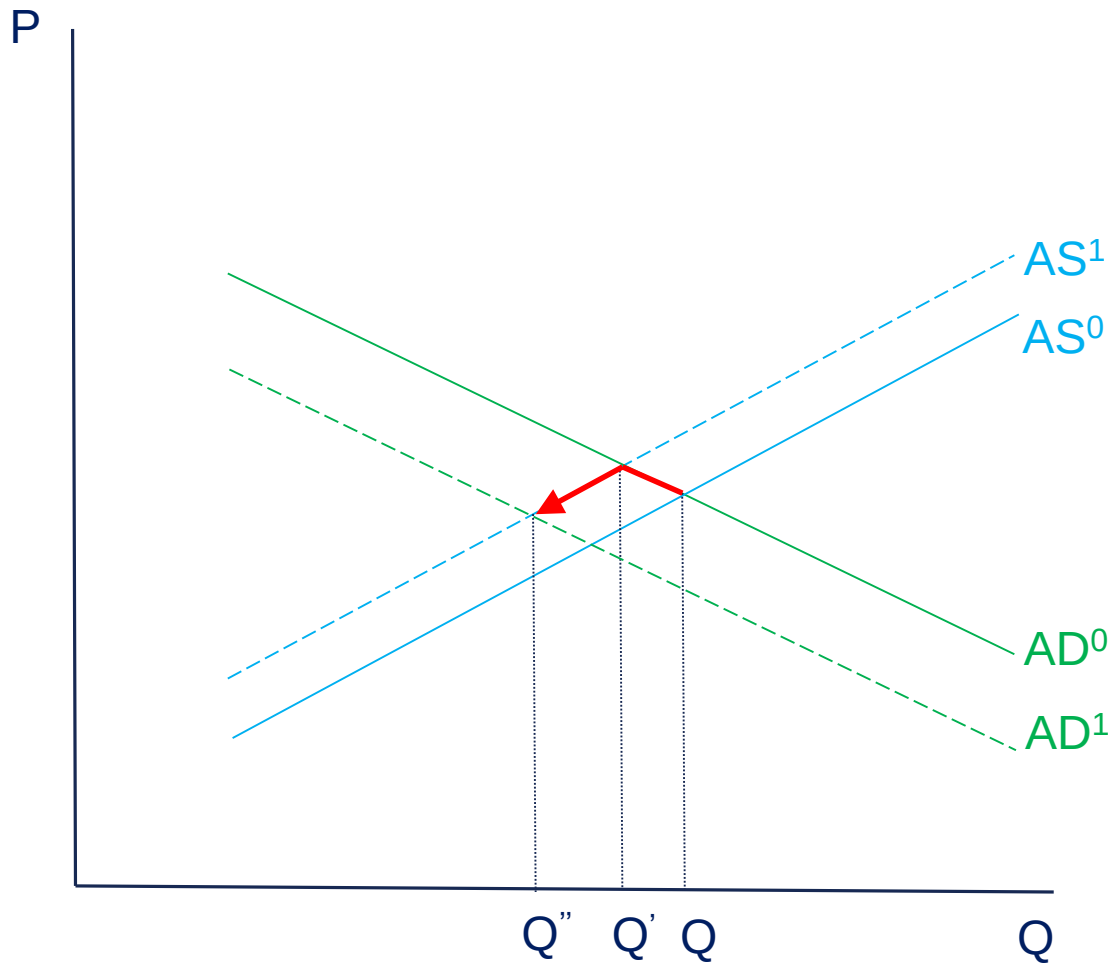
- Great recession of 2007-09: origin of supply shock was in the financial sector
- War/natural disaster: origin of the supply shock is destruction of infrastructure or large-scale permanent loss in labour force.



The race between supply and demand

Then, demand effects materialize:

- Uncertainty about the progress of disease
- Uncertainty about economic policies that will alleviate
- Non-permanent workers will lose income, particularly in affected industries (e.g. hospitality, manufacturing)
- Households increase precautionary savings
- Firms wary of investing until situation clears; also lack liquidity to do so



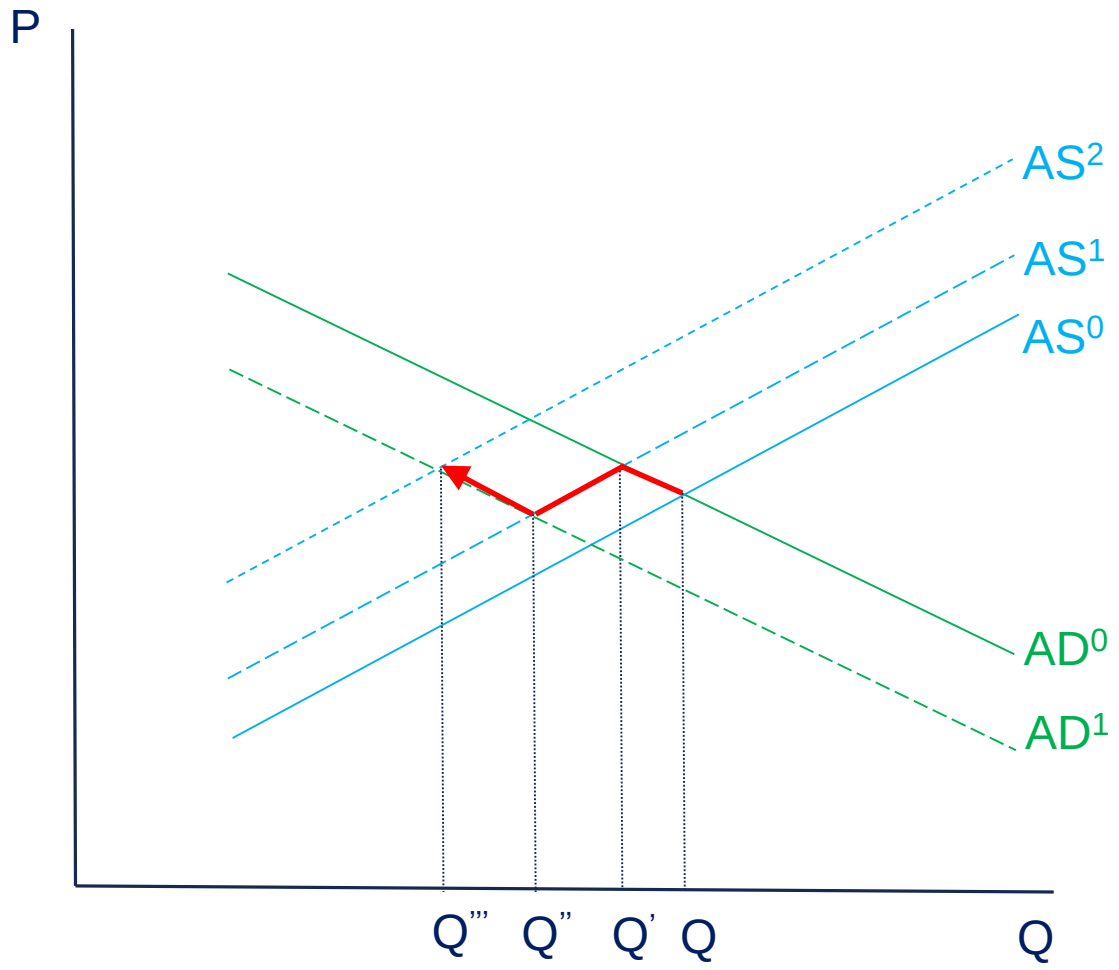
The race between supply and demand

Feedback loop into supply:

- Firms (especially those more dependent on cash flows) lack liquidity to fulfill commitments while facing lower demand and thus are forced to file for bankruptcies.

Demand and supply loop similarly to financial crisis, though uncertainty is about the disease.

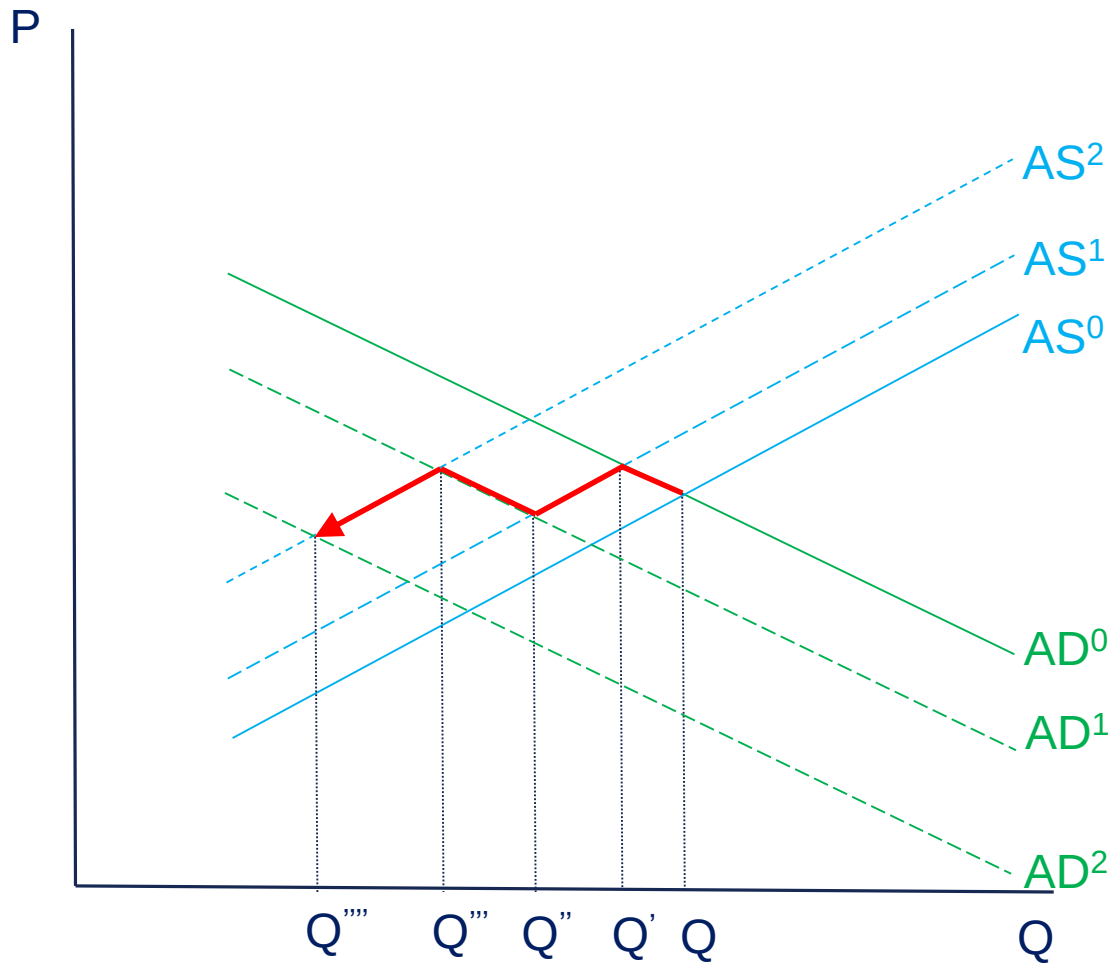
Different from war/disaster: there, demand might increase as governments redirect war efforts towards fight/rebuild and so potentially inflationary.



The race between supply and demand

Feedback loop into demand:

- Workers who lose jobs from closing businesses do not have an income anymore and therefore lower consumption, eventually depressing aggregate demand.

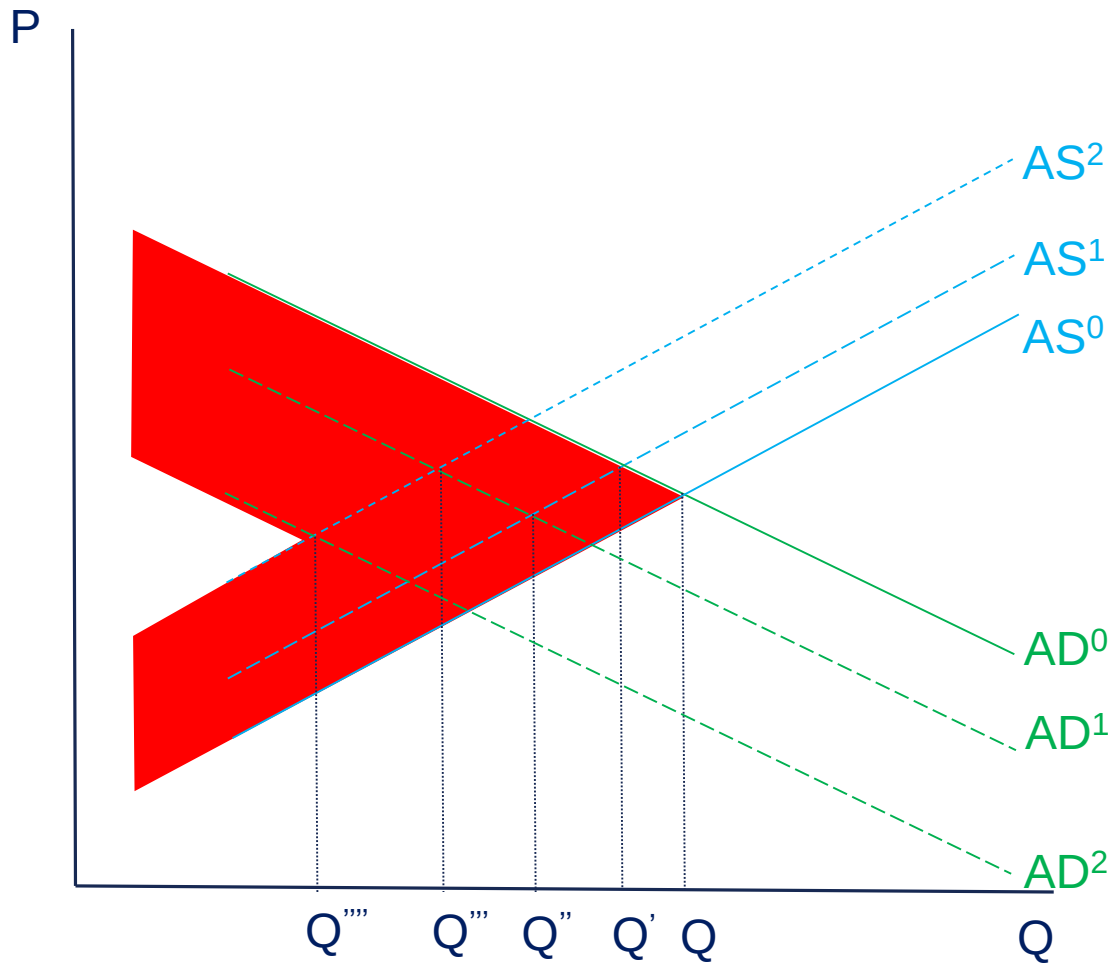


The destruction of economic surplus

Covid-19 virus is not ‘just’ a (large) shock on real economic fundamentals; it is a shock on the frictionless of the market;

it introduces ‘a wall between demand and supply’ with strong complementary feedbacks in the real economy;

contraction in supply, leading to a contraction in demand, leading to contraction in supply…..leading to a large destruction of economic surplus (red shaded area in the chart on the right)

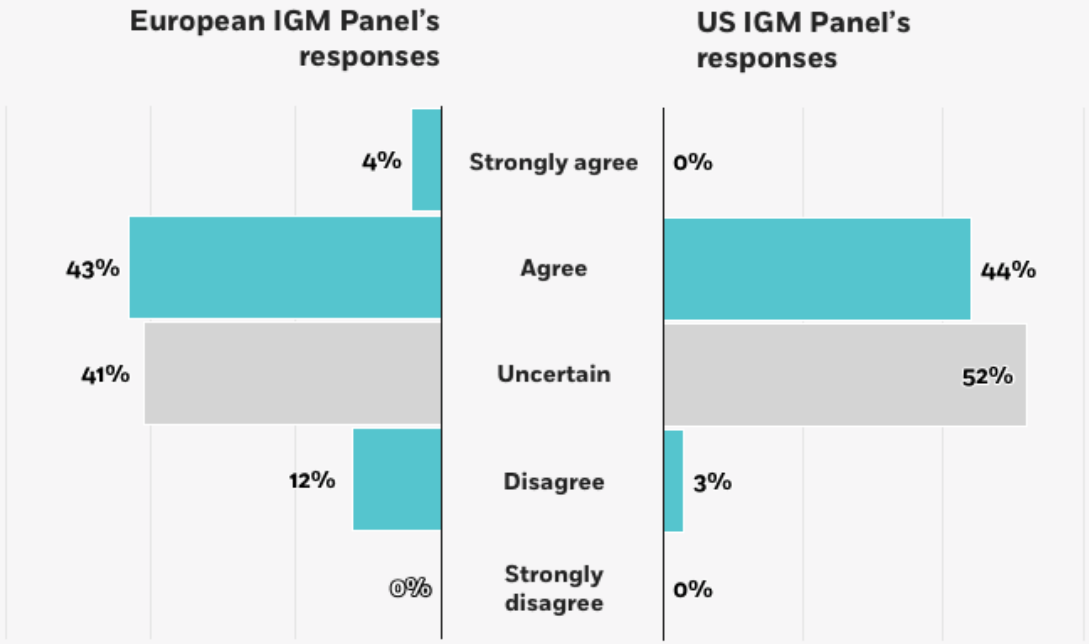


Supply vs demand

- IGM poll of top economists suggest that impact of demand shock will be larger than that of supply

Statement B: The economic effects of COVID-19 coming from reduced spending wil be larger than those coming from disruptions to supply chains and illness-related workforce reductions.

Responses weighted by each panelist's confidence



Source: https://voxeu.org/article/economic-impact-pandemic-igm-forum-survey

Social isolation will increase

- Increase in social isolation during social distancing/quarantine phase
- Costly across demographics..
- .. And particularly so for elderly, whose families are more likely to distance from to minimize chances of contagion
- Older population is both:
  - vulnerable to the disease
  - AND vulnerable to the side effect of the disease

Opinion

Coronavirus and the Isolation Paradox

"Social distancing" is required to prevent infection. But loneliness can make us sick.

By Abdullah Shihipar

Mr. Shihipar studies public health.

March 13, 2020

Source: New York Times (https://www.nytimes.com/2020/03/13/opinion/coronavirus-social-distancing.html)

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Long-lasting impacts to mental health

Research from previous outbreaks requiring quarantine capture the negative impacts of mental health

- Of those quarantined, generally reported ***high prevalence of symptoms of psychological distress*** including low mood and irritability
- ***Fear, nervousness, sadness and guilt*** reported by those quarantined after close contact with SARS
- Some links reported to ***post-traumatic stress symptoms, depression, and alcohol abuse / dependency 3 years later***. 4 times greater post traumatic stress scores for quarantined children
- ***For quarantined healthcare workers***, studies linked significant negative impacts such as stress, exhaustion, detachment, irritability, insomnia, deteriorating performance and potential resignation.
- A recent study about the impact of COVID-19 on healthcare workers in China report symptoms of ***depression, anxiety, insomnia, and distress***, especially for women, nurses, those in Wuhan, and front-line health care workers

Key mitigation tactics include limiting quarantine length as much as possible, allowing for frequent and clear communications, providing adequate supplies, introducing means to reduce the boredom, and importantly providing special support for healthcare workers

Source: Brooks et al, The psychological impact of quarantine and how to reduce it (Mar 2020), Lai et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019 (Mar 2020)

Demand for mental health services is on the rise

Individuals and companies are responding to cries for mental health support during periods of lockdown, working from home, and the additional stress associated with COVID-19

talkspace THERAPY FOR HOW WE LIVE TODAY

65% increase in customers since mid-February

Big Health

50+ companies have signed up or expanded their use

Anthem aetna UnitedHealth Group℠

limeade

Expecting triple digit growth in number of interested companies

Brightside

50% increase in customers since beginning of quarter

headspace

400% increase in company requests

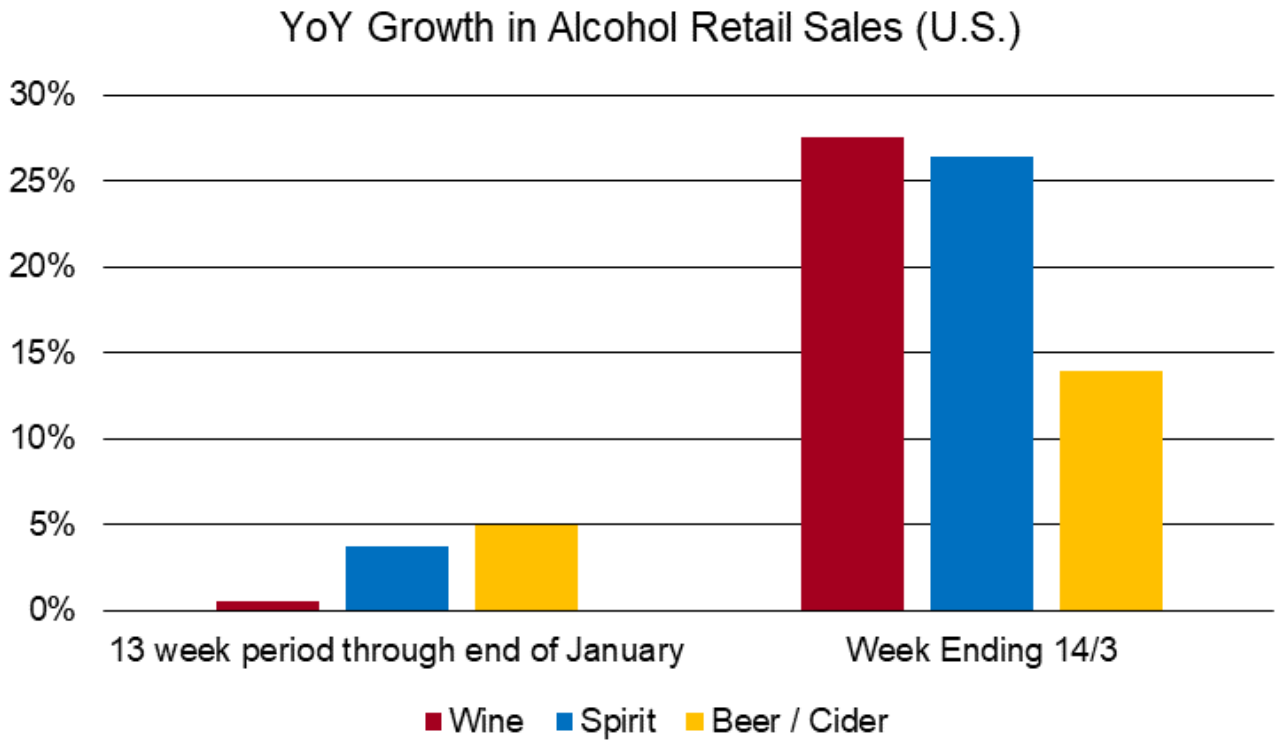
betterhelp

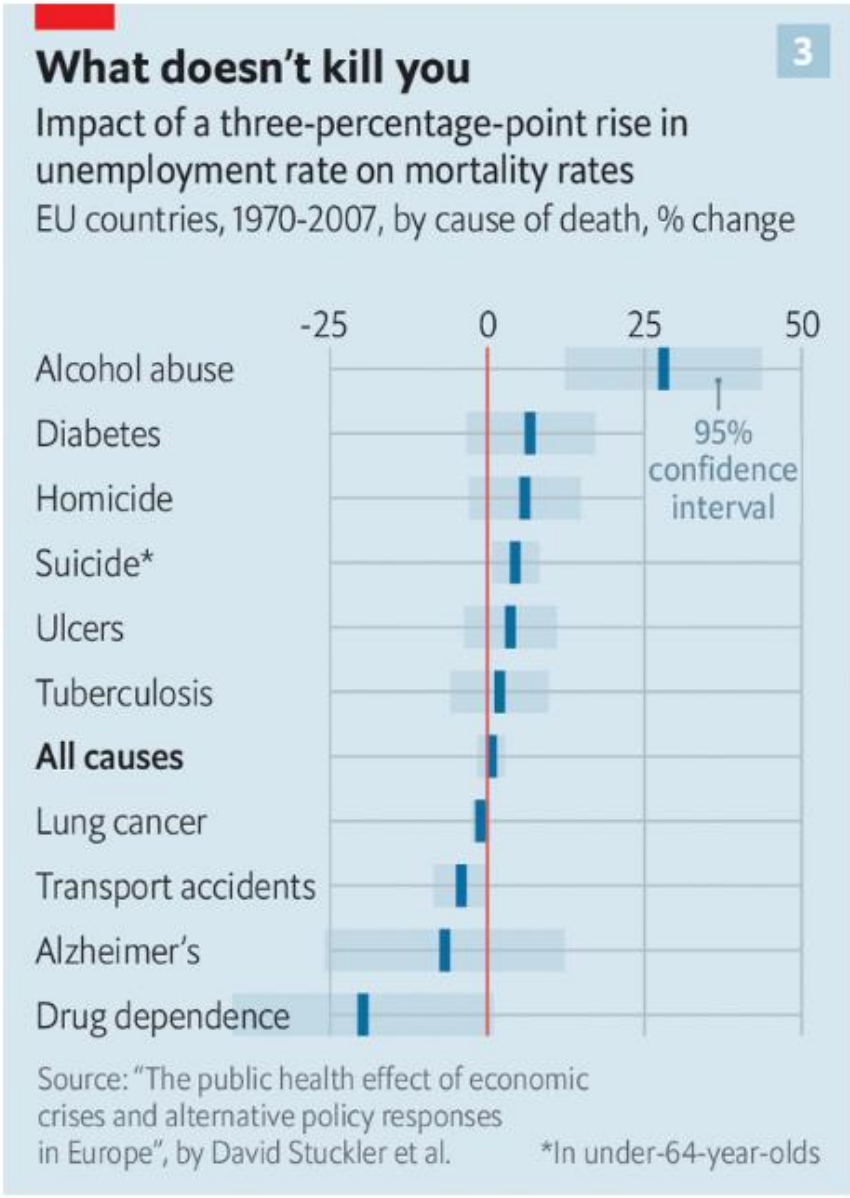
More than doubled new users with stress and anxiety in February YOY

- **Waiving copay or co-insurance for telemedicine or mental health telecare**
- **Expanded services to include virtual outpatient treatment for conditions such as substance use disorders**
- **Providing anxiety and stress management care at no cost**

Source: Coons (1 Apr, Bloomberg Businessweek), Hroncich et al (2 Apr, Business Insider)

Alcohol consumption spiked in March 2020

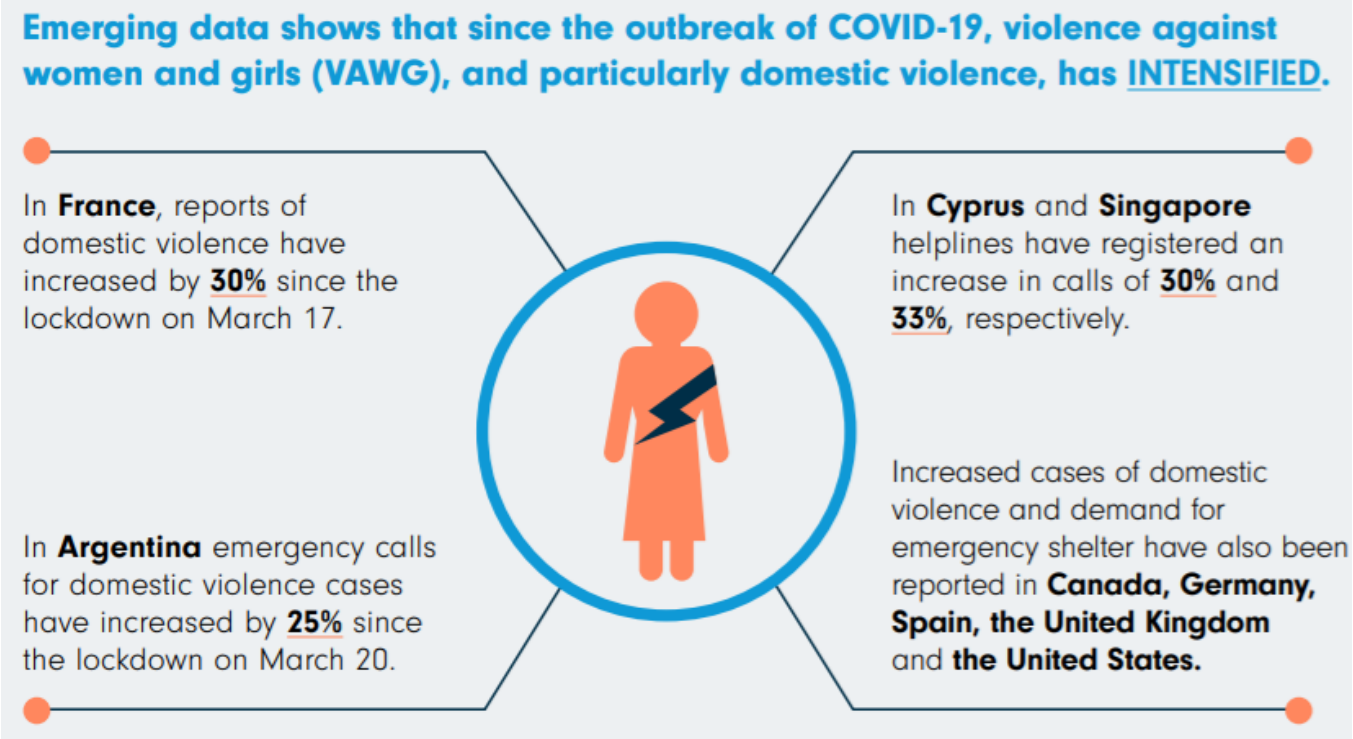




Source: The hard choices covid policymakers face (4th Apr, Economist)
Nielsen Says Beverage Alcohol Retail Sales Are Soaring During The Crisis (25th Mar, Forbes)

Worrying surge in domestic abuse

- As healthcare, shelters, and law enforcement systems are over capacity, effects are being seen in a shadow pandemic – violence against women and girls
- Countries are reporting increased reports of domestic violence; increased demand for emergency shelter; and in some cases, reports of escalated violence intensity
- This comes despite a potential decrease in ability to report, with limited access to phones, helplines, and the justice system for victims
- On top of the increased risk of domestic violence while trapped at home and facing security, health, and money worries, financial uncertainty or loss of a job can further inhibit a woman's ability to leave



Source: UN Women, Violence against women and girls: the shadow pandemic (6 Apr), Fielding (3 Apr, The Guardian)

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Social and economic impacts felt more by women

Over and above the COVID-19 health risks, the pandemic presents disproportionate negative social and economic impacts to women

Prevalence in health and service care putting women at the front line

Women comprise majority of health and service care workers, requiring longer work hours and increased risk of infection

- Women comprise 70% of the health and service care workforce according to WHO analysis of 104 countries
- They also earn 11% less than men in the same field

Impacts of school closures on ability to continue working

Women more often work part time or for less, making their job the one more likely to abandon when children have to stay home

- Women more likely participate in informal work, without the social protection of contracts and legal guidelines according to ILO
- Compounded with wage gaps and less female business owners

Share of unpaid care work increases workload and risk

Women complete 3 times more unpaid care work than men, further exacerbated when relatives get sick

- ILO reports that women complete 76.2% of the total unpaid care work hours globally (80% in Asia)
- This increases the workload during the coronavirus pandemic as well as likelihood of infection

Source: Hutt (12 Mar, World Economic Forum); ILO News, Women still less likely to be active in the labour market than men in most of the world (08 Mar 2018)

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Inequality of opportunities

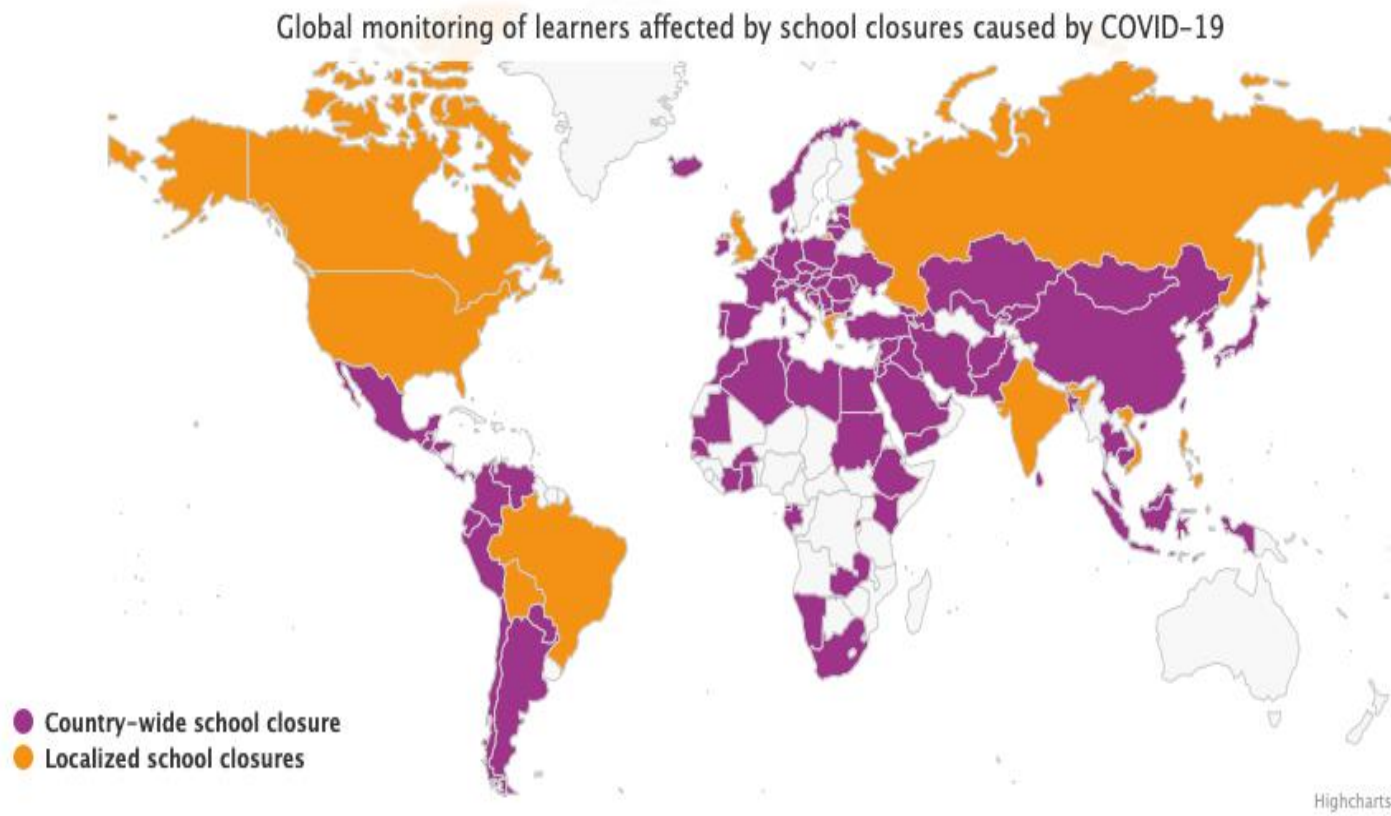
home schooling, internet access and education

More than 770 million learners are now being affected by school and university closures (United Nations).

School closing: “home-schooling” and on-line tutorial

- Empirical studies show strong impacts of quality of parental education on pupil educational attainment and long-term outcomes (Heckman, 2006) Science

Hence, School closing will reinforce this inequality



- Access to on-line resources not universal:

Between 56 million and 80 million people in China reported lacking either an internet connection or a web-enabled device in 2018 (NY Times, March 17)

10% of Households in UK have no internet connection.

- The closures could disproportionately affect children from poor and low-income families, many of whom receive their weekday breakfast and lunch and, in some cases, dinner on campus (LA Times, March 13).

Source: World Economic Forum (https://www.weforum.org/agenda/2020/03/3-ways-coronavirus-is-reshaping-education-and-what-changes-might-be-here-to-stay/)

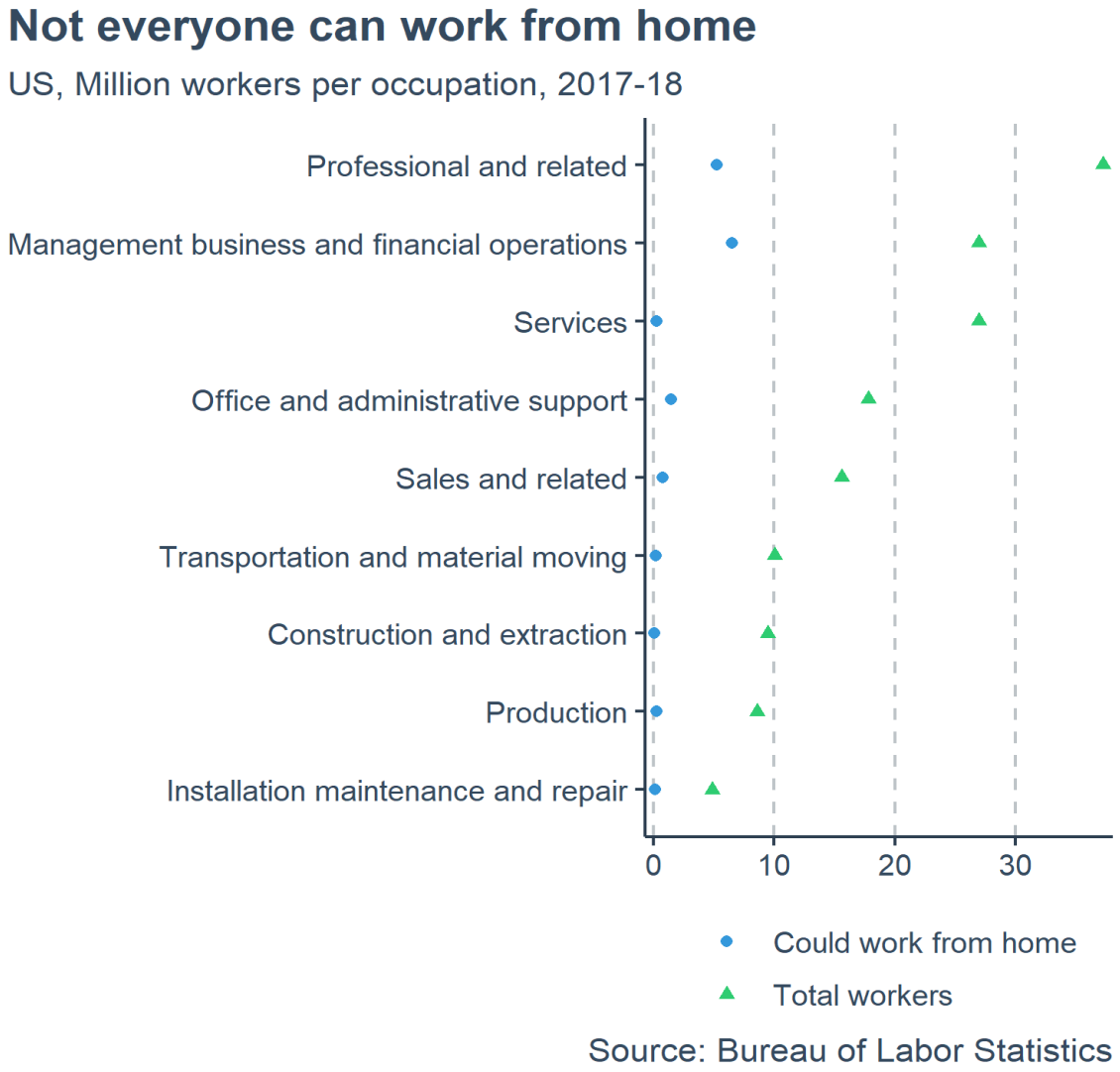
The acceleration of digital learning

- Universities and business worldwide have quickly moved towards remote working and learning for the remainder of the school year
- Despite the disruption, this event has been seen as a critical opportunity for digital learning
  - Companies hope this can become a persistent change
- Zoom, a popular remote conferencing software, has seen a sharp increase in its stock price during the first few months of 2020

Source: Lorenz et all (17 March, nytimes.com), Bary (18 March, marketwatch.com)

Inequality of income
high-earners more likely to work from home

- Less than 10% of American workers could work from home according to a 2019 BLS employee benefits survey
- Proportions varies widely across occupation (see chart) and industry
- Income is also a crucial factor:
  - 0-25th percentile: 9.2%
  - 25-50th percentile: 20.1%
  - 50-75th percentile: 37.3%
  - 75-100th percentile: 61.5%

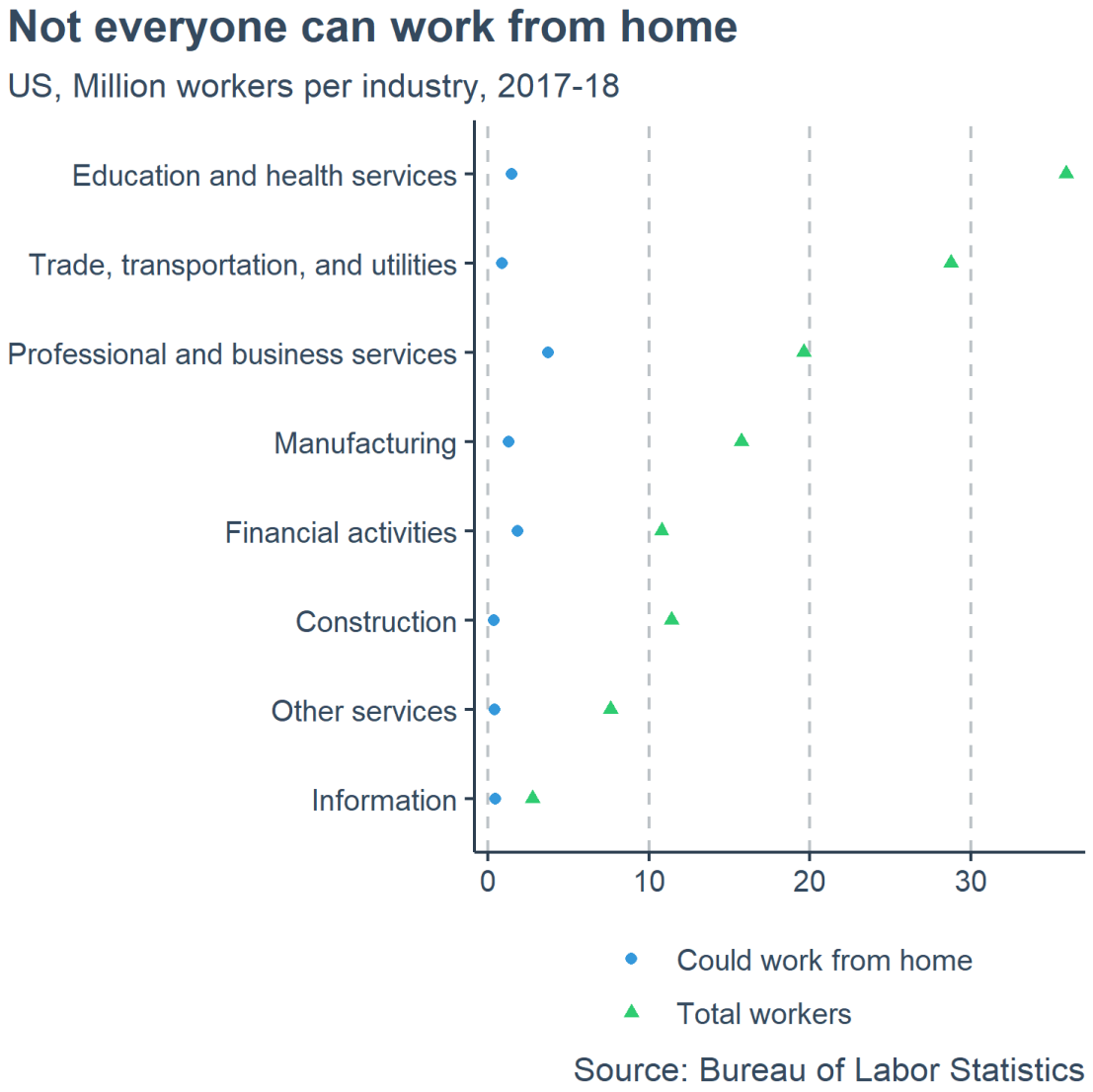


Source: BLS (https://www.bls.gov/ncs/ebs/benefits/2019/ownership/private/table39a.pdf)

Inequality of income

high-earners more likely to work from home

Most workers in education and health; trade, transport and utilities; manufacturing; and construction can hardly work from home.

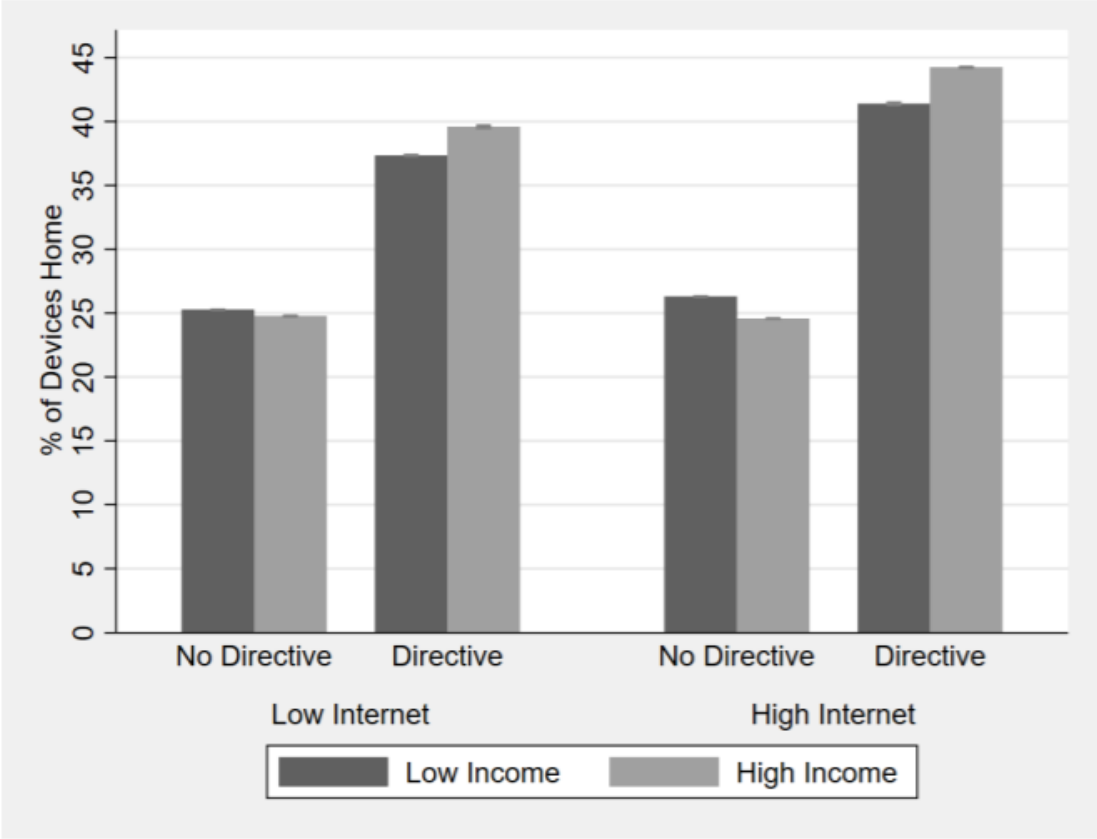


Source: BLS (https://www.bls.gov/ncs/ebs/benefits/2019/ownership/private/table39a.pdf)

Access to internet improves ability to remain at home

High-income individuals with access to high-speed internet were less likely to stay at home prior to containment measures being put in place

Trend reverses when containment measures are enacted, highlighting higher income individuals more likely to stay at home and those with above-median internet connections more likely to stay at home



Notes: February and March 2020 data. High income is defined by whether that PUMA region has above median household income. High-internet is defined by whether that PUMA region has above average broadband penetration.

Source: Chiou et al, (April 2020) "Social distancing, Internet, and Access Inequality". PUMA: Public Use Microdata Areas, with population around 100,000 residents.

Inequality of productivity
high-skilled more likely to work from home

- Firms may reconsider and increase acceptance of remote work going forward
  - More flexibility for workers
  - Lower congestion in cities
- Unequal opportunity:
  - More high-skilled individuals can work from home (education, financial services, corporate jobs; not health professionals) than low-skilled workers (drivers and deliverers, cleaners, distribution supply chain, retail workers, etc.)
  - Skills may correlate with liquidity to sustain brief unemployment spell during the health crisis

Business

Coronavirus forces industries across US to let employees work from home

- Ford, GM and banks tell employees to work remotely if possible
- Impact of shuttering US will take weeks if not longer to assess

Dominic Rushe *in New York*

@dominicru

Fri 13 Mar 2020 17.43 GMT

24

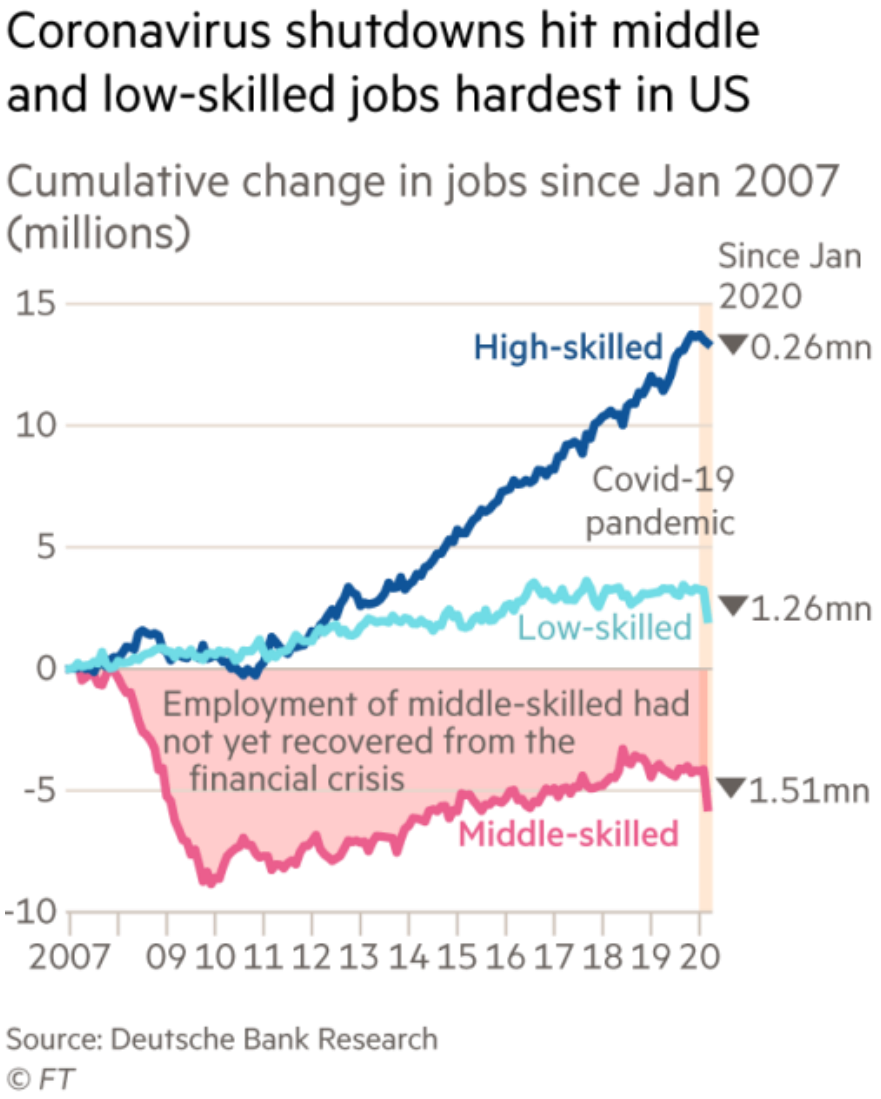
A man wears a face mask as he walks on Wall Street in New York, New York, on Friday. Photograph: Lucas Jackson/Reuters

The coronavirus pandemic swept across US business on Friday as industries from automotive to tech and leisure moved to contain the growing threat.

Source: The Guardian (https://www.theguardian.com/business/2020/mar/13/us-companies-work-from-home-policy-ford-general-motors)

Inequality of opportunities again

lower-skilled workers more likely to lose their job

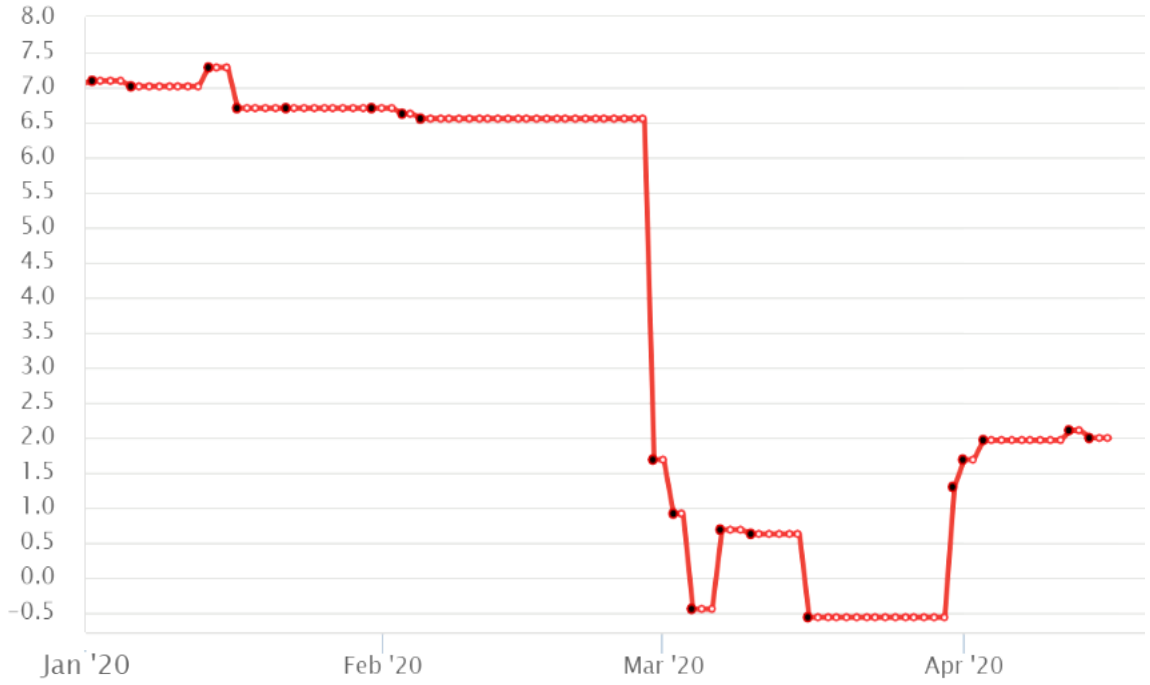


Source: FT Coronavirus Business Update, 8 Apr

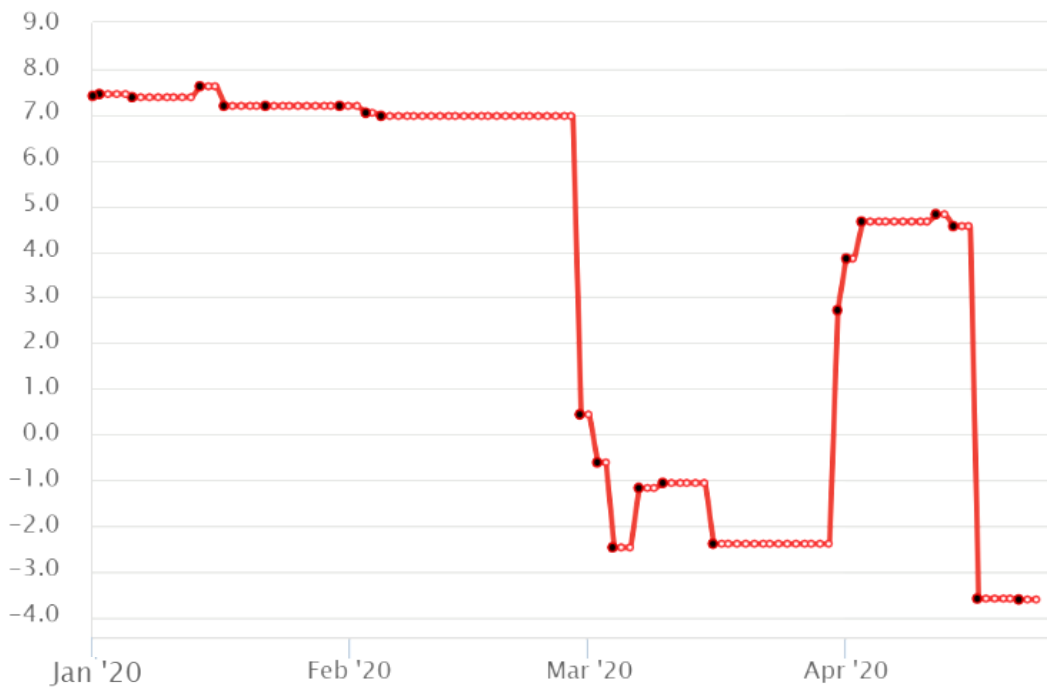
CHINA – NOWCAST AND FORECAST – in real-time, everyday!

*Quarterly GDP growth, **year-on-year, %***

Q1 2020



Q2 2020



Source: live Now-Casting model (24 Apr 2020)

EURO AREA – NOWCAST AND FORECAST – in real time, everyday

Quarterly GDP growth, ***quarter-on-quarter, %***

Q1 2020

Q2 2020

Source: live Now-Casting model (24 Apr 2020)

ITALY – NOWCAST AND FORECAST – in real time, everyday

Quarterly GDP growth, ***quarter-on-quarter, %***

Q1 2020

Q2 2020

Source: live Now-Casting model (24 Apr 2020)

Estimates of vulnerability for other countries

Sick and sicker

OECD countries, vulnerability to lockdowns, April 2020

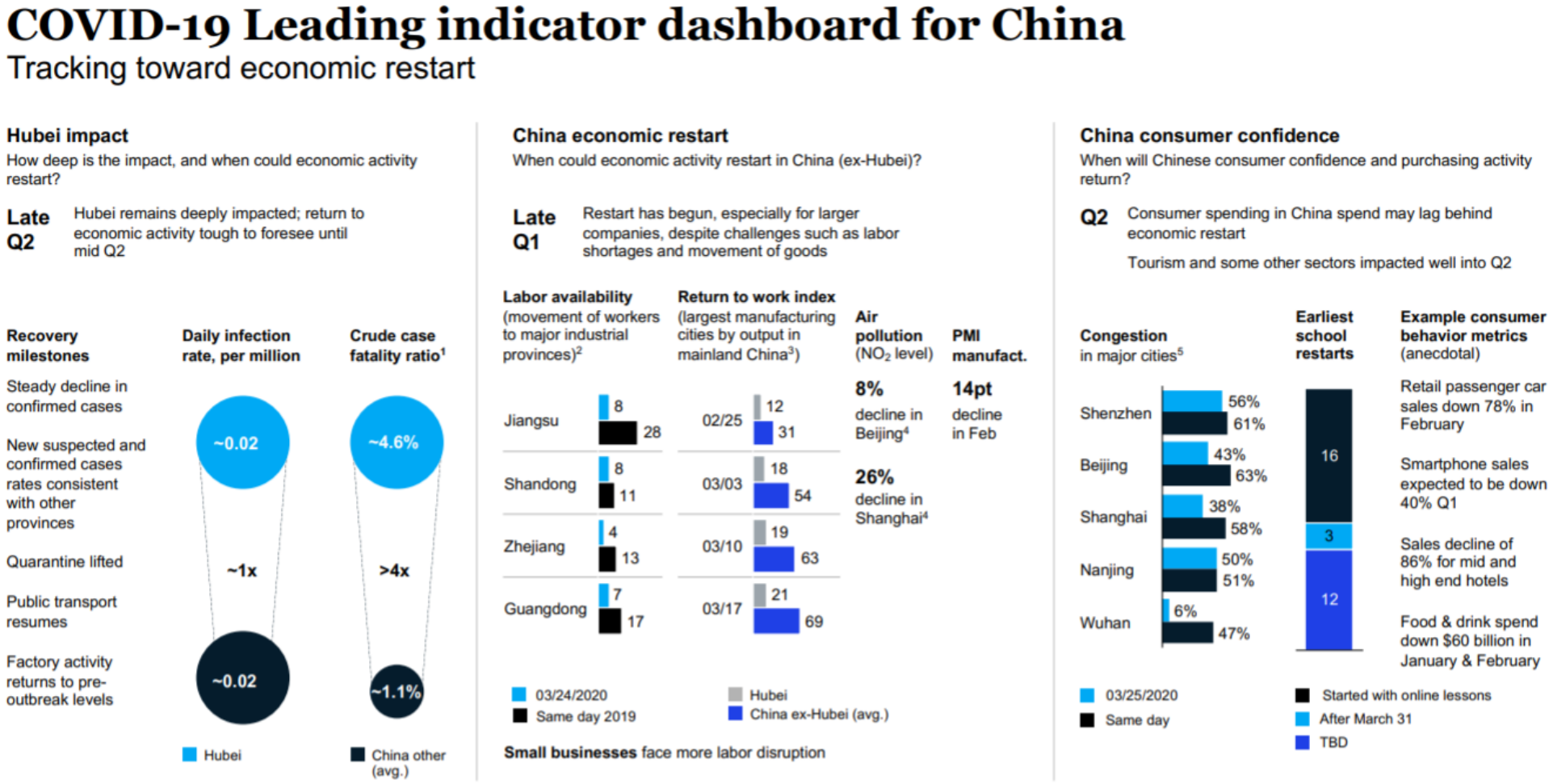
Vulnerability score* Rank out of 33, 1=most vulnerable	Jobs that cannot be done from home, %	Retail, transport and hospitality, % of GDP	Fiscal stimulus† % of GDP
(1) Greece	68	23	1.0‡
(3) Spain	68	24	1.2
(5) Italy	65	21	1.2
(15) France	62	18	0.7
(23) Japan	67‡	22	10
(28) Sweden	56	18	2.2
(29) Germany	63	16	4.4
(31) Britain	56	17	3.1
(33) United States	58	16	6.9

*Average score of five indicators: employment in small firms; ability to work from home; size of retail and leisure sector; fiscal stimulus; focus on job protection †Spending/revenue measures ‡*The Economist* estimate

Sources: "How many jobs can be done at home?" by J. Dingel and B. Neiman; OECD; IMF; World Bank; UBS; Goldman Sachs; *The Economist*

Source: How deep will downturns in rich countries be? (16 Apr, The Economist)

Predictions for economic recovery

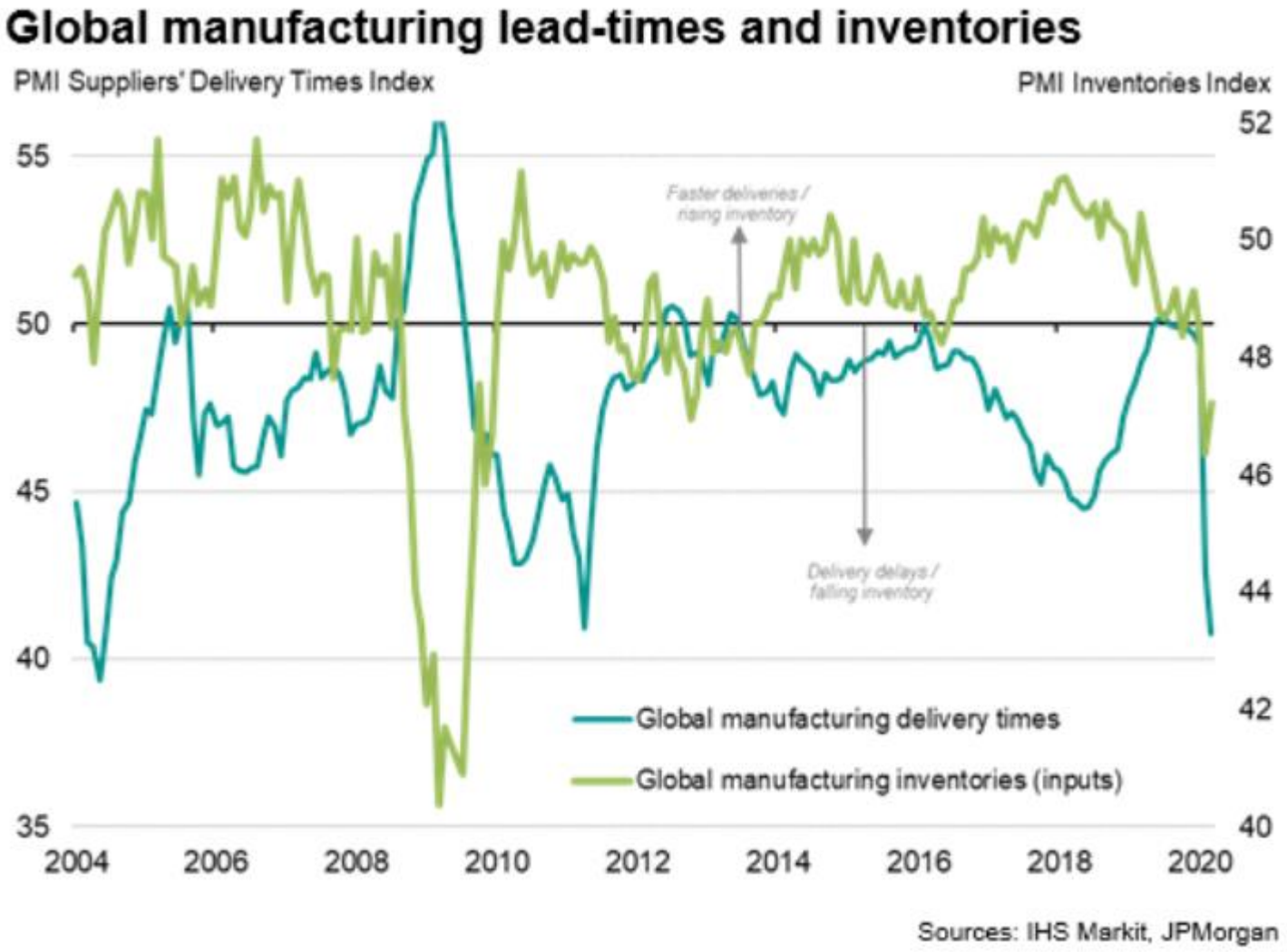


Source: WHO Situation Reports; National Bureau of Statistics of China; McKinsey Global Institute; OCED data, Johns Hopkins CSSE, press research, TomTom traffic index, Baidu QianXi, CDC, New York Times, Reuters, The Economist, Peking University, HSBC Business School, Tencent News, Sina News, Beijing Environmental Protection Monitoring Center, Shenzhen Environment Network

McKinsey & Company 49

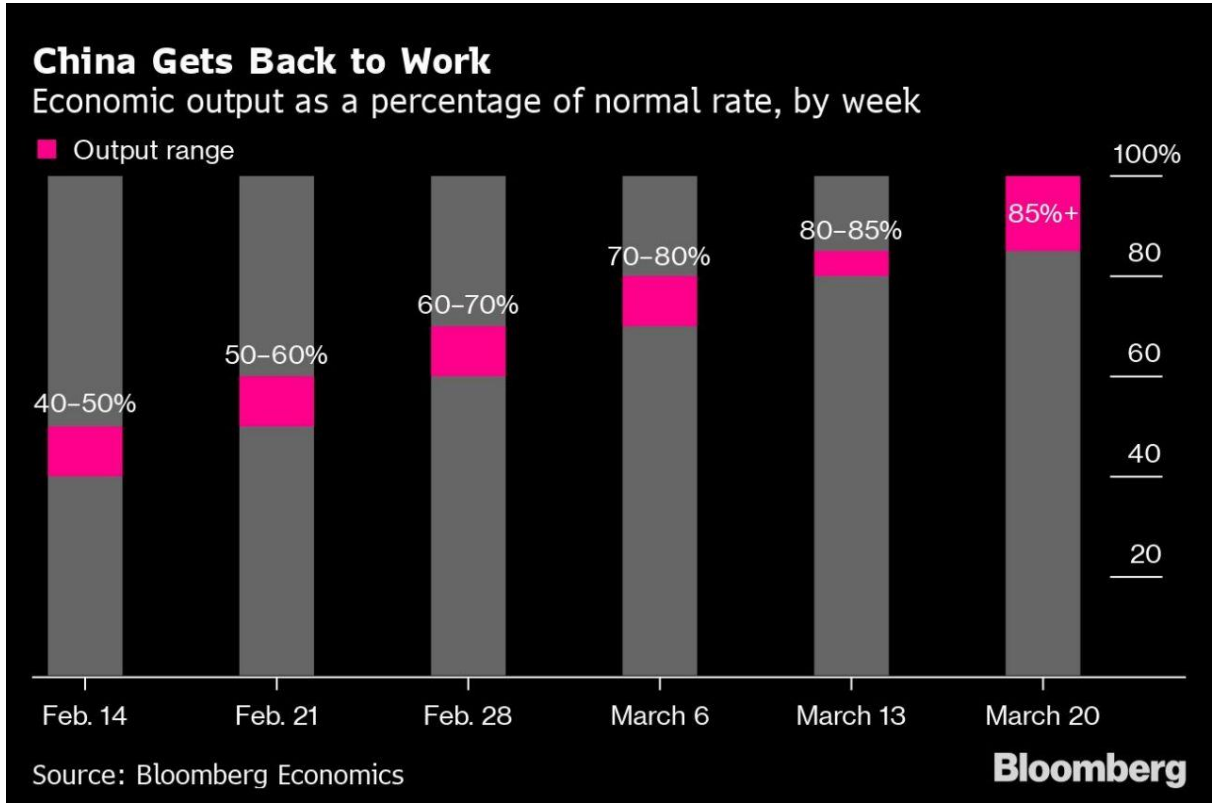
Source: McKinsey Global report (25th March 2020)

Impact on the supply chain



Signs of recovery in China, despite global shift

- Indicators of improvement as restrictions are lifted in China
  - Steel demand and coal consumption of electricity approach normal levels
  - Increase in domestic air travel, traffic, and pollution show reopening of businesses
- Rebound comes after 19% decline in Chinese sourcing in late March
- However, companies and countries have started looking elsewhere to fulfil their supply needs
  - Japan, whose largest trading partner is China, had imports almost halved in February. Now there is government support for multinational companies to leave China
  - GE and SLM report increased interest in 3D printing machines, a solution to single-source manufacturing and logistics challenges in the face of the pandemic



Source: Rees and Burden (21 Mar, telegraph.co.uk), Rapoza (9 Apr, forbes.com), Sutherland (9 Apr, Bloomberg.com)

London Business School

Food supply chains significantly impacted

Abdolreza Abbassian, a senior economist at the United Nations Food and Agriculture Organization, said. “You don’t have labor, you don’t have trucks to move the food, you don’t have money to buy the food.” ®

Sourcing / Production	• ***Migrant workers:*** Millions around the world are being prevented from completing seasonal jobs by border closures, lockdowns, and limited domestic travel options ® • ***Mismatch in global supply:*** Thailand, the second largest rice exporter, has succeeded in exporting from stockpiles at an increased price. But #1 exporter, India, and #3 exporter, Vietnam, decreasing exports due to labor shortages and logistics challenges ®
Logistics / Transport	• ***Air travel:*** Significant trade cargo previously carried on international flights have decreased by 55% since the start of the pandemic • ***Sea travel:*** More than 30 ports worldwide are restricting entry to vessels or prohibiting crew changes • ***Shipping containers:*** Shortage of shipping containers in the U.S. and Canada as lockdowns caused reduced demands and voyages of container ships from China to the West Coast fell 25%
Retail / Sales	• ***Perishable goods:*** Estimated impact of $1.32 billion in US farm losses alone between March and May as perishable food goes to waste • ***Collapse in demand:*** Companies relying on demand from food services are hardest hit. Attempts to deliver to food banks face challenges with logistics, additional costs, and supplying to charities that aren’t set up to handle such quantities of perishable foods

Source: Jadhav et al (3 Apr, reuters.com), Defterios (8 Apr , CNN Business), Liao and Fan (6 Apr, World Economic Forum), Cagle (9 Apr, guardian.com)

Emerging markets face challenges on many fronts

Emerging markets are struggling to acquire supplies necessary for testing or preventing coronavirus as richer countries outbid or divert output, the lack of global trade and logistics capabilities will also severely impact

AFRICA

- Sub-Saharan Africa is 3rd largest rice-consumer but has the smallest grain inventories relative to demand due to limited government budget or storage capacities

INDIA

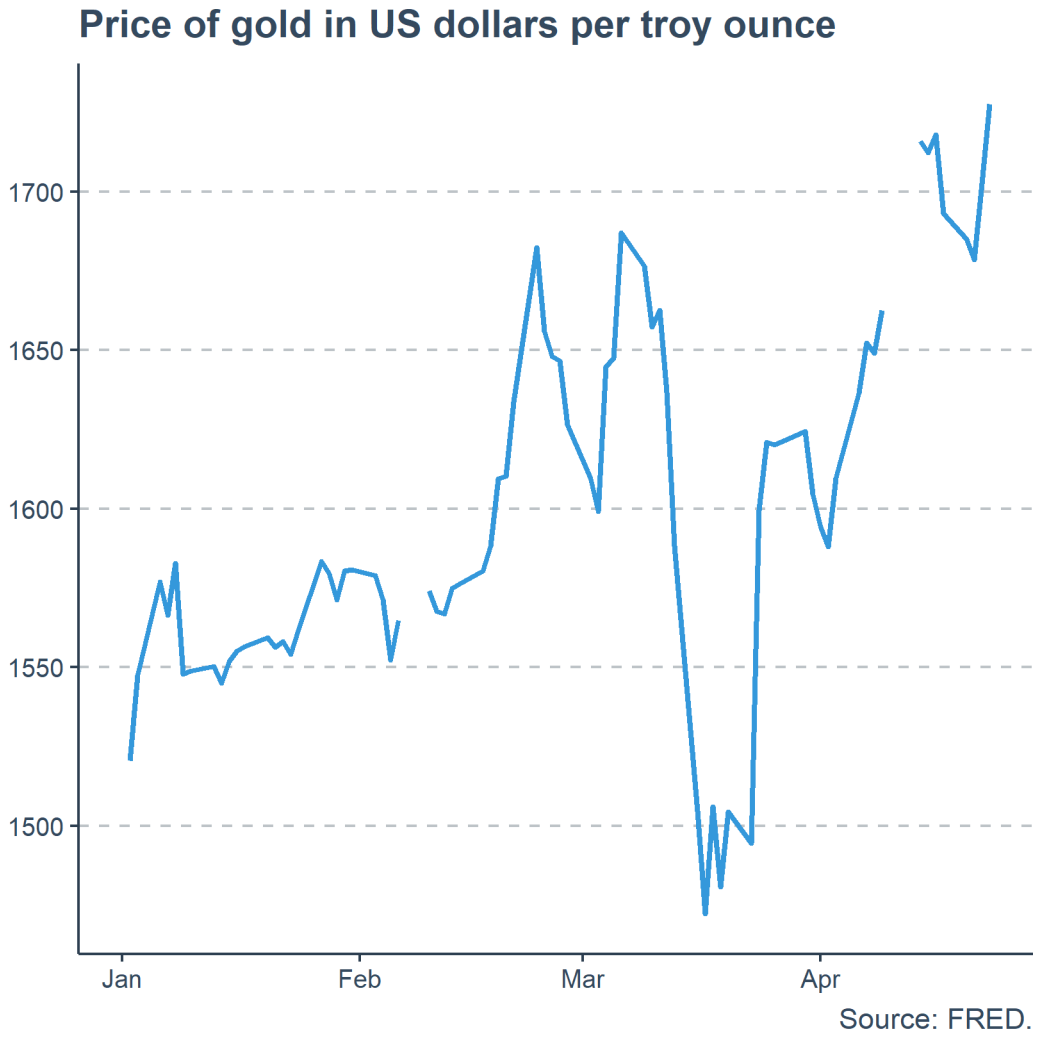
- Many of India's 120 million migrant laborers unable to get home and unable to work

SOUTH AMERICA

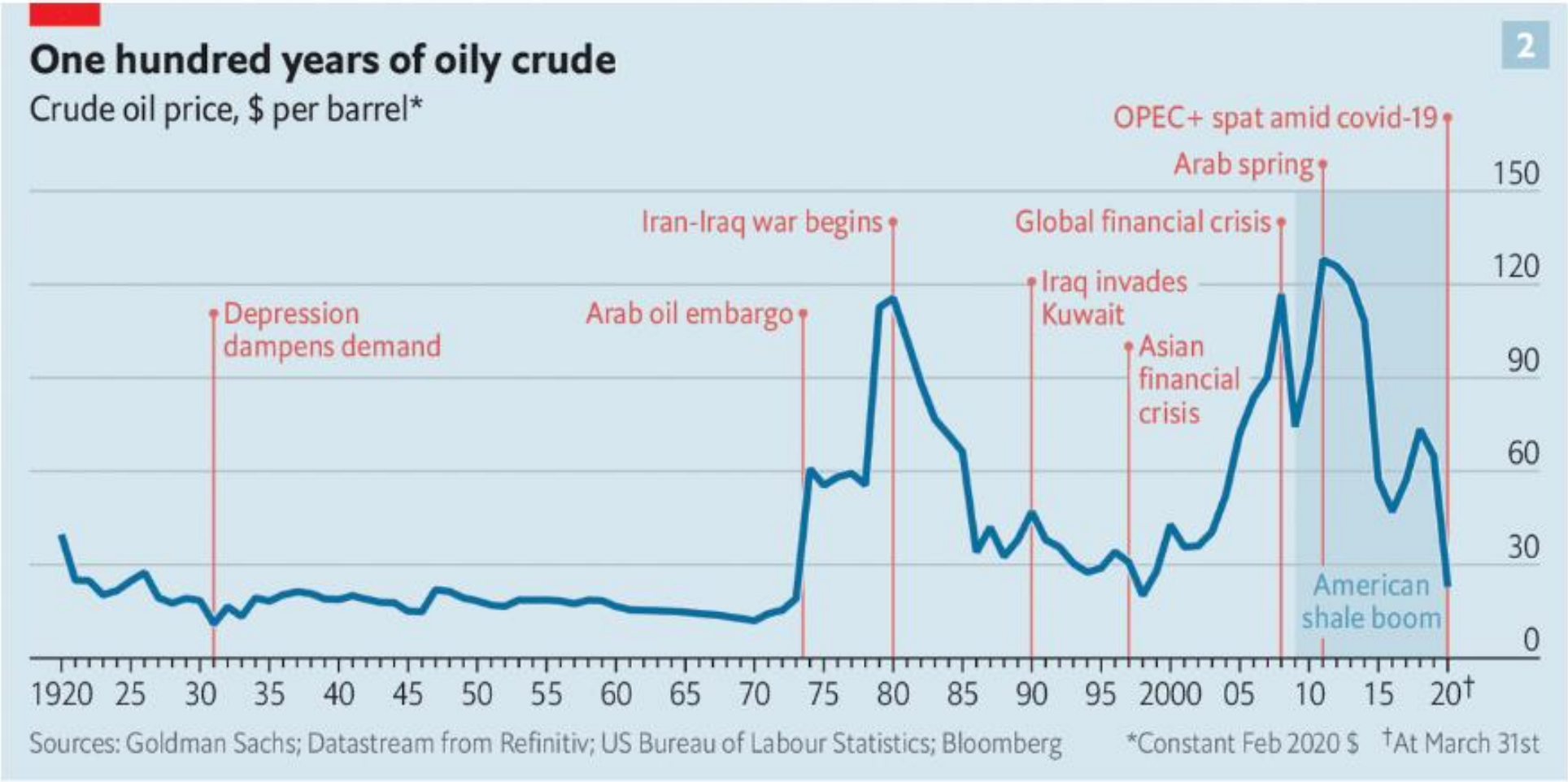
- Top exporter of soymeal – Argentina – faces delays based on increased inbound cargo ship inspections
- Top exporter of soybeans, coffee, and sugar – Brazil – facing issues due to inability to hire truck drivers or farm part shortages despite delays in a national lockdown

Source: Jadhav et al (3 Apr, reuters.com)

The search for a safe haven

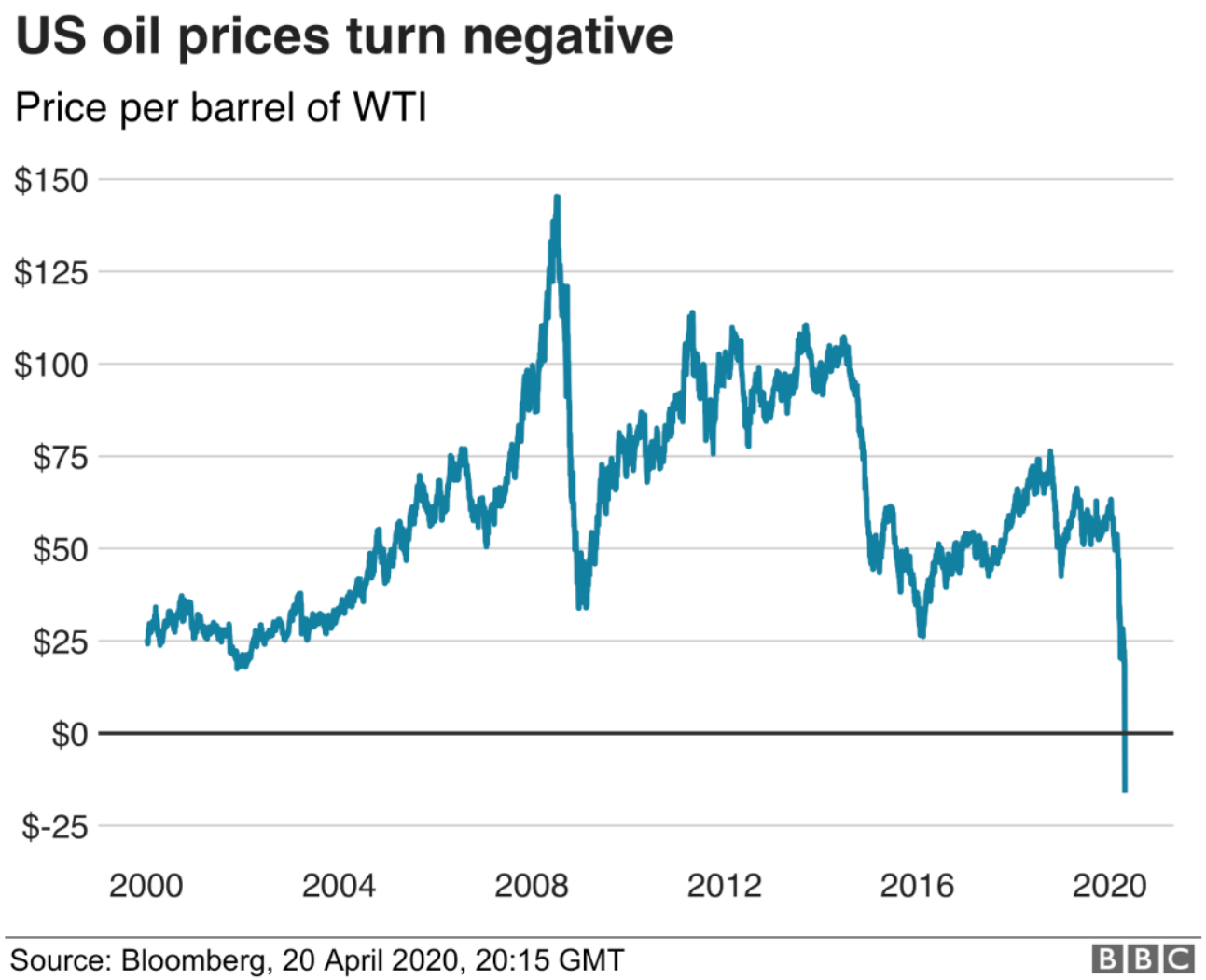


Meanwhile in Russia and Saudi Arabia



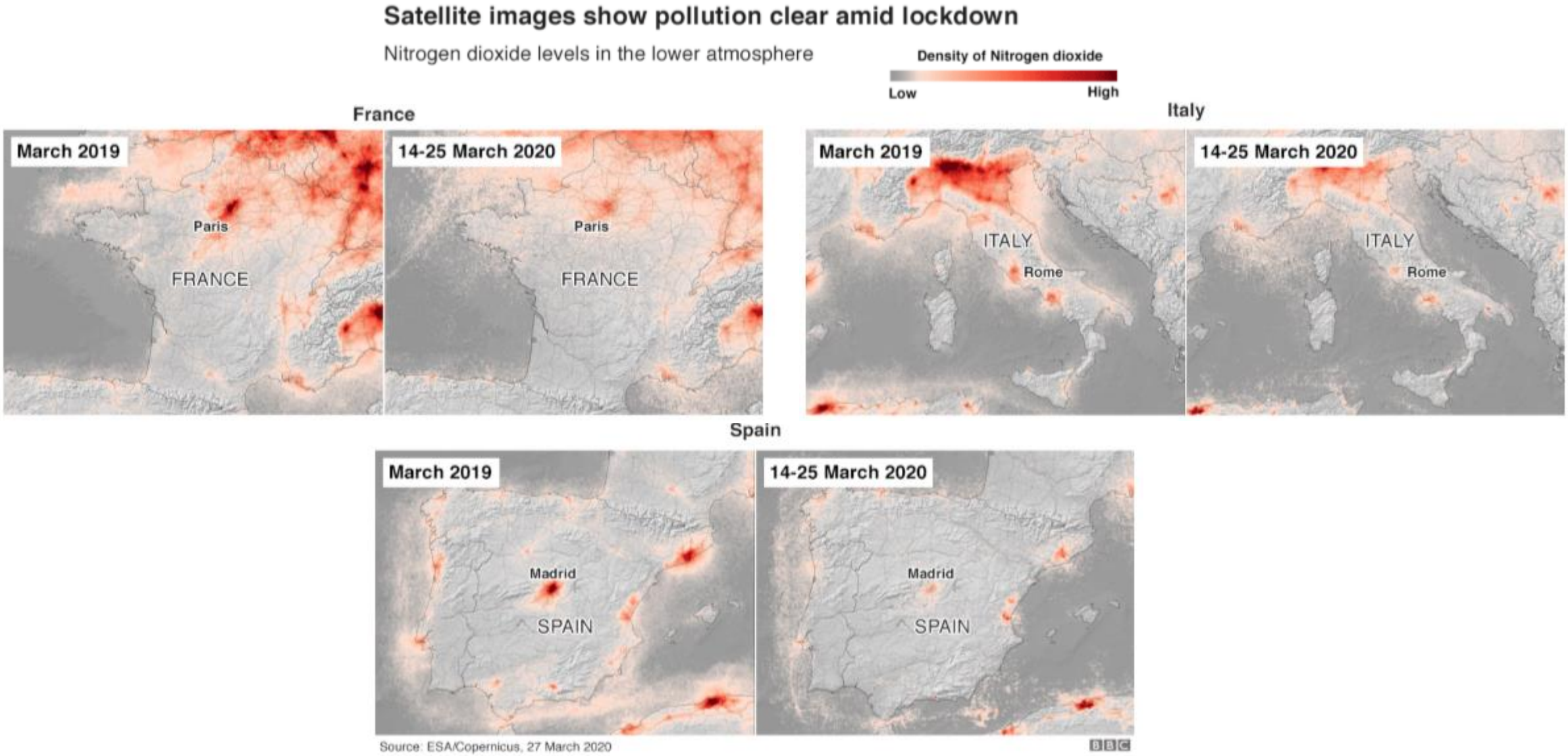
Source: Upside Down (11 Apr, The Economist)

And in the US



Source: US oil prices turn negative as demand dries up (21 Apr, BBC)

Short-run effects: pollution levels decline



Adding economics into an epidemiology model

- Goal: reassess the health and economic trade-offs of different containment policies.
- The SIR-Macro model assumes that individual transition from susceptible to infected is not exogeneous, but depends upon the economic decisions that are made:
  - **Supply effect:** people get sick resulting in less labour
  - **Demand effect:** people consume less because going out puts them at risk
- Incorporating a reduction in consumption and labour hours results in predictions of a larger and more persistent recession, but fewer deaths than when individuals' health statuses are assumed to be exogenous to economic conditions
  - Larger decline in consumption of 4.7%, versus 0.7% when consumption reduction is not a factor
  - Peak percent of population that suffers infection is 5.2% versus 6.8%
  - 54% of population gets infected versus 60%, equating to 220k fewer deaths in the U.S. alone

Source: Eichenbaum, Rebelo and Trabandt (2020, NBER wp 26882): "The Macroeconomics of Epidemics"

The health and economic policy trade-offs

Scenario	Optimal Policy
Base Case Economic decisions have an impact on an individuals likelihood of contracting the virus	Gradual Ramp-Up Build up a fraction of population to be immune, curtailing consumption when infection rates spike, and slowly retracting as critical immunity level is reached
Medical preparedness If the mortality rate depends on the number of infected people (e.g. healthcare systems are overwhelmed)	More Aggressive Containment As more people die from the disease, the cost to everyone is higher. People further reduce consumption and less people recover from the disease
Discovery of Treatment Probability of discovering a treatment (e.g. a cure for infected people, not a prevention for future infections)	Gradual Ramp-Up Similar results to the base case, with a smaller recession given people are more willing to engage in market activities
Discovery of Vaccine Probability of discovering a vaccine (e.g. a prevention for susceptible people from becoming infected)	Immediate and Severe Containment Minimizes deaths, cause a large recession, hoping that a vaccination is found before infections rise

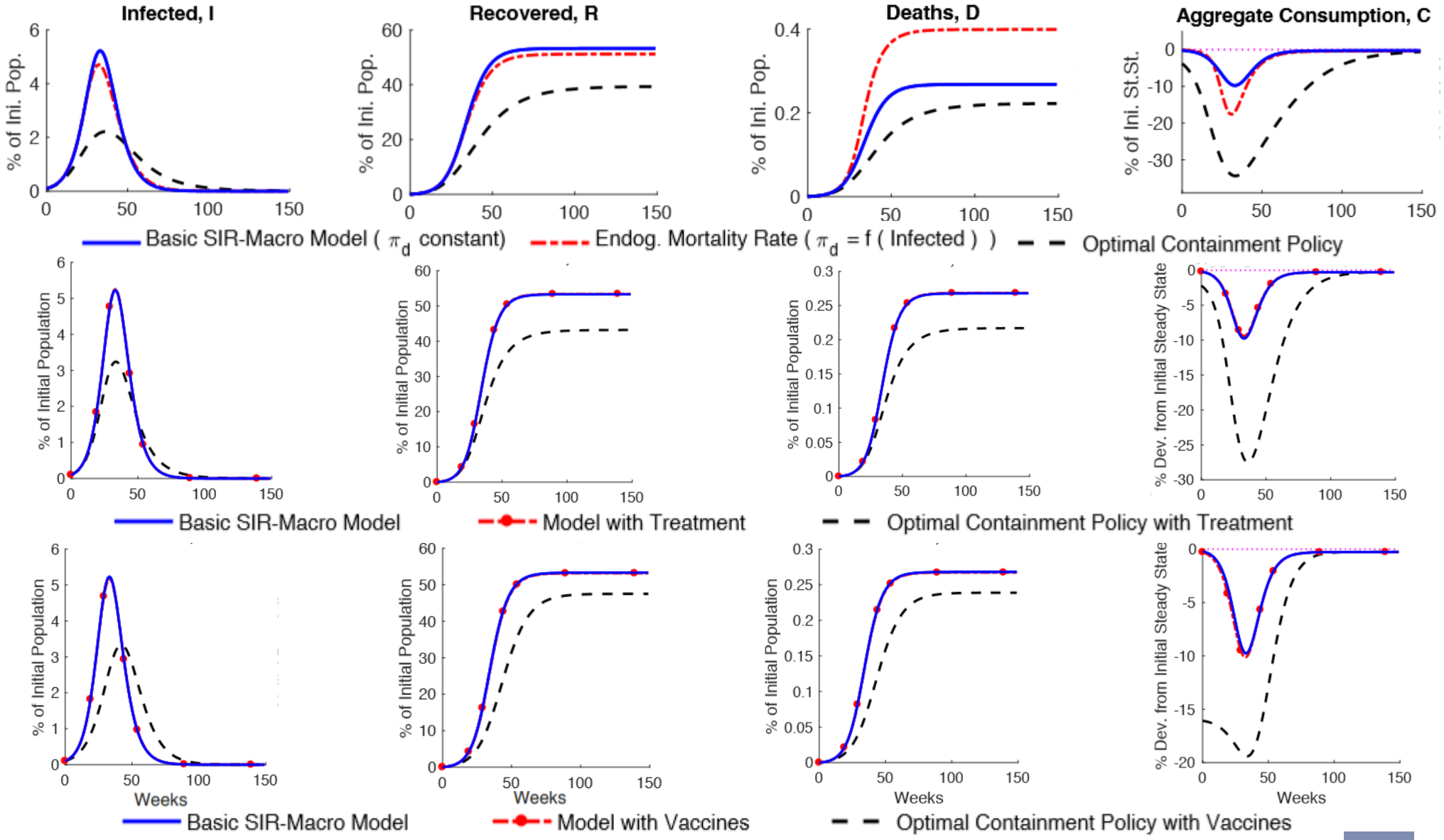
Source: Eichenbaum, Rebelo and Trabandt (2020, NBER wp 26882): "The Macroeconomics of Epidemics"

Health and economic outcomes by scenario

Medical preparedness

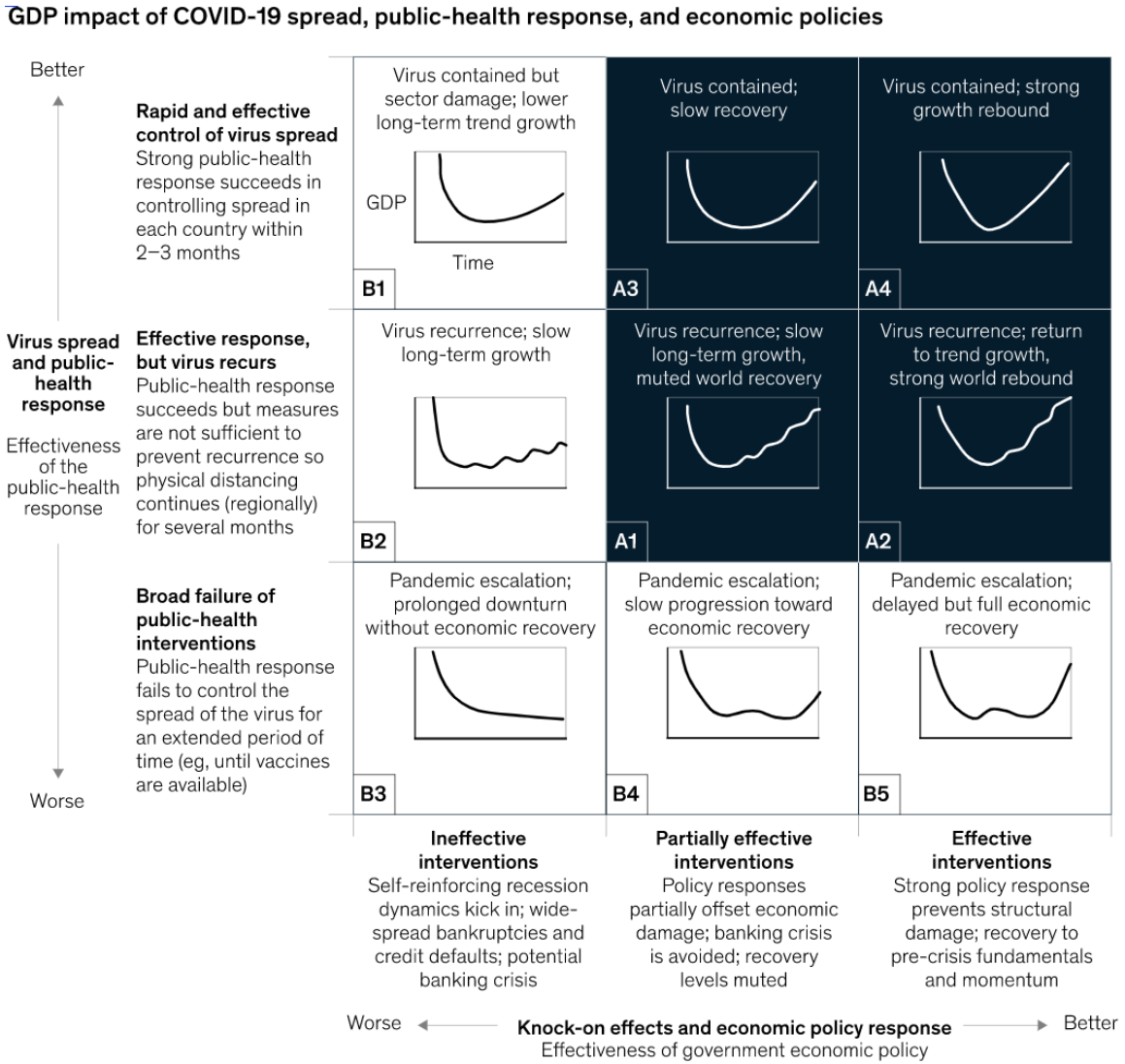
Discovery of Treatment

Discovery of Vaccine



Source: Eichenbaum, Rebelo and Trabandt (2020, NBER wp 26882): "The Macroeconomics of Epidemics"

Potential impacts of action / inaction



Source: “Safeguarding our lives and our livelihoods: The imperative of our time,” Sven Smit, Martin Hirt, Kevin Buehler, Susan Lund, Ezra Greenberg, and Arvind Govindarajan

Summary of part 3 (economics)

- Global recession seems inevitable, possibly in emerging markets too.
- Overall, demand effects probably much larger than the initial supply shock.
- Uncertainty, panics and lock-down policies key to drive large drop in demand.
- The investment of many firms (esp. *small* and *young*) and spending of many households (esp. *renters* and *mortgagors*) depend largely on cash flows.
- Large drop in demand thus force these firms to close. This leads to a rise in lay-offs and a further drop in consumption. Economy enters a depressing loop!

Full set of slides available at https://sites.google.com/site/paolosurico/covid-19

Next video: A user guide to Covid-19. Part iv – policy options

This Lecture

1. Science
2. Health policies
3. Economics
4. **Macroeconomic policies**

A four stage strategy?

Link: https://www.youtube.com/watch?v=nSXIetP5iak

Health policies and health expenditure

- At the FIRST sign of a highly contagious disease, isolate immediately the more vulnerables (e.g. the old) and test ‘at random’ representative samples of the population to identify the most contagious groups.

- Those who test positive need to self-isolate, independently of the symptoms.
- Trace the positive case and keep testing and isolating (more on next slide).

- Expand intensive care capacity (both beds and equipment) by building new units or convert available estates (e.g. hotel, barracks, etc)

- If the contagion is geographically concentrated, spread non-pandemic-related intensive care cases to other regions.

A simple policy proposal

Random testing, statistical analysis and surveillance

1. Test a representative sample of the population (independently of symptoms), recording socio, economical, demographic and locational characteristics at the household level

2. Use standard statistical methods to infer the household characteristics most likely to predict whether someone is infected or not in the whole population

3. Develop surveillance strategies based on the information revealed in (2): nation-wide contact tracing, targeted social distancing.

Collecting the right data and conducting extensive statistical analysis can save MANY lives!!!
Goal: prevent a 2nd peak and flatten the contagion curve that may spike again in the Fall 2020.

Direct and Indirect Effects on the economy

- Round 1: supply side disruptions and large death toll generates heightened uncertainty and panic for households and businesses

- Round 2: heightened uncertainty and panic leads to drop in consumption and investment.
- Round 3: large drop in demand dries up corporate cashflows, triggering firms' bankruptcies
- Round 4: layoffs and exiting firms generate sharp rise in unemployment
- Round 5: Labour income fall significantly and non-performing loans spike up, which weakens demand and increases uncertainty further. Back to round 2 for another loop!

Indirect effects 2-to-5 potentially very large but not unprecedented by historical standards.

Major macroeconomic cost is associated with the suppression strategy to solve the health crisis.

Flattening the recession curve

- Short-run trade-off between flattening the epidemic curve and the size of the recession. Slowing down the peak of infections is likely to prolong the time that the economy is not at full capacity

- Economy is complex, made of interconnected agents (suppliers, customers, consumers, workers, banks)

- Individually rational decisions can cause a catastrophic chain reaction:

  i. Consumers not spending because self-isolated

  ii. Firms cut costs and reduce workers, default on loans and suppliers

  iii. Banks with non-performing loans will cut lending

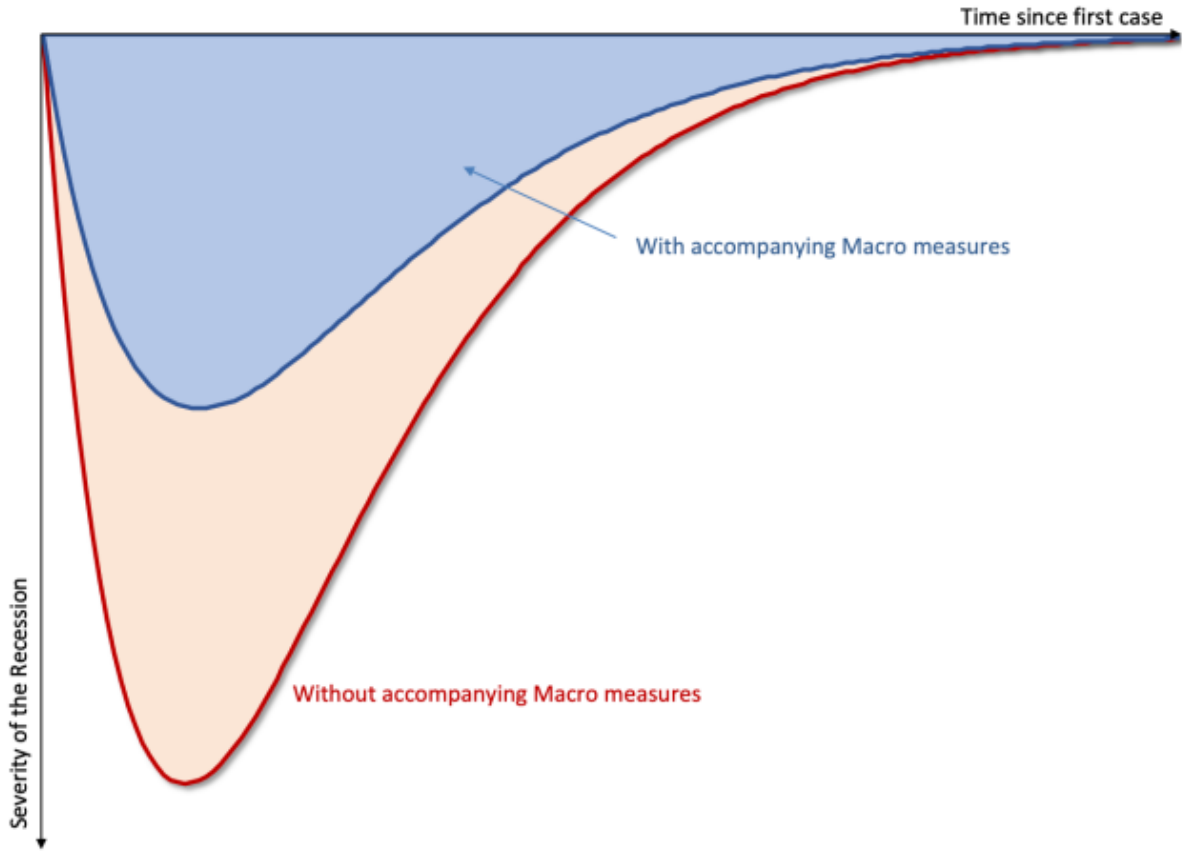


Figure 2: Flattening the Recession Curve

For health, isolation has positive externalities.
For the economy, isolation has negative externalities.

Source: Gourinchas: "Flattening the Pandemic and Recession Curves", 13 March 2020

Economic costs of a suppression strategy

Assume only a temporary drop in economic activities: 50% for a month and 25% in the two following months. Then, GDP drop of almost 10% of annual output! (Gourinchas, 2020).

Make the countries lock down longer and add the supply/demand downward spiral, then the actual costs (without policy interventions) could exceed 15% of GDP!

Output loss associated with the Great Recession was about 4.5% and still unrecovered.

Output loss associated with the Covid-19 crisis likely to be permanent. A global recession in the advanced world is inevitable and a recession in China seems now likely already in 2020Q2!

TREASURY
CORONAVIRUS
TRY NOT TO PUT YOUR HEAD IN YOUR HANDS AFTER LOOKING AT THE LATEST ECONOMIC FIGURES

What macroeconomic objectives?

1. Ensure households delay mortgage/rental payments and have cash-on-hands.

2. Ensure workers receive paychecks even in quarantine or if temporarily laid off.

3. Ensure firms have enough cash flows (to pay workers and suppliers), especially small and young businesses, and can avoid bankruptcy.

4. Support financial system to avoid the health crisis becomes a financial crisis.

What macroeconomic policies?

A. Government spending on public health sector.

B. Tax relieves, tax cuts, tax holidays, tax incentives.

C. Tax rebates and temporary universal income to households; cash grants to firms.

D. Cut interest rates, launch QE programmes and lending schemes.

All would help but (C) most likely to stop immediate economic collapse.

What microeconomic policies?

Most sectors suffer from the Covid-19 shock generating unemployment

Other sectors, like shipping and delivery services, grocery stores, online learning companies, digital businesses cannot cope with the hike in demand.

e.g., Amazon announces 100000 new hires (March 16), The U.K.'s largest supermarket chains are leading the call for over 45,000 new staff (March 24)

Industrial policies:

- Facilitate labour market adjustment by relaxing regulations and creating matching platforms for re-deployment
- Incentivise deployment of labour from hold-up sectors to booming sectors

Example: Taxi drivers in Italy are put on hold and, at the same time, delivery services are congested. Taxi drivers should be deployed towards the delivery service

Whatever mix is chosen, policies need to:

i. be **now and** be **massive**, of the same order of magnitude of the output loss. UK announced a package worth about 15% of GDP. Unprecedented!

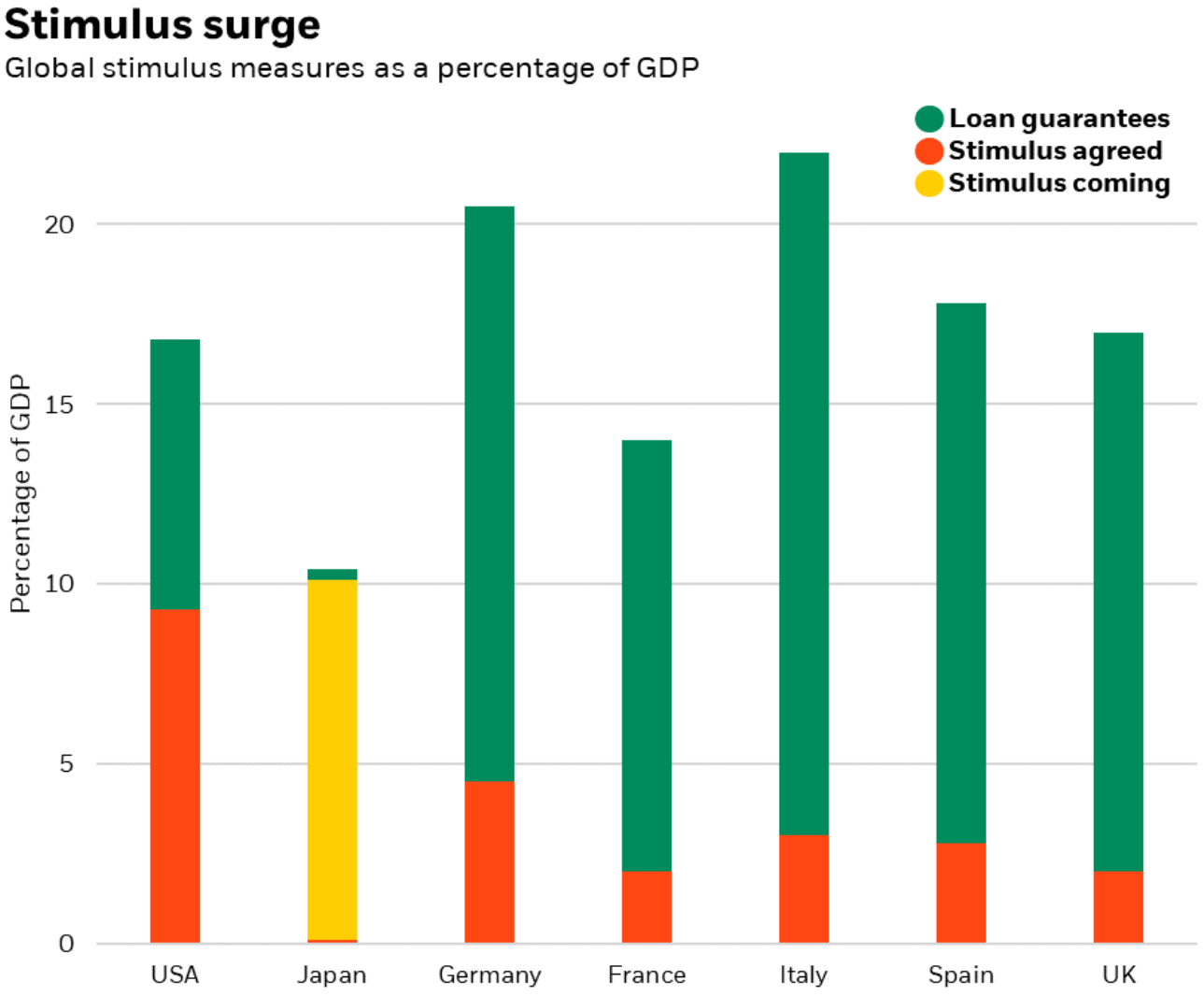
ii. start from **health expenditure**: invest in testing and expansion of supply. Too late now for the first peak but still time to contain the second peak in the Fall of 2020.

iii. be about **cash disbursements to households and businesses, and incentivise labour deployment**.
Tax incentives or cuts, emergency loans and borrowing on better terms, by their own, are unlikely to prevent a collapse in aggregate demand.

iv. use a **coordination of fiscal and monetary interventions** to maximize and multiply impact and provide financial backing to each other policy.

v. be **global**: interconnected society and economy requires global coordination.

Governments have started responding

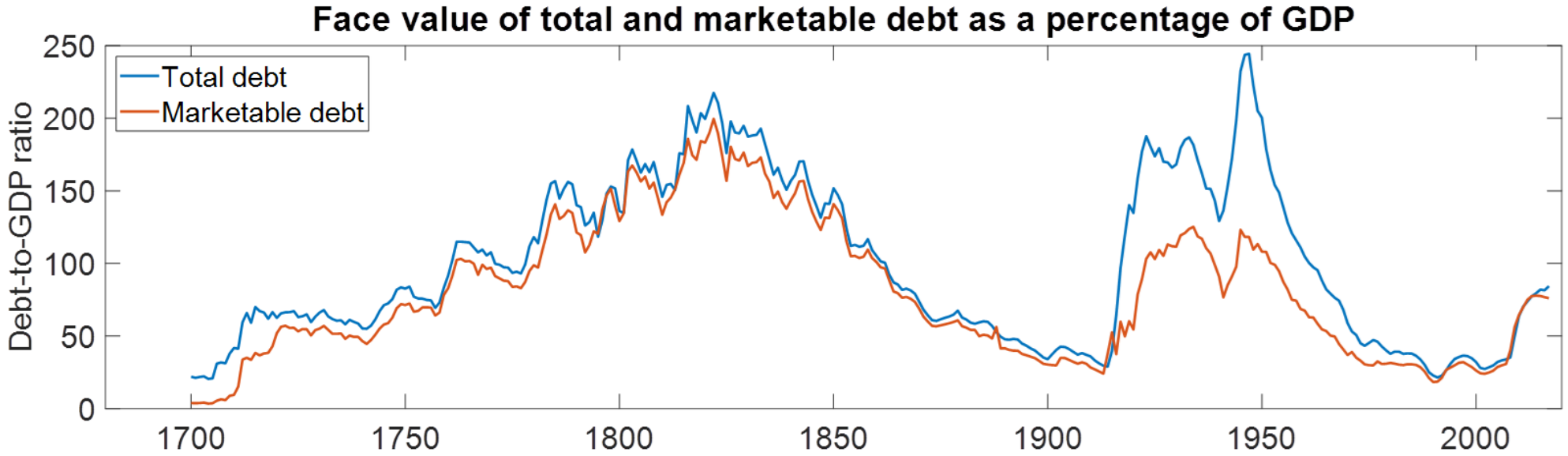


Source: Macro Insights from Blackrock Investment Institute (26 Mar, blackrock.com)

How to finance these macroeconomic policies?

Debt is attractive, especially given the ultra-low interest rates. But guaranteed by whom?

UK/US governments have sufficient credibility to afford it without too much sovereign risk but would still require coordination with the central bank (more on next slide)…



Source: Ellison-Scott (2020, AEJM)

But Italy can't! Lack both government credibility and independent national central bank. An Italian problem? Not really. Just timing is different: "Europeans are all Italians"

A Governance Crisis in the EU. Again!

Common shocks require common policy.
von Der Leyen: “We will give Italy all it asks for”

Question is how? A few options:

A) Eurobonds via (an empowered) ESM

B) Coordinated sovereign debt issuance, ‘Corona bond’

C) Helicopter money

All require ECB backing by some form of public debt monetisation: the last economic taboo! ECB launched a €750bn Pandemic Emergency Purchase Programme to buy government and corporate debt until Covid-19 crisis is over. Fed launched a similar $700 bn programme.

Summary of part 4 (macroeconomic policies)

- With little or no government interventions, economic costs will be immense!
- Government priority should be on health expenditure but need a strategy to flatten the contagion curve that may spike back in the Fall of 2020.
- Simple proposal: ‘random testing’ to identify individual treats that predict being infected and then targeted testing and surveillance on the ‘most likely’ infected.
- Government spending should be **now** and as large as the predicted economic costs, focusing **directly** on cash disbursement to firms and households.
- Central banks should provide financial backing to the government, not just through their own reserves but also by printing money if necessary.
- Global shock needs global response. No country has fiscal capacity to stand alone.

Full set of slides available at https://sites.google.com/site/paolosurico/covid-19

Thank you!