

Lecture 22:

6.1. “Deep Roots” and Path Dependence

Brad DeLong

Department of Economics & Blum Center, U.C. Berkeley; & WCEG

last revised: Su 2020-04-12

for presentation: Tu 2020-04-21

Original course by Melissa Dell (Harvard Econ 1342), revised by Brad DeLong

<<https://github.com;braddelong/public-files/blob/master/econ-135-lecture-22.pptx>>

Discussion

“Deep Roots” and Path Dependence:

- What strikes you as important here?

“Deep Roots” & Path Dependence

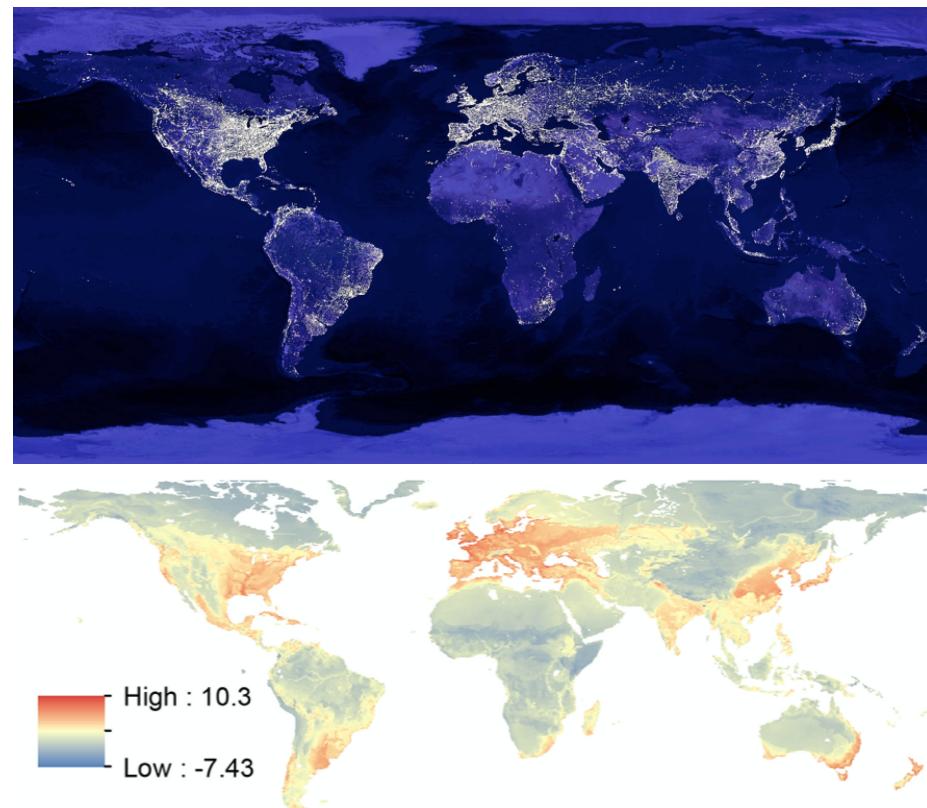
Econ 135: Tu Apr 21: 5.4. “Deep Roots” & Path Dependence:

- **Read Before:** Nathan Nunn (2012): Culture and the Historical Process <<https://delong.typepad.com/files/nunn-culture.pdf>>
- Slides: <<https://github.com;braddelong/public-files/blob/master/econ-135-lecture-22.pptx>>
- Discussion Thread <>
- Lecture Notes <>

Lights from Space

Top is artificial illumination at night:

- This reveals the global geographical distribution of human economic activity
- Bottom is what is predicted from a regression of lights on geographical variables:
 - Base (ruggedness & malaria)
 - Soil & climate (suitability for agriculture)
 - Trade (ease of communication and transport by water)
- “Geography” accounts for half of the global land variation in lights from space *today*
 - It has been a long time—500 years?—since humanity was tied in its location to where the most productive farms were
 - It has been a shorter but still substantial time—200 years—since humanity was bound in its location by the essential need for cheap water transport
- Yet those factors are the “deep roots” of relative economic development, even though there is no geographical necessity today
- And humanity’s geographical distribution of economic activity exhibits “path dependence”: the places where people settled and produced for reasons of trade and agriculture 500 and more years ago are still the places where people settle and produce.

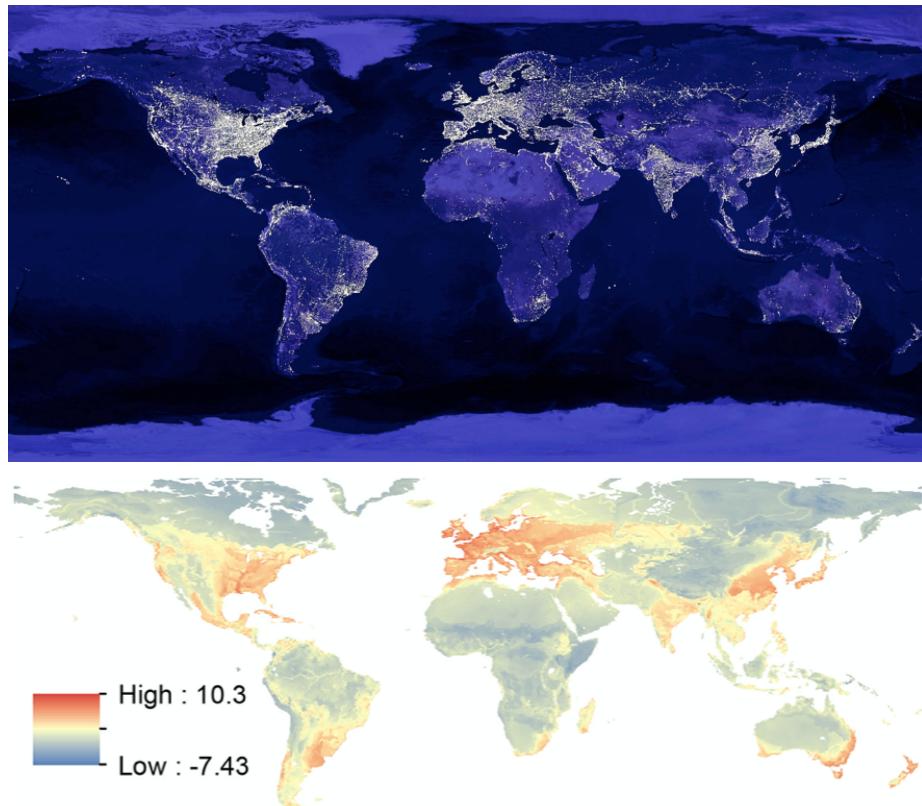


Vernon Henderson, Tim Squires, Adam Storeygard, and David Weil: The Global Distribution of Economic Activity: Nature, History, & the Role of Trade <<https://github.com/braddelong/public-files/blob/master/readings/article-henderson-geography.pdf>> <<https://github.com/braddelong/public-files/blob/master/readings/article-henderson-geography-ii.pdf>>

What Does This Get Right? Wrong?

It gets a lot very right:

- But it is not a perfect fit
- Regions that are surprisingly prosperous?
 - Johannesburg & surroundings
 - India
 - The Persian Gulf
 - Northwest Europe/eastern USA
 - Coastal Brazil
 - Malaya and Java
- Reasons that are not as prosperous as expected?
 - The lower Mississippi basin
 - The Boomerang Coast & New Zealand



Vernon Henderson, Tim Squires, Adam Storeygard, and David Weil: The Global Distribution of Economic Activity: Nature, History, & the Role of Trade <<https://github.com/braddelong/public-files/blob/master/readings/article-henderson-geography.pdf>> <<https://github.com/braddelong/public-files/blob/master/readings/article-henderson-geography-ii.pdf>>

Technological Persistence

Take a look at what relative level of technological development economies were at in 1500:

- Half of the relative technological level in 1500 is predicted by the relative technological level in -1000
 - When people move, they tend to carry their technologies with them
 - Across economies, half of the variation in log income per capita today is accounted for by the migration-adjusted level of technology back in 1500
 - Biggest outliers:
 - Vietnam, Laos, Cambodia, India—and Moldova
 - Burkina Faso, Mali, Niger, Ethiopia, Guinea Bissau, Tanzania, Sierra Leone, and Madagascar
 - Tonga, Botswana, South Africa, Saudi Arabia, and Mexico
 - Most influential observations:
 - the global north in the upper right, and much of sub-Saharan tropical Africa in the lower left

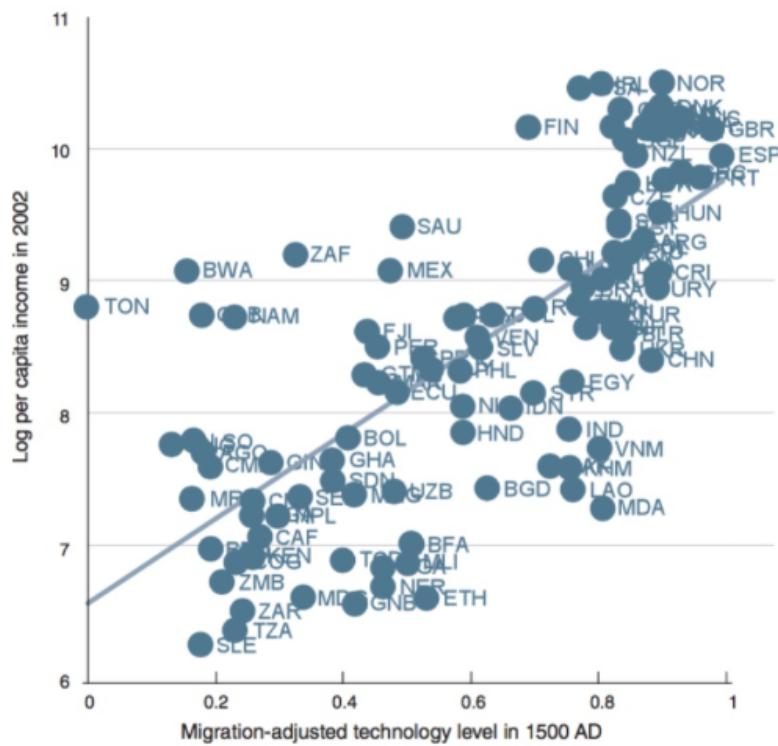


FIGURE 2. SCATTERPLOT OF PER CAPITA INCOME IN 2002 AGAINST MIGRATION-ADJUSTED TECHNOLOGY HERITAGE FROM 1500 AD

Diego Comin, William Easterly, and Erick Gong: Was the Wealth of Nations Determined in 1000 BC?

<<https://github.com;braddelong/public-files/blob/master/readings/article-comin-wealth-of-nations.pdf>>

Drought, Revolution, & Development in Mexico

The end of the *Porfiriato*:

- Porfirio Diaz, President of Mexico 1876-1911
- Patrimonial régime
 - No improvement in life expectancy
 - National income per capita up from \$1400 to \$2700
 - Stable at 35% of the U.S. level
- Porfiriato benefitted *haciendados*, foreign investors, his own allies
 - Labor, *campesinos*, “liberals”, frozen-out elites thought that Mexico should be doing better
- 80 years old in 1919
- Promised not to run again in 1910
- Reneged on his promise, and declared he had won a landslide victory
- Widespread revolt broke out
 - Revolution 1911-1920
 - Starts as elite deposition of Diaz
 - Becomes much broader



Melissa Dell (2015): Path Dependence in Development: Evidence from the Mexican Revolution <<https://github.com;braddelong/public-files/blob/master/readings/article-dell-mexican-revolution.pdf>>

The Mexican Revolution

1911-1920:

- Starts as elite deposition of Diaz
- Things get confusing:
 - 1910-11: Diaz vs. Maderistas, Orozquistas, Magonistas, Zapatistas
 - 1911-13: Maderistas vs. Bernardo Reyes, Mareo Valesques, Felix Diaz, Orozquistas, Magonistas, Zapatistas
 - 1913-1914: Victoriana Huerta vs. Villistas, Zapatistas, Carrancistas
 - 1914-1919: Villistas, Zapatistas, Félix Díaz, Aureliano Blanquet vs, Carrancistas
 - 1920: Alvaro Obregon, Zapatistas vs. Carrancistas
- In the end the Carrancistas won
 - But the last act of the revolution sees Venustiano Carranza assassinated
 - By his former general and long-time ally and subordinate Alvaro Obregon
- Obregon then became post-revolutionary president 1920-1924
- Established the PRI—the Institutional Revolutionary Party, which ruled Mexico as a one party state until the 1990s



(a) Francisco Madero



(b) Victoriano Huerta



(c) V. Carranza



(d) Pancho Villa



(e) Emiliano Zapata

Melissa Dell (2015): Path Dependence in Development: Evidence from the Mexican Revolution
<https://github.com/braddelong/public-files/blob/master/readings/article-dell-mexican-revolution.pdf>

What Was the Mexican Revolution?

In the end the Carrancistas won:

- But the last act of the revolution sees Venustiano Carranza himself assassinated
- By his former general and long-time ally and subordinate Alvaro Obregon
- You can see the Mexican Revolution as a(n at least) three-cornered fight, between:
 - Those who wanted to control the government and its patronage
 - Those who wanted a more democratic, more liberal, more open society less prone to *caudillismo*
 - Those who wanted land reform and a more egalitarian distribution of property more generally
- Obregon then became post-revolutionary president 1920-1924
 - Established the PRI—the Institutional Revolutionary Party
 - The PRI ruled Mexico as a one party state until the 1990s
- The PRI had elements of all three
- Therefore what actually happened as a result of the Mexican Revolution depended on the strength of forces—patrimonial, liberal, power elite, populist—on the ground

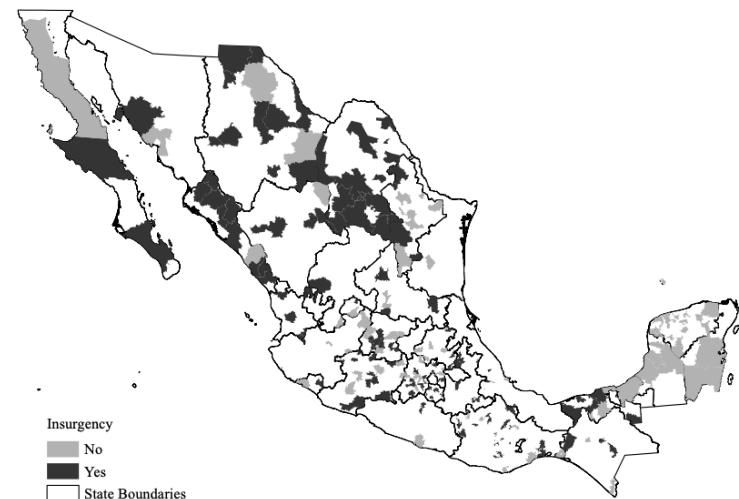


Melissa Dell (2015): Path Dependence in Development: Evidence from the Mexican Revolution
<<https://github.com/braddelong/public-files/blob/master/readings/article-dell-mexican-revolution.pdf>>

Land Reform—& Thus Institutions—Were Local

Where there were local peasant insurgencies demanding land reform, there was land reform:

- There were many local insurgencies
- There were also many places in which the rural scene was quiet
 - And there was no large-scale uprising
- Land reform in the wake of insurgency included:
 - Confiscation of the land from hacendados
 - Allocation of the land to the campesinos
 - In an institutional form called the ejido
 - You could not sell your ejido
 - By the same token a rich guy could not take it away from you if you defaulted on a debt
- Trading away the ability to pledge your land for finance in order to be entrepreneurial for security and a permanent floor keeping you from becoming a landless dependent or beggar
 - But State and federal officials had influence over the distribution of plots



Melissa Dell (2015): Path Dependence in Development: Evidence from the Mexican Revolution <<https://github.com;braddelong/public-files/blob/master/readings/article-dell-mexican-revolution.pdf>>

Where Were There Insurgencies?

There were insurgencies where there was drought 1906-1910:

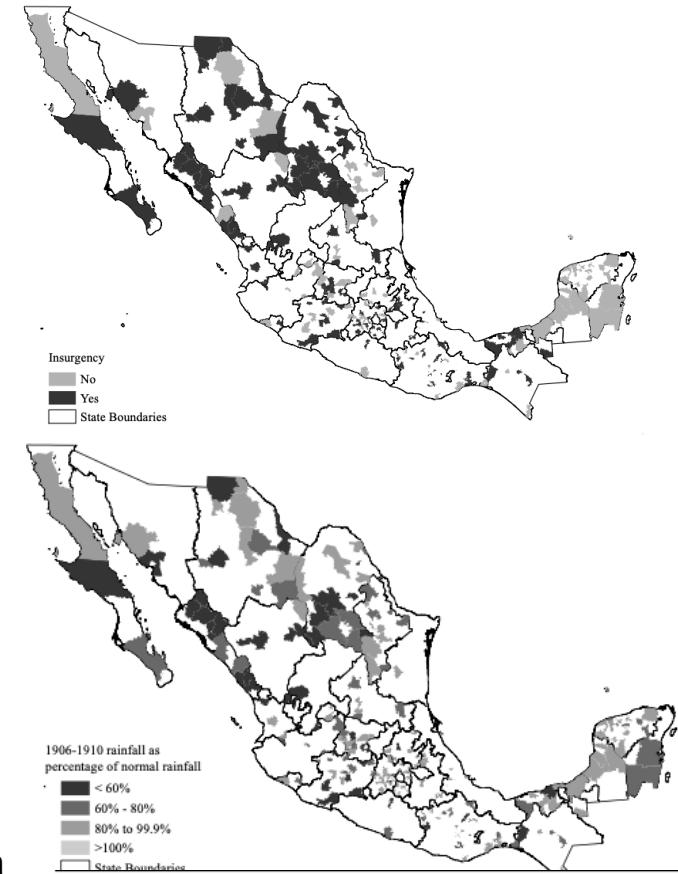
- Torreon (Coahuila):

- Huge crowds formed and began to ransack large properties and attack Chinese immigrants on the streets...Over 250 Chinese died in the sack of Torreon (Knight, 1986, p. 207).... Common people swaggering in the streets believed the day had come when all were equal and made respectable ladies walk down the middle of the street (Knight, 1986, p. 209)...

- On October 1st, 1914, Torreon fell to Pancho Villa's forces...

- Coatepec (Mexico State):

- 1915: Constructed the first primary school in this municipality, which consisted of three classrooms.
- "In Coatepec Harinas, the revolutionary era did not cause the disruptions that other areas suffered." (Encyclopedia of Mexican Municipalities)



| Dependent variable is insurgency. Sample is: | | | | | |
|--|----------------------|---------------------|----------------------|----------------------|--------------------|
| | Baseline | Close U.S. | Far | More agricultural | Less agricultural |
| | (1) | (2) | (3) | (4) | (5) |
| Rainfall | -0.770*** (0.176) | -0.650** (0.254) | -0.917*** (0.224) | -1.288*** (0.293) | -0.498* (0.265) |
| R-squared | 0.449 | 0.371 | 0.502 | 0.534 | 0.499 |
| Observations | 210 | 97 | 113 | 104 | 103 |
| Mean Dep. Var. | 0.59 | 0.68 | 0.51 | 0.52 | 0.45 |

Where Were the Effects of Having Ejidos?

Ejidos today:

- Account for 54% of Mexico's land area
- Account for two thirds of Mexico's arable land area
- Account for over half of its rural population.
- Ejidos reduced access to functioning credit markets (DeWalt, 1979; Wilkie, 1971).
- Ejidos promoted clientelistic politics (Benjamin, 1989; de Janvry et. al, 1997; Ronfeldt, 1973; Larreguay, 2013)
- Ejidal lands were a key instrument for generating PRI political support
- Insurgent municipalities received more land reform and today are poorer, more agricultural, less industrial, and less politically competitive
- Agrarian reform may be important for promoting stability, but can impose significant long-run costs when it is accompanied by major restrictions on markets or the politicization of agriculture

Public Employees in 1940

| | All | National authorities/1000 inhabitants | State | Local |
|---------------------|----------------------|---------------------------------------|-------------------|----------------------|
| | (1) | (2) | (3) | (4) |
| <i>Panel A: IV</i> | | | | |
| Insurgency | -5.648 (4.564) | -3.769 (3.276) | -0.811 (1.848) | 0.298 (0.750) |
| <i>Panel B: OLS</i> | | | | |
| Insurgency | -4.134*** (1.571) | -2.880** (1.129) | -0.748 (0.638) | -0.827*** (0.242) |
| Observations | 205 | 205 | 205 | 205 |
| Mean Dep. Var. | 20.03 | 16.27 | 2.436 | 1.104 |

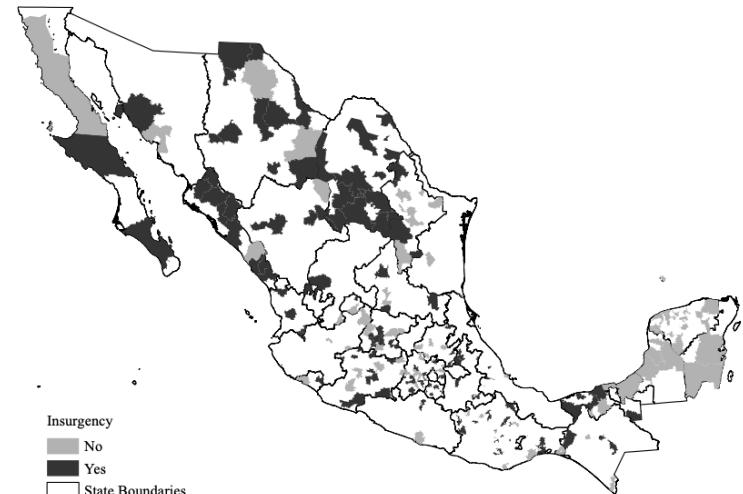
Economic outcomes today

| | Overall | Agricultural | Industrial | Services |
|---------------------|----------------------|--------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) |
| <i>Panel A: IV</i> | | | | |
| Insurgency | -0.292** (0.141) | -0.322 (0.274) | -0.289* (0.169) | -0.218** (0.109) |
| <i>Panel B: OLS</i> | | | | |
| Insurgency | -0.109*** (0.021) | -0.082* (0.044) | -0.122*** (0.021) | -0.086*** (0.019) |
| Observations | 734,127 | 53,363 | 222,267 | 458,497 |
| Clusters | 210 | 210 | 210 | 210 |

“Deep Roots” and Path Dependence in Mexico

A good deal of rural prosperity or its absence today hinges on roots from 1905-10:

- The flap of the butterfly’s wings
- And then path dependence
- Drought \Rightarrow insurgency
- Insurgency \Rightarrow land reform & ejidos
- Ejidos \Rightarrow manifold consequences, including slower growth
- A modest event—here the 1907-1910 drought—exerts large and persistent effects



Economic outcomes today

| | Overall (1) | Agricultural log wage (2) | Industrial log wage (3) | Services (4) |
|-----------------------------------|----------------------|---------------------------------|-------------------------------|----------------------|
| <i>Panel A: IV</i> Insurgency | -0.292** (0.141) | -0.322 (0.274) | -0.289* (0.169) | -0.218** (0.109) |
| <i>Panel B: OLS</i> Insurgency | -0.109*** (0.021) | -0.082* (0.044) | -0.122*** (0.021) | -0.086*** (0.019) |
| Observations | 734,127 | 53,363 | 222,267 | 458,497 |
| Clusters | 210 | 210 | 210 | 210 |

Culture and the Historical Process

A great dissatisfaction with what are called “institutions” here:

- Nathan Nunn (2012): Culture and the Historical Process <<https://delong.typepad.com/files/nunn-culture.pdf>>
- Culture as heuristics—the way you jump when choosing strategies in (possibly cooperatives) interpersonal games
- Long-run historical shadows cast by history that produce “cultural” differences:
 - The plough and gender roles
 - The African slave trade(s) and “trust”
 - Italian cities’ levels of social capital (Guiso, Sapienza, and Zingales)
 - Mediterranean mercantile cultures (Avner Greif)
 - The “Protestant ethic”?



Legal Origins

La Porta, Lopez-do-Silanes, Shleifer, & Vishny:

- Rafael La Porta, Florencio Lopez-de-Silanes, & Andrei Shleifer: *The Economic Consequences of Legal Origins* <<https://github.com;braddelong/public-files/blob/master/readings/article-la-porta-legal-origins.pdf>>
- France, Germany, Scandinavia, Britain
- Britain produces by far the “best” legal system
- France poisonous in terms of how convoluted and restrictive their legal systems are
 - What is not expressly authorized is forbidden...
 - “Legal Origin Theory traces the different strategies of common and civil law to different ideas about law and its purpose that England and France developed centuries ago. These broad ideas and strategies were incorporated into specific legal rules, but also into the organization of the legal system, as well as the human capital and beliefs of its participants.
 - “When common and civil law were transplanted into much of the world through conquest and colonization, the rules, but also human capital and legal ideologies, were transplanted as well. Despite much local legal evolution, the fundamental strategies and assumptions of each legal system survived and have continued to exert substantial influence on economic outcomes...
- Legal origins not “culture” or “politics”

A Skeptic's Guide

Dietz Vollrath:

- Dietrich Vollrath (2014): *A Skeptic's Guide to Institutions 4* <<https://growthecon.com/blog/the-skeptics-guide-to-institutions-part-4/>>
- Cross-country studies of institutions are inherently flawed by lack of identification and ordinal institutional indexes treated as cardinal
- Instrumental variable approaches—settler mortality included—are flawed due to bad data and questions and more identification problems.
- Historical studies show that there is path dependence or a poverty trap, but not that institutions themselves are central to underdevelopment
- I'm uncomfortable making broad pronouncements that we have to get institutions "right" or "improve institutions" to generate economic development.
- Institutions are not a thing that we can easily or independently alter. If they were, then they wouldn't be *institutions*
 - Bad institutions get you stuck in a bad equilibrium
 - The result of a skewed distribution of economic power that grants some elite a skewed amount of political power
 - The implication is that redistributing wealth away from a predatory elite will lead to economic development



Big Ideas: Lecture 22: “Deep Roots” and Path Dependence

Takeaways from this class:

Readings: Lecture 22: “Deep Roots” and Path Dependence

Required:

- Nathan Nunn (2012): Culture and the Historical Process <<https://delong.typepad.com/files/nunn-culture.pdf>>

Optional:

- Diego Comin, William Easterly, and Erick Gong: Was the Wealth of Nations Determined in 1000 BC? <<https://github.com;braddelong/public-files/blob/master/readings/article-comin-wealth-of-nations.pdf>>
- Melissa Dell (2015): Path Dependence in Development: Evidence from the Mexican Revolution <<https://github.com;braddelong/public-files/blob/master/readings/article-dell-mexican-revolution.pdf>>
- Vernon Henderson, Tim Squires, Adam Storeygard, and David Weil: The Global Distribution of Economic Activity: Nature, History, & the Role of Trade <<https://github.com;braddelong/public-files/blob/master/readings/article-henderson-geography.pdf>> <<https://github.com;braddelong/public-files/blob/master/readings/article-henderson-geography-ii.pdf>>

Roadmap for the Next Two Weeks...

23. Th Apr 23: 6.2. Growth and Fluctuations; Trade and Development, Foreign Aid

- **Read Before:** Barry Eichengreen (2015): Hall of Mirrors: The Great Depression, The Great Recession, and the Uses-and Misuses-of History, selections <<https://delong.typepad.com/files/eichengreen-mirrors.pdf>>
- **Read Before:** David Atkin (2014): Endogenous Skill Acquisition and Export Manufacturing in Mexico <<https://delong.typepad.com/files/atkin-skill.pdf>>
- **Slides:** <<https://github.com;braddelong/public-files/blob/master/econ-135-lecture-23.pptx>>

24. Tu Apr 28: 6.3. Populism, Plutocracy, Kleptocracy, & Neo-Fascism

- **Read Before:** Ernest Gellner (1973): *Nations & Nationalism*, selections <<https://delong.typepad.com/files/gellner-nations.pdf>>
- **Read Before:** Barry Eichengreen (2018): *The Populist Temptation Economic Grievance & Political Reaction in the Modern Era*, selections <<https://delong.typepad.com/files/eichengreen-populist.pdf>>

25. Th Apr 30: 6.4. Global Warming

- **Read Before:** Melissa Dell et al. (2012): *Temperature Shocks & Economic Growth: Evidence from the Last Half Century* <https://scholar.harvard.edu/files/dell/files/aej_temperature.pdf>
- **Read Before:** Melissa Dell et al. (2014). *What Do We Learn from the Weather? The New Climate-Economy Literature*, selections <<https://economics.mit.edu/files/9138>>

26. Tu May 5: 6.5. The Pace and Meaning of Economic Growth

- **Read Before:** William Nordhaus: Do Real-Output and Real-Wage Measures Capture Reality? <<https://www.nber.org/chapters/c6064.pdf>>
- **Read Before:** John Maynard Keynes: Economic Possibilities for Our Grandchildren <<<https://delong.typepad.com/files/keynes-persuasion.pdf>>
- **Read Before:** Edward Bellamy (1887): Looking Backward 2000-1887, selections <<https://delong.typepad.com/files/bellamy-backward.pdf>>

Roadmap Following...

7. Conclusion

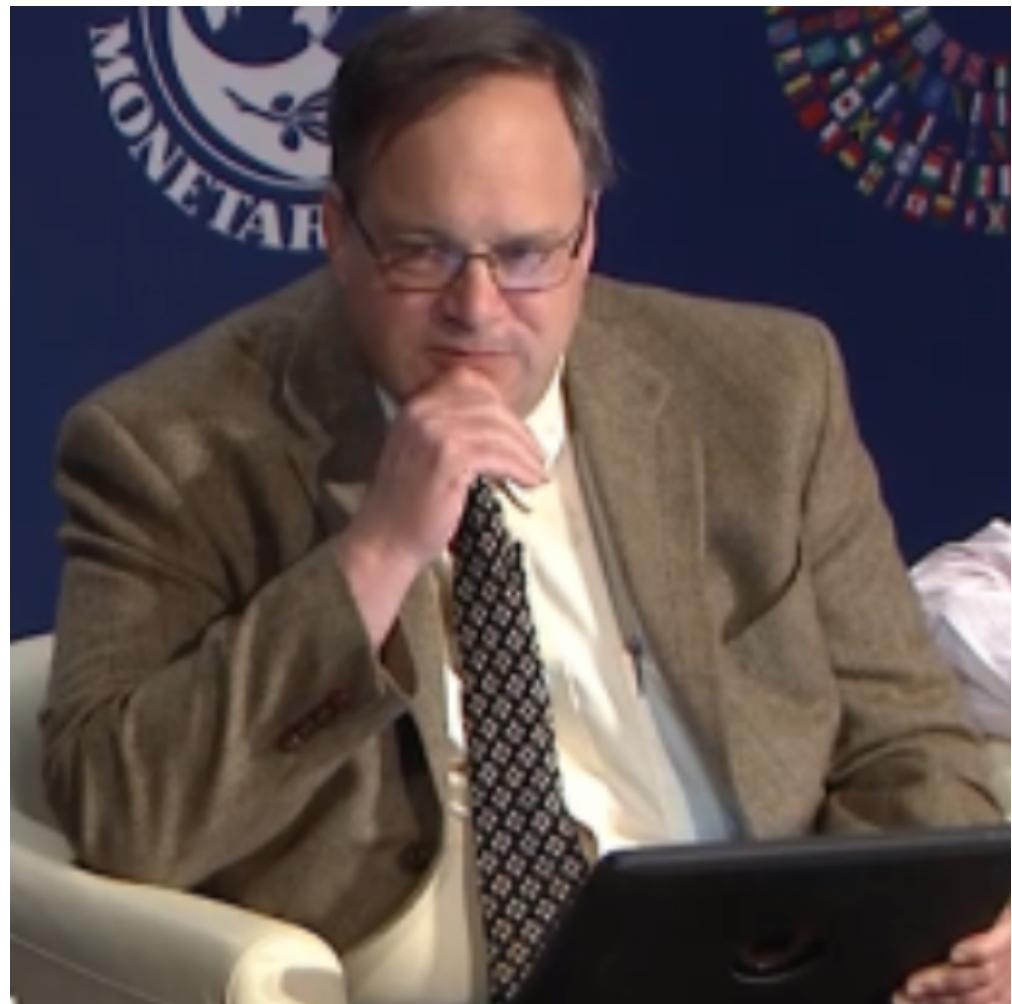
Th May 7: 7. Conclusion: The Future?

- **Read After:** Robert Allen (2011): *Global Economic History: A Very Short Introduction*, selections <<https://delong.typepad.com/files/allen-geh.pdf>>

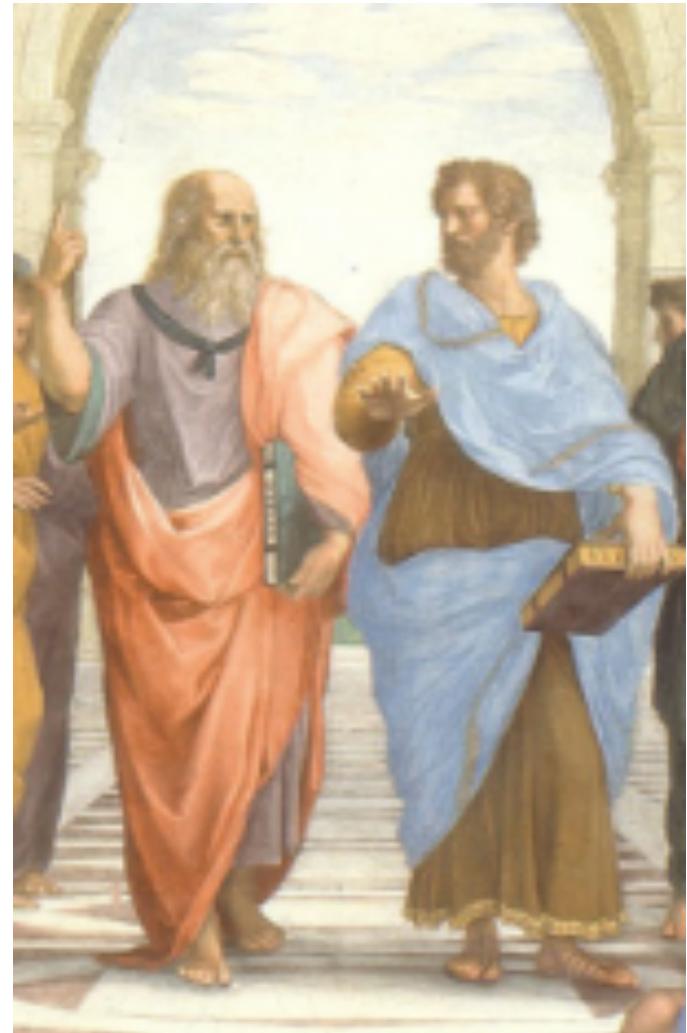
W May 13 11:30-14:30: FINAL PAPER/PROJECT DUE

Catch Our Breath...

- Ask a couple of questions?
- Make a couple of comments?
- Any more readings to recommend?



Notes, etc....



Coronavirus!

Members of the public were told to avoid gatherings of 10 or more



ABC News



Trump warns coronavirus crisis could stretch into summer

Watch

Members of the public were told to avoid gatherings of 10 or more and older people and those with underlying condition were asked to stay home.

Coronavirus

Where we think we are, as of Th Apr 09:

- We really do not know
- No random samples...
- If we extrapolate out the past week straight-line log:
 - We will have 440,000 deaths in three weeks
 - But it is unlikely to be that bad
- Best thing I have read comes from Jim Stock <<https://drive.google.com/file/d/12MV466ZZy5xHir4xdPhoTrL1oQ8CbZU-/view>>:
 - The basic SIR epidemiological model of contagion
 - The effect of social distancing and business shutdowns on epidemic dynamics enters the model through a single parameter: the case transmission rate β
 - Re-express the model in terms of β and the asymptomatic (or not very symptomatic) hence non-tested rate—the fraction of the infected who are not tested
 - The COVID-19 non-testing rate is unidentified in our model
 - Estimates in the epidemiological literature range from 0.18 to 0.86.
 - The asymptomatic rate could be estimated accurately and quickly by testing a random sample
 - The optimal policy response and its economic consequences hinge critically on the asymptomatic rate

| Coronavirus Extrapolations | | | | | | |
|----------------------------|--------|----------------------|---------------------------|-----------------------|-------------------------|---------------------------------------|
| Date | Deaths | Cases = Deaths x 100 | Constant Weekly New Cases | Cases = 5 x Cases(-3) | Cases = 20 x Cases (-3) | Cases = Cases (-3) x exp(3 x week ch) |
| 2020-04-05 | 9618 | | 3,102,000 | 4,809,000 | 19,236,000 | 55,832,145 |
| 2020-03-29 | 2484 | | 869,400 | 1,242,000 | 4,968,000 | 53,654,400 |
| 2020-03-22 | 414 | | 144,900 | 207,000 | 828,000 | 8,942,400 |
| 2020-03-15 | 69 | 961,800 | 19,800 | 34,500 | 138,000 | 128,966 |
| 2020-03-08 | 26 | 248,400 | 10,100 | 13,000 | 52,000 | 45,697,600 |
| 2020-03-01 | 1 | 41,400 | 370 | 500 | 2,000 | 100,000 |
| 2020-02-23 | | 6,900 | 37 | 50 | 200 | 10,000 |
| 2020-02-16 | | 2,600 | 4 | 5 | 20 | |
| 2020-02-09 | | 100 | | | | |
| 2020-02-02 | | 10 | | | | |
| 2020-01-26 | | 1 | | | | |
| | | 0 | | | | |

<https://www.incloud.com/numbers/0FzRFAnAOnIAin4VJWWiWIC0>

Coronavirus Cases:  United States

1,342,235

[view by country](#)

Coronavirus Cases:

364,059

Deaths:

74,554

Deaths:

10,792

Recovered:

278,182

Recovered:

19,536

| USA State | Tot Cases/ 1M pop | Deaths/ 1M pop |
|---------------|----------------------|-------------------|
| USA Total | 1,100 | 33 |
| New York | 6,662 | 243 |
| New Jersey | 4,626 | 113 |
| Michigan | 1,729 | 73 |
| California | 404 | 10 |
| Louisiana | 3,188 | 110 |
| Massachusetts | 2,026 | 38 |
| Florida | 662 | 12 |
| Pennsylvania | 1,016 | 13 |
| Illinois | 956 | 24 |
| Washington | 1,095 | 46 |
| Texas | 263 | 5 |
| Georgia | 710 | 22 |

Coronavirus II

We do not really know where we are, as of Mo Apr 6:

- Best thing I have read comes from Jim Stock <<https://drive.google.com/file/d/12MV466ZZy5xHir4xdPhoTrL1oO8CbZU-/view>>:
 - The basic SIR epidemiological model of contagion
 - The effect of social distancing and business shutdowns on epidemic dynamics enters the model through a single parameter: the case transmission rate β
 - Re-express the model in terms of β and the asymptomatic (or not very symptomatic) hence non-tested rate—the fraction of the infected who are not tested
 - The COVID-19 non-testing rate is unidentified in our model
 - Estimates in the epidemiological literature range from 0.18 to 0.86.
 - The asymptomatic rate could be estimated accurately and quickly by testing a random sample
 - The optimal policy response and its economic consequences hinge critically on the asymptomatic rate

| Coronavirus Extrapolations | | | | | | |
|----------------------------|--------|----------------------|---------------------------|-----------------------|-------------------------|---------------------------------------|
| Date | Deaths | Cases = Deaths x 100 | Constant Weekly New Cases | Cases = 5 x Cases(-3) | Cases = 20 x Cases (-3) | Cases = Cases (-3) x exp(3 x week ch) |
| 2020-04-05 | 9618 | | 3,102,000 | 4,809,000 | 19,236,000 | 55,832,145 |
| 2020-03-29 | 2484 | | 869,400 | 1,242,000 | 4,968,000 | 53,654,400 |
| 2020-03-22 | 414 | | 144,900 | 207,000 | 828,000 | 8,942,400 |
| 2020-03-15 | 69 | 961,800 | 19,800 | 34,500 | 138,000 | 128,966 |
| 2020-03-08 | 26 | 248,400 | 10,100 | 13,000 | 52,000 | 45,697,600 |
| 2020-03-01 | 1 | 41,400 | 370 | 500 | 2,000 | 100,000 |
| 2020-02-23 | | 6,900 | 37 | 50 | 200 | 10,000 |
| 2020-02-16 | | 2,600 | 4 | 5 | 20 | |
| 2020-02-09 | | 100 | | | | |
| 2020-02-02 | | 10 | | | | |
| 2020-01-26 | | 1 | | | | |
| | | 0 | | | | |

<https://www.incloud.com/numbers/0FzRFArAOnIAin4VJWWIWIC0>

Coronavirus Cases:  United States

1,342,235

[view by country](#)

Coronavirus Cases:

364,059

Deaths:

74,554

Deaths:

10,792

Recovered:

278,182

Recovered:

19,536

| USA State | Tot Cases/ 1M pop | Deaths/ 1M pop |
|---------------|----------------------|-------------------|
| USA Total | 1,100 | 33 |
| New York | 6,662 | 243 |
| New Jersey | 4,626 | 113 |
| Michigan | 1,729 | 73 |
| California | 404 | 10 |
| Louisiana | 3,188 | 110 |
| Massachusetts | 2,026 | 38 |
| Florida | 662 | 12 |
| Pennsylvania | 1,016 | 13 |
| Illinois | 956 | 24 |
| Washington | 1,095 | 46 |
| Texas | 263 | 5 |
| Georgia | 710 | 22 |

Coronavirus Extrapolations

| Date | Deaths | Cases = Deaths x 100 | Constant Weekly New Cases | Cases = 5 x Cases(-3) | Cases = 20 x Cases (-3) | Cases = Cases (-3) x exp(3 x week ch) |
|------------|--------|----------------------|---------------------------|-----------------------|-------------------------|---------------------------------------|
| 2020-04-05 | 9618 | | 3,102,000 | 4,809,000 | 19,236,000 | 55,832,145 |
| 2020-03-29 | 2484 | | 869,400 | 1,242,000 | 4,968,000 | 53,654,400 |
| 2020-03-22 | 414 | | 144,900 | 207,000 | 828,000 | 8,942,400 |
| 2020-03-15 | 69 | 961,800 | 19,800 | 34,500 | 138,000 | 128,966 |
| 2020-03-08 | 26 | 248,400 | 10,100 | 13,000 | 52,000 | 45,697,600 |
| 2020-03-01 | 1 | 41,400 | 370 | 500 | 2,000 | 100,000 |
| 2020-02-23 | | 6,900 | 37 | 50 | 200 | 10,000 |
| 2020-02-16 | | 2,600 | 4 | 5 | 20 | |
| 2020-02-09 | | 100 | | | | |
| 2020-02-02 | | 10 | | | | |
| 2020-01-26 | | 1 | | | | |
| | | 0 | | | | |

<https://www.icloud.com/numbers/0FzRFAoAQoiAin4V.IWYWIWICQ>

Coronavirus Case



United States

1,342,235

[view by country](#)

Coronavirus Cases:

364,059

Deaths:

74,554

Deaths:

10,792

Recovered:

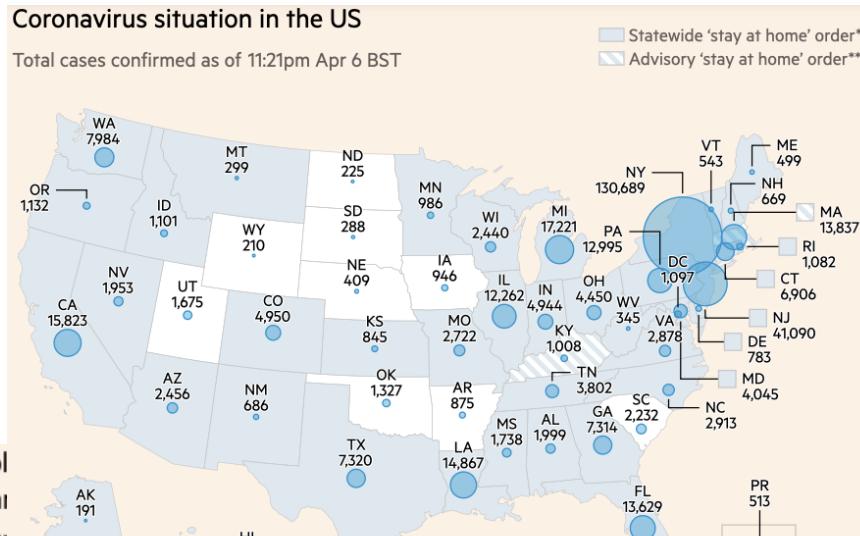
278,182

Recovered:

19,536

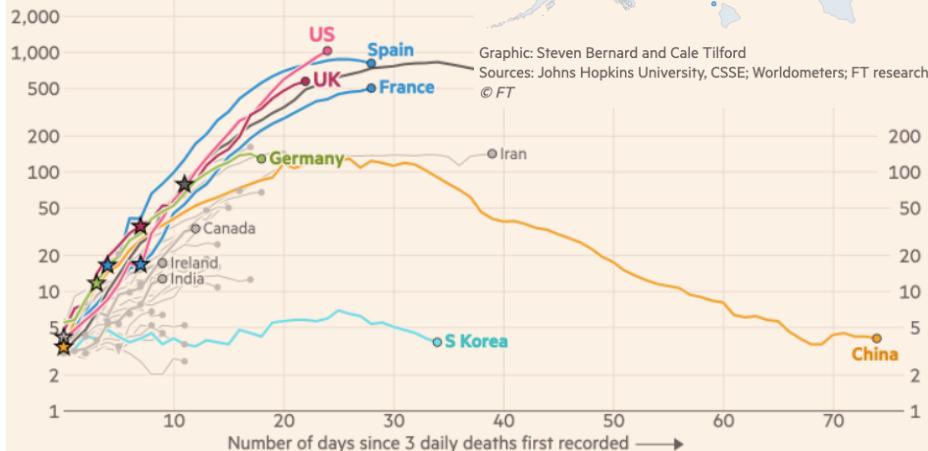
| USA State | Tot Cases/ 1M pop | Deaths/ 1M pop |
|---------------|----------------------|-------------------|
| USA Total | 1,100 | 33 |
| New York | 6,662 | 243 |
| New Jersey | 4,626 | 113 |
| Michigan | 1,729 | 73 |
| California | 404 | 10 |
| Louisiana | 3,188 | 110 |
| Massachusetts | 2,026 | 38 |
| Florida | 662 | 12 |
| Pennsylvania | 1,016 | 13 |
| Illinois | 956 | 24 |
| Washington | 1,095 | 46 |
| Texas | 263 | 5 |
| Georgia | 710 | 22 |

Financial Times Graphs Blown Up...



Italy and Spain's daily death tolls are plateauing, while the US and UK's are rising. Every day brings more new deaths than the day before.

Daily coronavirus deaths (7-day rolling avg.), by number of days since 30 daily cases first recorded



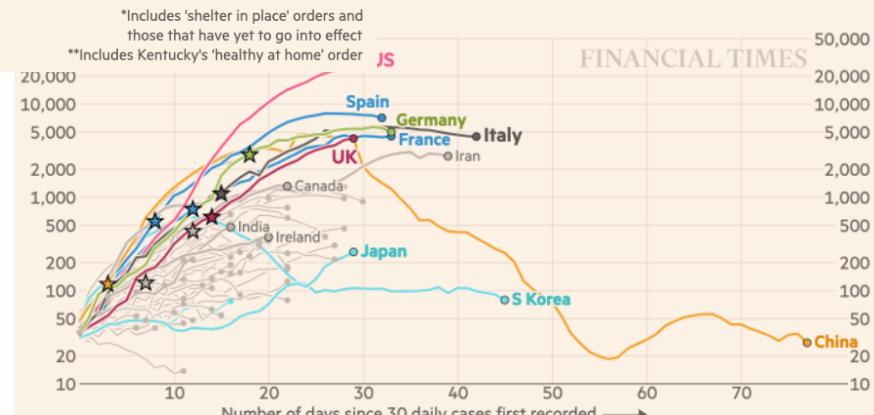
FT graphic: John Burn-Murdoch / @jburnmurdoch

Source: FT analysis of European Centre for Disease Prevention and Control; Worldometers; FT research. Data updated April 06, 19:00 GMT

© FT

numbers of new cases now in decline,

by number of days since 30 daily cases first recorded



FT graphic: John Burn-Murdoch / @jburnmurdoch

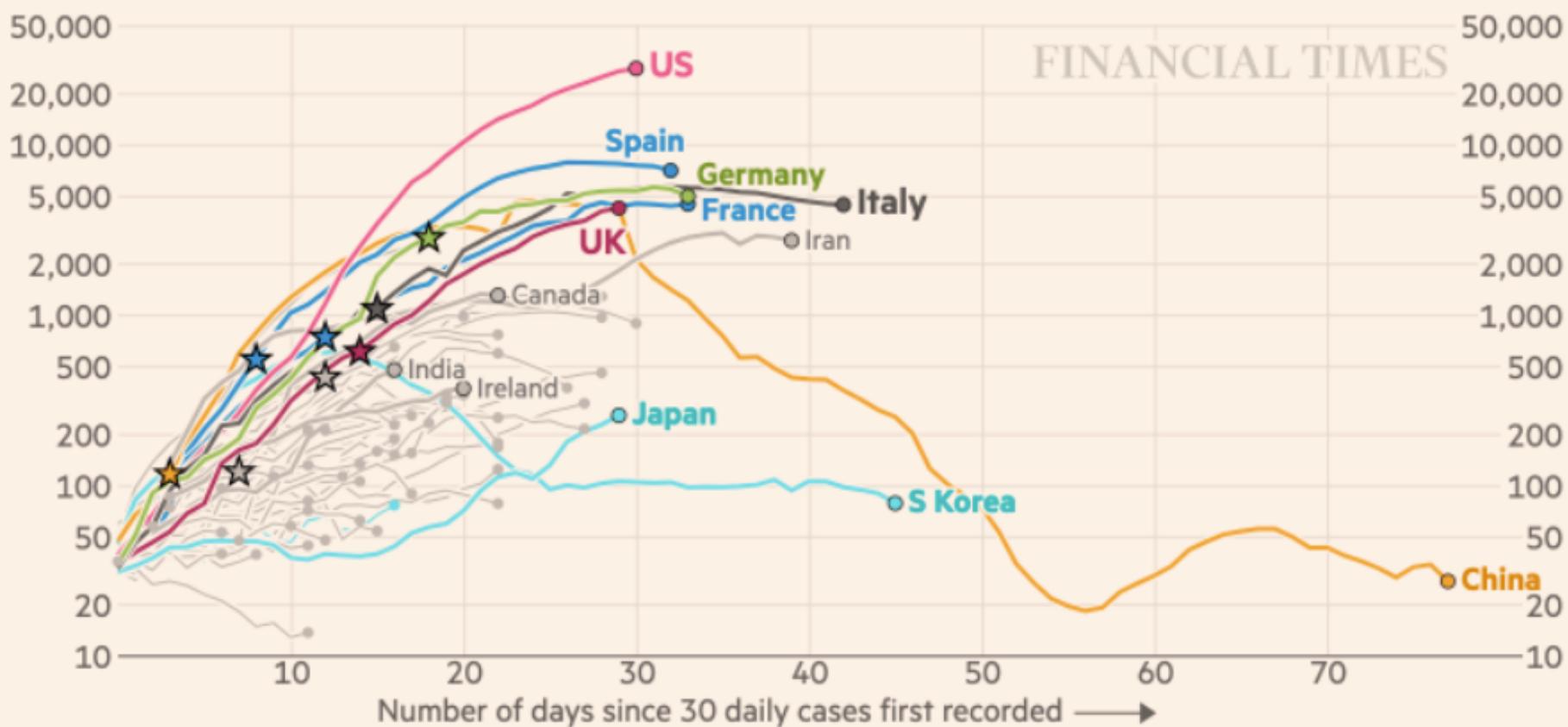
Source: FT analysis of European Centre for Disease Prevention and Control; Worldometers; FT research. Data updated April 06, 19:00 GMT

© FT

Italy has turned the corner, with numbers of new cases now in decline, following in China's footsteps

Daily confirmed cases (7-day rolling avg.), by number of days since 30 daily cases first recorded

Stars represent national lockdowns ★



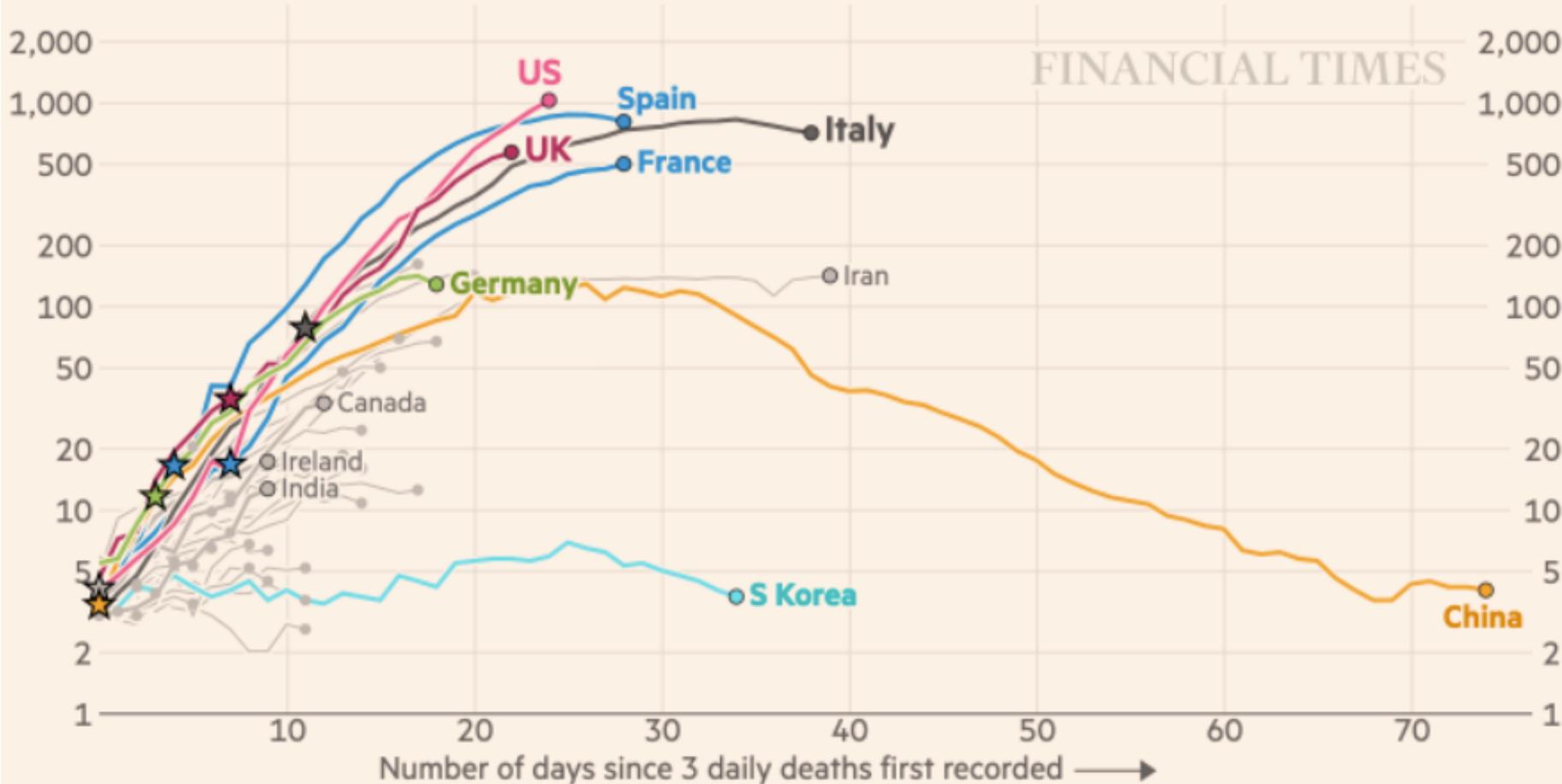
FT graphic: John Burn-Murdoch / @jburnmurdoch

Source: FT analysis of European Centre for Disease Prevention and Control; Worldometers; FT research. Data updated April 06, 19:00 GMT

© FT

Italy and Spain's daily death tolls are plateauing, but in the UK and US every day brings more new deaths than the last

Daily coronavirus deaths (7-day rolling avg.), by number of days since 3 daily deaths first recorded



FT graphic: John Burn-Murdoch / @jburnmurdoch

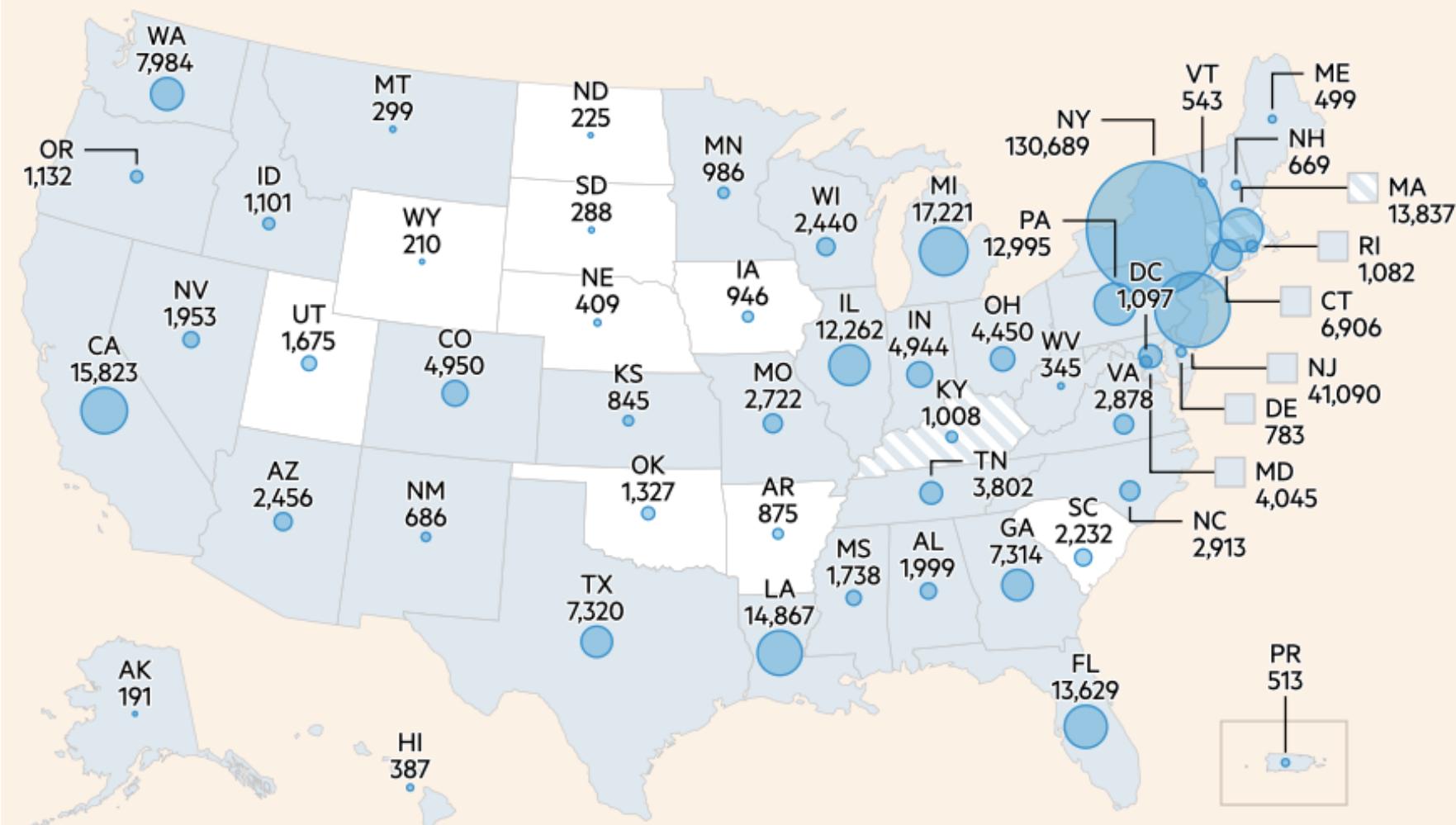
Source: FT analysis of European Centre for Disease Prevention and Control; Worldometers; FT research. Data updated April 06, 19:00 GMT

© FT

Coronavirus situation in the US

Total cases confirmed as of 11:21pm Apr 6 BST

- Statewide 'stay at home' order*
- Advisory 'stay at home' order**



Graphic: Steven Bernard and Cale Tilford

Sources: Johns Hopkins University, CSSE; Worldometers; FT research

© FT

*Includes 'shelter in place' orders and those that have yet to go into effect

**Includes Kentucky's 'healthy at home' order

James Stock (2020)

Standard SIR model: <<https://drive.google.com/file/d/12MV466ZZy5xHir4xdPhoTrL1oO8CbZU-/view>>:

- Susceptible, Infected, Recovered (& immune), transmission rate β , recovery rate γ , reproduction number R_0 , asymptomatic hence non-tested rate π_0
- Calibration: half-life of infection one week: $\gamma = 0.5$, $s_0 = 0.02$, 50 cases on Jan 24
- For March 21, 2020, the positive test rate in the United States is approximately 10%...

$$\Delta S_t = -\beta I_{t-1} \frac{S_{t-1}}{N}$$

$$\Delta R_t = \gamma I_{t-1},$$

$$\Delta I_t = \beta I_{t-1} \frac{S_{t-1}}{N} - \gamma I_{t-1}$$

<<https://drive.google.com/file/d/12MV466ZZy5xHir4xdPhoTrL1oO8CbZU-/view>>

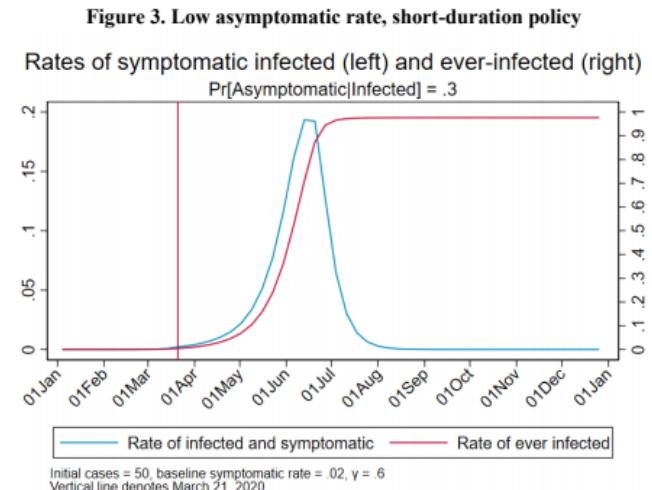


Figure 2. High asymptomatic rate, short-duration policy

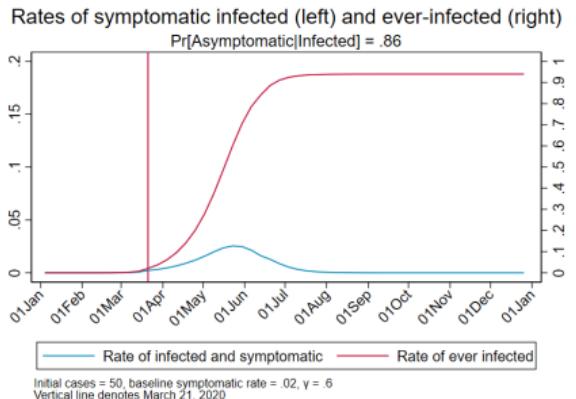


Figure 4. Low asymptomatic rate, severe long-duration policy

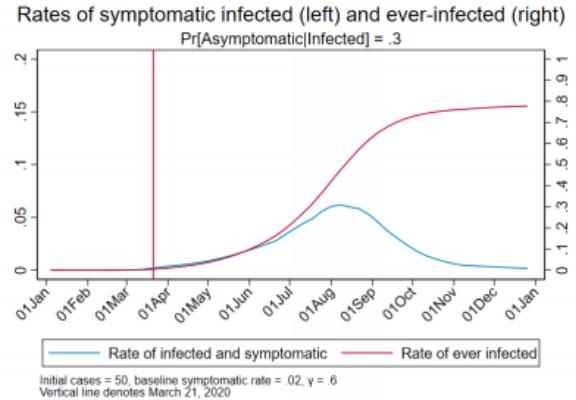
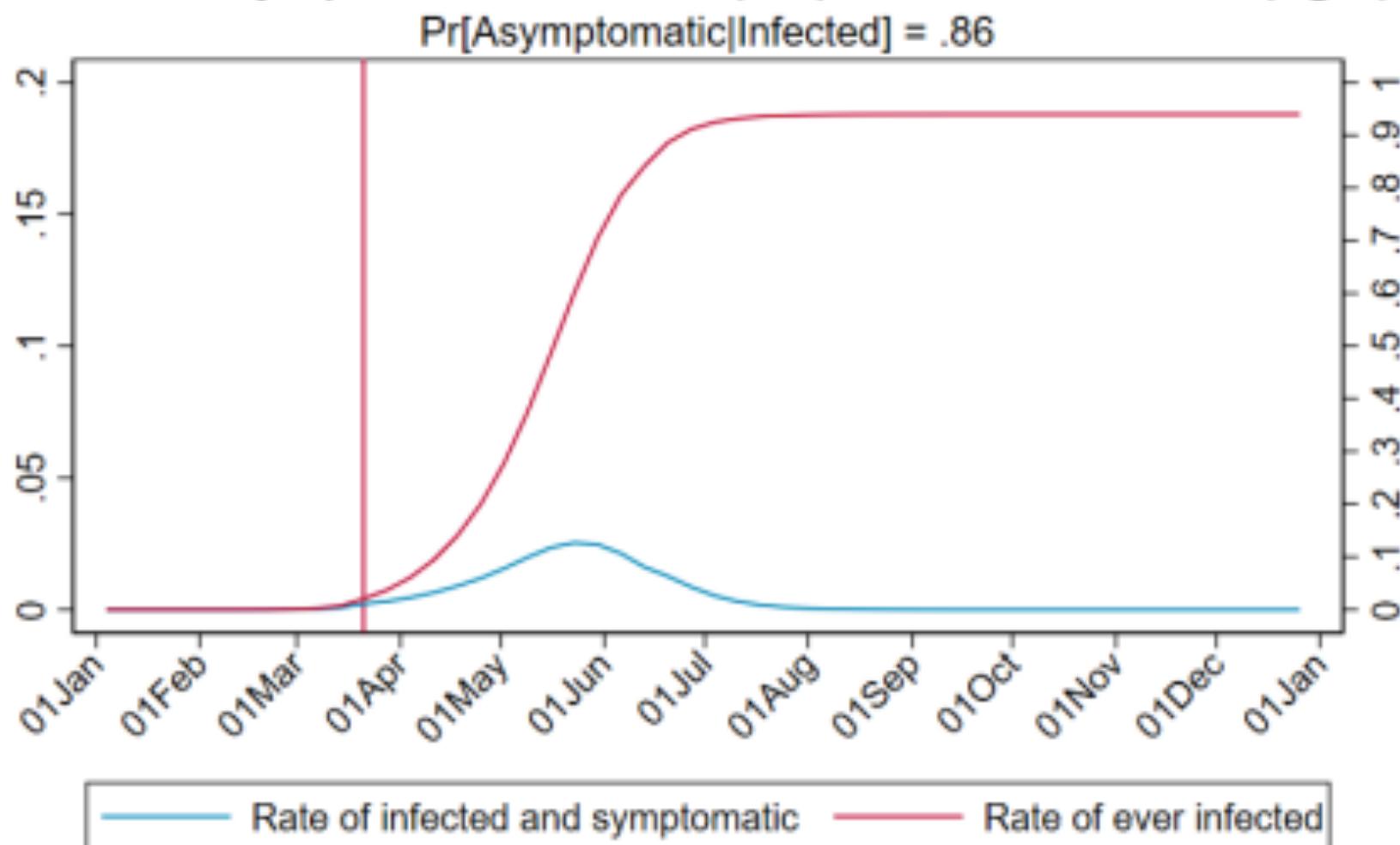


Figure 2. High asymptomatic rate, short-duration policy

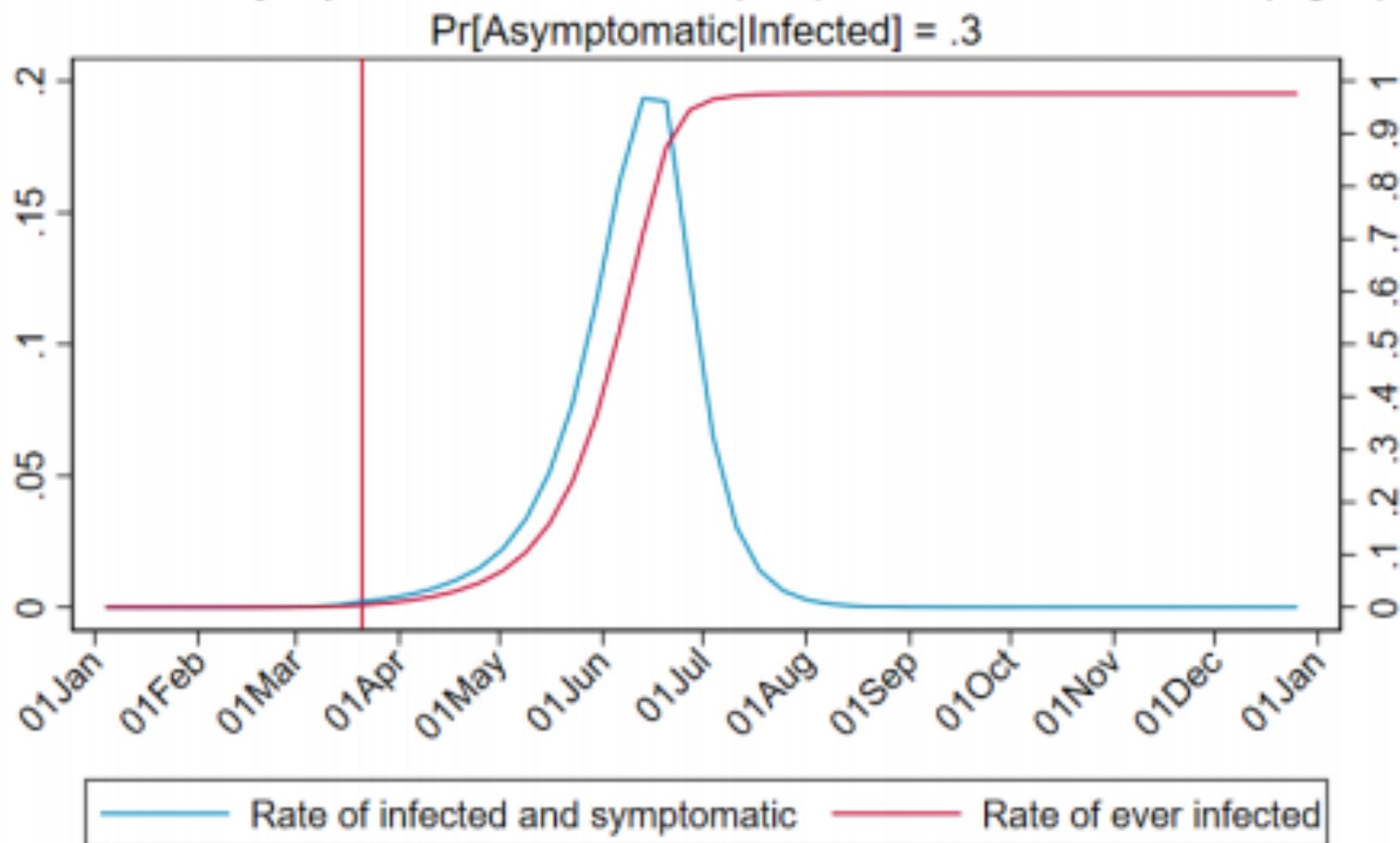
Rates of symptomatic infected (left) and ever-infected (right)



Initial cases = 50, baseline symptomatic rate = .02, $\gamma = .6$
Vertical line denotes March 21, 2020

Figure 3. Low asymptomatic rate, short-duration policy

Rates of symptomatic infected (left) and ever-infected (right)

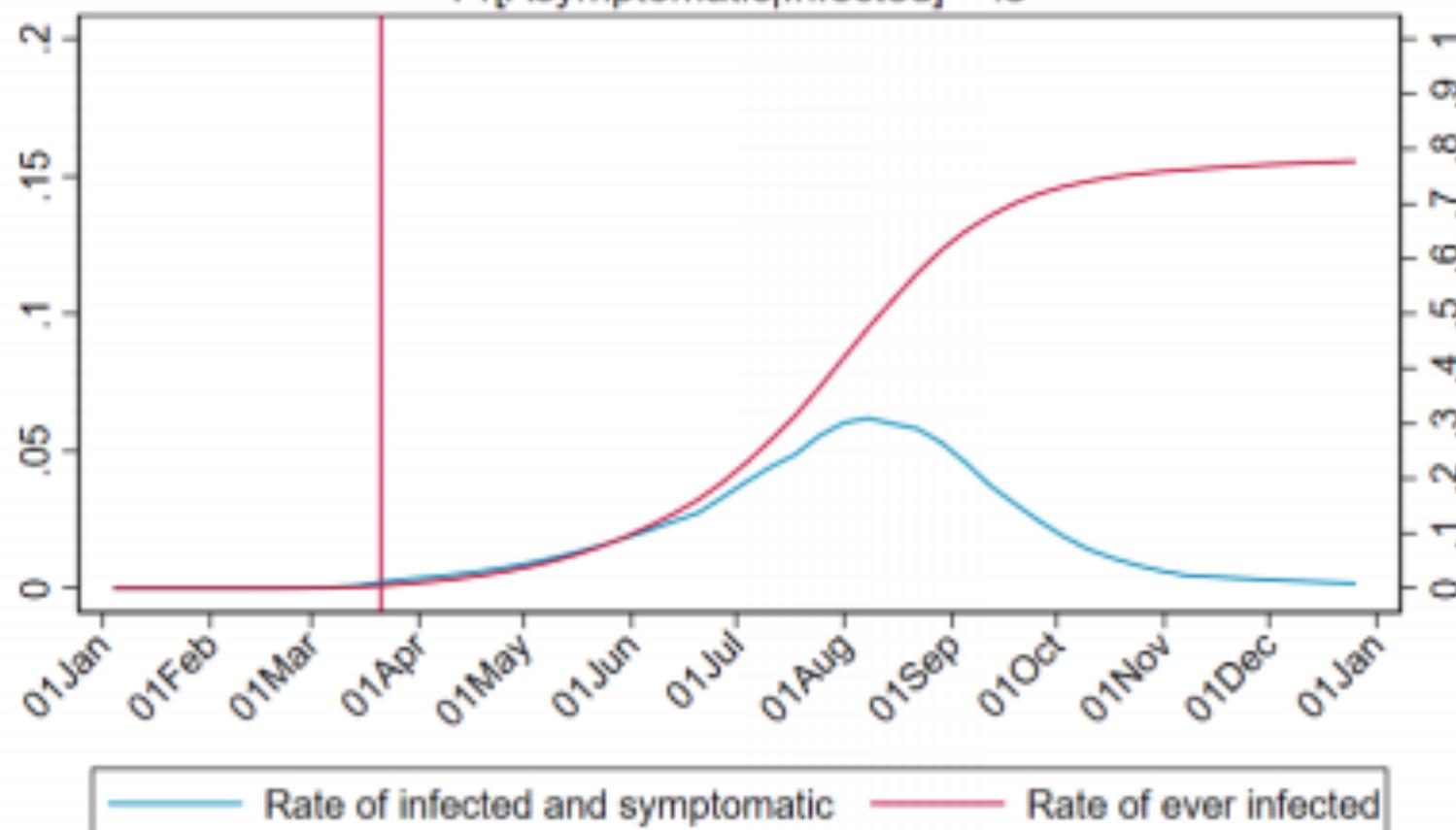


Initial cases = 50, baseline symptomatic rate = .02, $\gamma = .6$
Vertical line denotes March 21, 2020

Figure 4. Low asymptomatic rate, severe long-duration policy

Rates of symptomatic infected (left) and ever-infected (right)

$$\Pr[\text{Asymptomatic} | \text{Infected}] = .3$$



Initial cases = 50, baseline symptomatic rate = .02, $\gamma = .6$
Vertical line denotes March 21, 2020

$$\Delta S_t = -\beta I_{t-1} \frac{S_{t-1}}{N}$$

$$\Delta R_t = \gamma I_{t-1},$$

$$\Delta I_t = \beta I_{t-1} \frac{S_{t-1}}{N} - \gamma I_{t-1}$$

Bringing the Economy Back Up from Anæsthesia

Major issues:

- Certificates of immunity:
 - Which requires test, test, test:
 - And not just disease virus tests
 - Presence-of-antibodies tests
- How quickly can we match the immune with public-contact jobs?
- What jobs can be done with minimal infection risk?
- What minimal-infection substitutes can we find for previous jobs?
- How quickly can restrictions be relaxed without the virus coming roaring back?
- How do we avoid having the market give a “shutdown” signal to enterprises we in fact want restarted?
 - Which is pretty much all of them
- How much of the potential caseload do we want to push out beyond the vaccine-arrival date?

ALL THESE QUESTIONS ARE ANSWERABLE IF WE LEARN THE ASYMPTOMATIC HENCE NON-TESTED RATE!!

Keeping the Economy from Crashing During the Lockdown

Nick Rowe: We have a 50% output cut in 100% of the sectors:

- A temporary 100% output cut in 50% of the sectors (what the Coronavirus does) is very different from a 50% output cut in 100% of the sectors
- Nick's thought experiment:
 - In three months we are going to invent unobtanium:
 - Substantial intertemporal substitutability
 - Plus lower cross-good contemporaneous substitutability
 - Hence high desired savings rate now
 - Flex-price market thus produces a nominal rate at the zero lower bound and a high inflation rate over the next three to six months
 - Plus liquidity-constrained workers in affected sectors see their demand go to zero immediately
 - Can we get there? Should we get there? What should we do instead?
 - We need a good RBC economist: are there any?...

Keeping the Economy from Crashing During the Lockdown II

Nick Rowe:

- <https://worthwhile.typepad.com/worthwhile_canadian_initi/2020/03/relative-supply-shocks-unobtainium-walras-law-and-the-coronavirus.html>
- Plus: to extend the thought experiment:
 - We just lost the ability to make “unobtainium”
 - So we *should* be substituting leisure for work, and moving workers into relatively unproductive labor, making the commodities we can still produce right now
 - How should relative prices move as a result? How should we make them move?

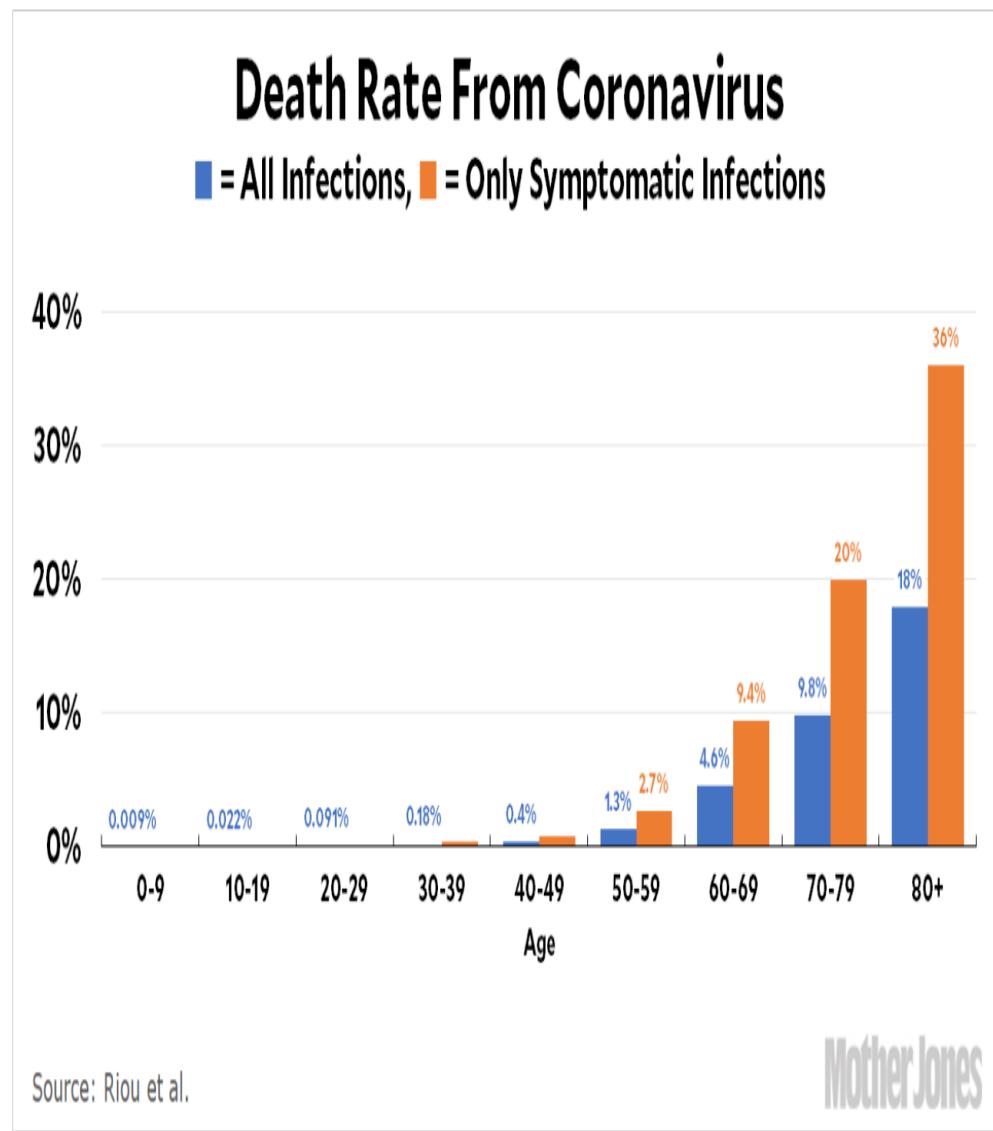
Plus: distributional issues

Plus: bankruptcy and credit chain issues

MOAR Coronavirus!

Death for Geezers!

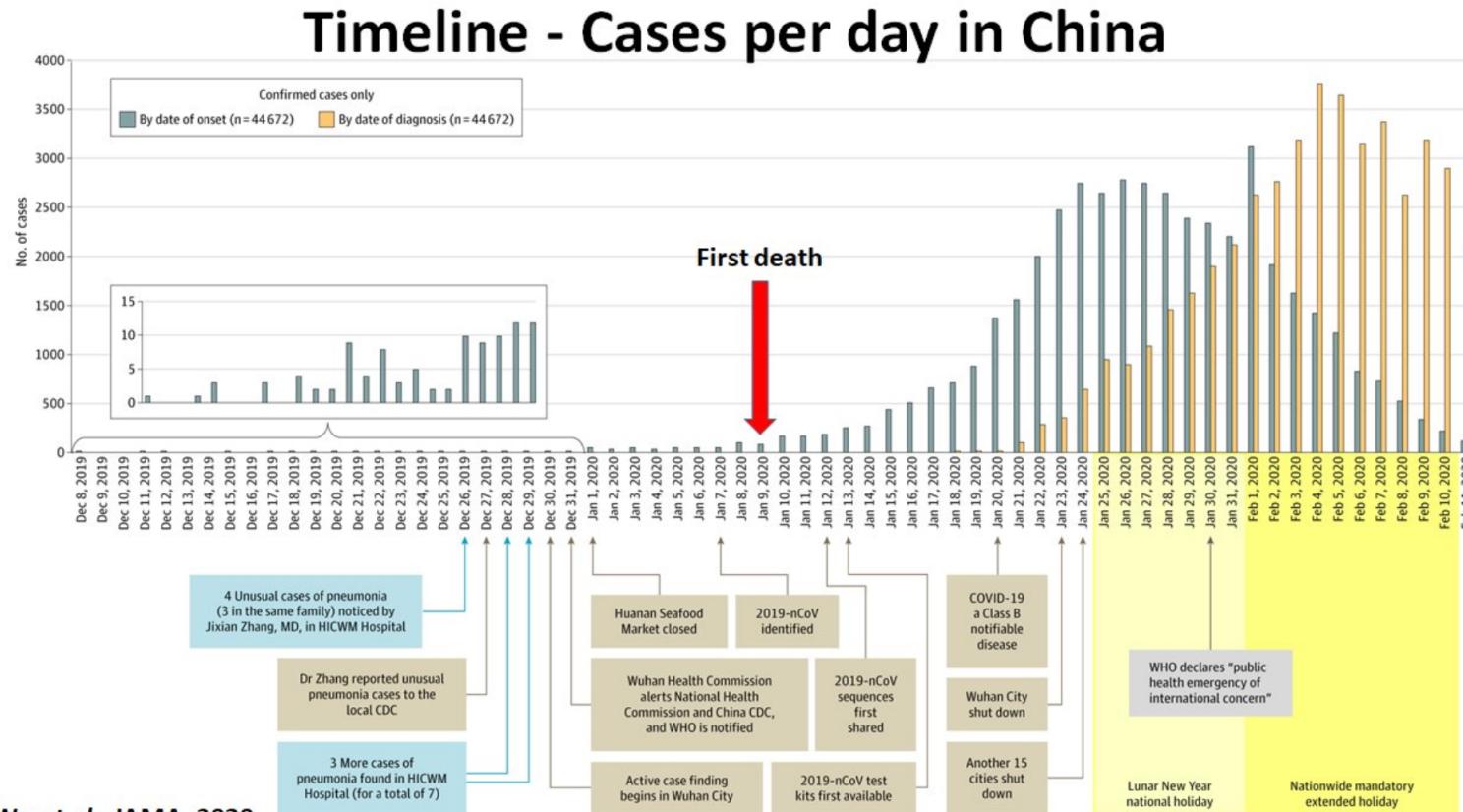
- Mortality for the Youngs very low...
- It's the flu for them—for you...
- And an extra doubling—or is it 5%?—mortality for the asthmatic
- And an extra doubling—or is it 5%?—mortality for the overweight



What We Think Happened in Wuhan

China beat it quickly & relatively easily!

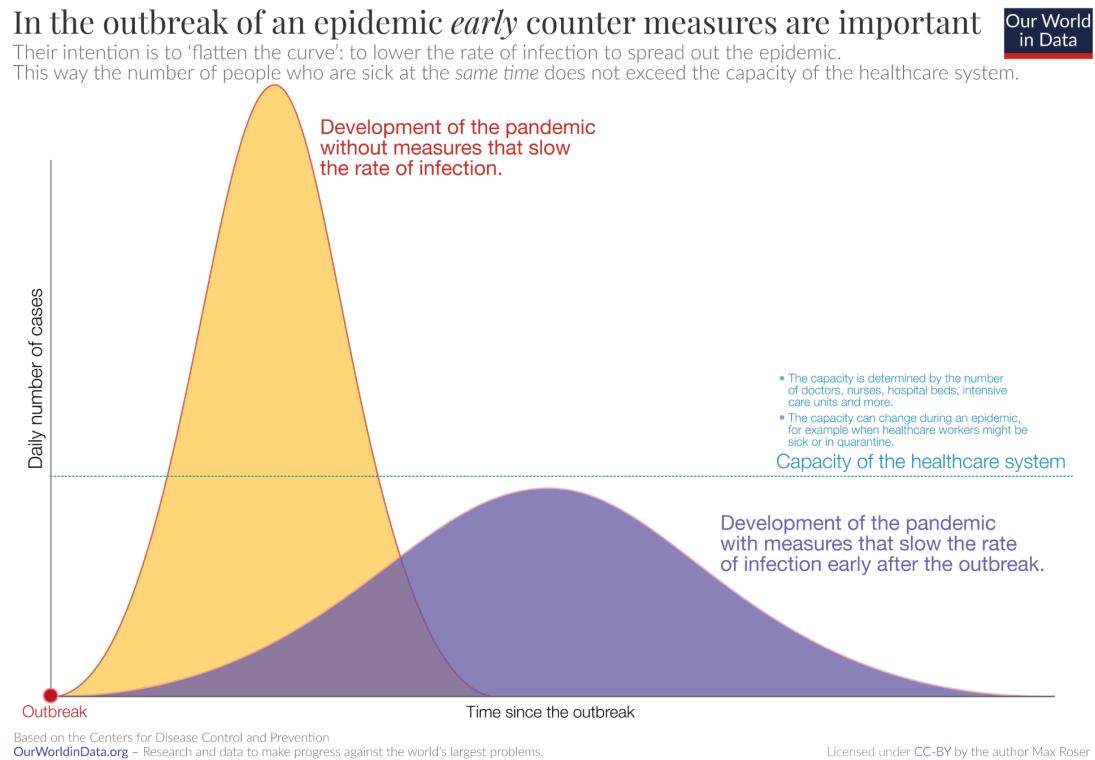
- We think
- Shut down Wuhan when 200 cases per day
- That seems to have been a good decision



The Goal

When Is It Appropriate to Move on This?

- Immediate social distancing...
- Self-isolate if you have a cough and a fever...
- Hope that warmer temperatures will do to this what they did to SARS...
- Otherwise, when do you want to start spreading out transmission. It seems that early is as good as later, so do it early...
 - I have no good intuition on why you want to move early
 - Plus your moving early will be wasted if you get reinfected
 - Plus the sparks you throw off making others' lives more difficult



References

- **Financial Times** (2020): Coronavirus Tracked: The Latest Figures as the Pandemic Spreads <<https://www.ft.com/coronavirus-latest>>
- **Nick Rowe** (2020): *Relative Supply Shocks, Unobtainium, Walras' Law, and the Coronavirus* <https://worthwhile.typepad.com/worthwhile_canadian_initi/2020/03/relative-supply-shocks-unobtainium-walras-law-and-the-coronavirus.html>
- **Jim Stock** (2020): *Coronavirus Data Gaps and the Policy Response* <<https://drive.google.com/file/d/12MV466ZZy5xHir4xdPhoTrL1oO8CbZU-/view>>

MOAR Coronavirus!

What I am watching:

- **Max Roser & Hannah Ritchie:** *Coronavirus Disease (COVID-19)* <<https://ourworldindata.org/coronavirus>>...
- **Worldometer:** *Coronavirus Update (Live)* <<https://www.worldometers.info/coronavirus/>>: '125,599 Cases and 4,605 Deaths from COVID-19 Virus Outbreak...'
- *FT Coronavirus Tracker* <<https://www.ft.com/content/a26fbf7e-48f8-11ea-aeb3-955839e06441>>
- Josh Marshall's COVID Twitter List <<https://twitter.com/i/lists/1233998285779632128>>
- NEJM Group: Updates on the Covid-19 Pandemic <http://m.n.nejm.org/nl/jsp/m.jsp?c=%40kxNtXckRDOq8oG0jJvAXsIzN4mPECIPhtxoTSdTU9k%3D&cid=DM89089NEJM_COVID-19_Newsletter&bid=173498255>: 'From the New England Journal of Medicine, NEJM Journal Watch, NEJM Catalyst, and other trusted sources...'

Catch Our Breath...

- Ask a couple of questions?
 - Make a couple of comments?
 - Any more readings to recommend?
-
- <<https://www.icloud.com/keynote/0YKEi7HeOrVGvKYtt9FEqH7nA>>
 - <<https://www.bradford-delong.com/2020/04/coronavirus.html>>
 - github:<<https://github.com/braddelong/public-files/blob/master/coronavirus.pptx>>
 - <https://github.com/braddelong/public-files/blob/master/coronavirus.pdf>
 - html File: <<https://www.bradford-delong.com/2020/04/coronavirus.html>>
 - Edit This File: <<https://www.typepad.com/site/blogs/6a00e551f08003883400e551f080068834/post/6a00e551f080038834025d9b3bd66a200c/edit>>
 - <<https://delong.typepad.com/files/2020-04-01-coronavirus.pdf>>



Coronavirus! (March 16)

With 31 deaths in the U.S. as of March 11, a 1% death rate, and up to 4 weeks between infection and death, that means that as of Feb 12 there were 3100 coronavirus cases in the United States.

With 87 deaths in the U.S. as of Mar 16, a 1% death rate, and up to 4 weeks between infection and death, that means that as of Feb 17 there were 8700 coronavirus cases in the United States

If it is doubling every seven days, then now about 150,000 people have and in the next week about 150,000 more people in the U.S. will catch coronavirus—which means 1/2200, currently 3500 of the 7.6 million inhabitants of San Francisco Bay. Touch a hard surface that any of those 3500 has touched in the last 48 hours, and the virus has a chance to jump to you...

These numbers could be five times too big. These numbers are probably not five times too small unless the thing is a lot less deadly, and there are a lot of asymptomatic cases...

- What is wrong with this analysis?

MOAR Coronavirus!

As of March 21: Things are not moving in the right direction:

- What is the R_0 ?
- How can the R_0 be changed?
- How will the R_0 change?
- What is the asymptote share of the population?
- What is the mortality rate?

| Country, Other | Total Cases | New Cases | Total Deaths | New Deaths | Total Recovered | Active Cases | Serious, Critical | Tot Cases/1M pop |
|-----------------------------|-------------|-----------|--------------|------------|-----------------|--------------|-------------------|------------------|
| China | 80,880 | +36 | 3,213 | +14 | 67,819 | 9,848 | 3,226 | 56.2 |
| Italy | 27,980 | +3,233 | 2,158 | +349 | 2,749 | 23,073 | 1,851 | 462.8 |
| Iran | 14,991 | +1,053 | 853 | +129 | 4,590 | 9,548 | | 178.5 |
| Spain | 9,428 | +1,440 | 335 | +41 | 530 | 8,563 | 272 | 201.6 |
| S. Korea | 8,236 | +74 | 75 | | 1,137 | 7,024 | 59 | 160.6 |
| Germany | 7,241 | +1,428 | 15 | +2 | 65 | 7,161 | 2 | 86.4 |
| France | 5,423 | | 127 | | 12 | 5,284 | 400 | 83.1 |
| USA | 4,186 | +506 | 73 | +5 | 73 | 4,040 | 12 | 12.6 |
| Switzerland | 2,353 | +136 | 19 | +5 | 4 | 2,330 | | 271.9 |
| UK | 1,543 | +152 | 55 | +20 | 52 | 1,436 | 20 | 22.7 |
| Netherlands | 1,413 | +278 | 24 | +4 | 2 | 1,387 | 45 | 82.5 |
| Norway | 1,323 | +67 | 3 | | 1 | 1,319 | 27 | 244.0 |

Coronavirus Cases:

179,836

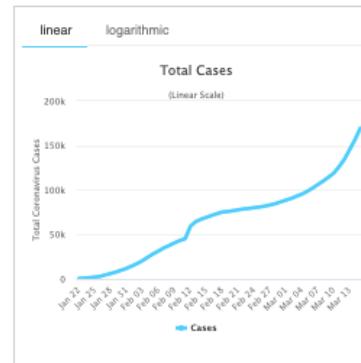
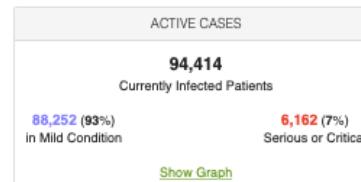
[view by country](#)

Deaths:

7,098

Recovered:

78,324



MOAR Coronavirus!

As of March 10: Things are not moving in the right direction:

- What is the R_0 ?
- How can the R_0 be changed?
- How will the R_0 change?
- What is the asymptote share of the population?
- What is the mortality rate?

Coronavirus Cases:

125,599

[view by country](#)

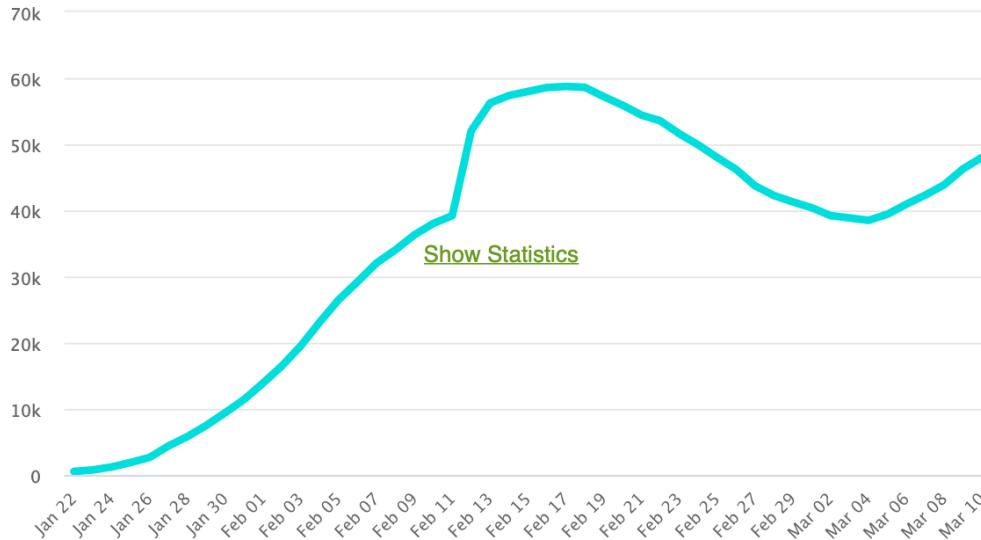
Deaths:

4,605

Recovered:

67,051

ACTIVE CASES



ACTIVE CASES

53,943

Currently Infected Patients

48,025

(89%)

in Mild Condition

5,918

(11%)

Serious or Critical

[Show Graph](#)

CLOSED CASES

71,656

Cases which had an outcome:

67,051

(94%)

Recovered / Discharged

4,605

(6%)

Deaths

[Show Graph](#)

linear logarithmic

Total Cases
(Logarithmic Scale)

1M

100k

10k

1k

100

10

100

10k

100k

1M

100

10k

1000

100

10

100

10k

1000

10000

100000

1000000

10000000

100000000

1000000000

10000000000

100000000000

1000000000000

10000000000000

100000000000000

1000000000000000

10000000000000000

100000000000000000

1000000000000000000

10000000000000000000

100000000000000000000

1000000000000000000000

10000000000000000000000

100000000000000000000000

1000000000000000000000000

10000000000000000000000000

100000000000000000000000000

1000000000000000000000000000

10000000000000000000000000000

100000000000000000000000000000

1000000000000000000000000000000

10000000000000000000000000000000

100000000000000000000000000000000

1000000000000000000000000000000000

10000000000000000000000000000000000

100000000000000000000000000000000000

1000000000000000000000000000000000000

10000000000000000000000000000000000000

100000000000000000000000000000000000000

1000000000000000000000000000000000000000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

100

1000

1000

100

1000

100

1000

100

1000

100

1000

100

Notes

