

# **Lecture 21b:**

## **5.4. Africa**

**Brad DeLong**

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

last revised: Th 2020-04-09

for presentation: Th 2020-04-14

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

<<https://github.com;braddelong/public-files/blob/master/econ-135-lecture-21b.pptx>>

<<https://www.icloud.com/keynote/0xRRhkj7cn2vsAXbYKCH4E9Ug>>

# Discussion

## African Retardation:

- What strikes you as important here?
- Some questions on my mind (the first two about Africa; the next three for trying to pull together the general cross-continent post-WWII growth experience):
  1. Is sub-Saharan Africa's trajectory a unique one, a “special way”, or has it just been an intensification of growth retarding features also seen substantially at work elsewhere?
  2. How are we to understand the end of apparent African retardation around 2000?
  3. Open till 1500 the middle east, especially what is now Turkey, Iran, and Egypt, seemed to have important and impressive civilizational advantages over western Europe. How old is the story of western Europe's growing post 1500 edge in prosperity look different if one looks not from the western European vantage point, as we did earlier in the course, but from the Middle Eastern?
  4. Do you think what is going on in the interior of China, with the exception of a few cities along the Yangtze that look a lot like the coasts, is more like what has been going on in the rest of Asia or just the Pacific rim story delayed by a few decades?
  5. Is your guess that China or India is more likely to be the world's predominant superpower come 2100

# Africa

## Tu Apr 14: 5.4. Africa:

- Read Before: **Nathan Nunn** (2008): *The Long Term Effects of Africa's Slave Trades* <<https://github.com;braddelong/public-files/blob/master/readings/article-nunn-long-term.pdf>>
- Slides: <<https://github.com;braddelong/public-files/blob/master/econ-135-lecture-21b.pptx>>
- Discussion Thread: <[https://bcourses.berkeley.edu/courses/1487685/discussion\\_topics/5747048](https://bcourses.berkeley.edu/courses/1487685/discussion_topics/5747048)>
- Zoom Q&A Session: <<https://github.com;braddelong/public-files/blob/master/econ-135-zoom-2020-04-14-10.02.09-92696375431-africa.zip>>

30 minutes of audio

# Africa Falls Behind, 1950-2000

The rest of the global south passes Africa between 1950 & 2000:

- Most African countries have respectable—not global north but respectable—levels of prosperity in 1950
- They do get richer from 1950-2000
- But by 2000 their levels of prosperity are no longer respectable for the global south
  - With the exception of the Maghreb
- After 2000 Africa gets into growth gear
- But “African retardation” vis-a-vis south & east Asia & Latin America was not a thing in 1950
- It is a creation of the post-WWII half century



# Africa Falls Behind, 1950-2000

## Four example African countries:

- Egypt (north, Maghreb), Ethiopia (east, poor), Ghana (west, well-integrated economically), & Zambia (south, industrializing)
  - Zambia, Ghana richer than Portugal in 1950
- Egypt does not converge, but it grows along with the world from 1950-2000
- The other three? Not
  - Substantial 1950-2000 improvements in life expectancy & other social indicators, however
- What changes for good for Africa in 2000?

Example African National Income per Capita & Life Expectancy: Levels & Growth Rates

YEAR	1950	2000	2020	Growth Rate 1950-2000	Growth Rate 2000-2020
<b>NATIONAL INCOME PER CAPITA</b>					
Egypt	\$3,220	\$7,190	\$11,400	1.61%	2.30%
Ethiopia	\$564	\$621	\$1,900	0.19%	5.59%
Ghana	\$1,680	\$2,220	\$4,430	0.56%	3.45%
Zambia	\$1,990	\$2,130	\$3,700	0.14%	2.76%
<b>LIFE EXPECTANCY</b>					
Egypt	38	68	71	1.16%	0.22%
Ethiopia	31	51	69	1.00%	1.51%
Ghana	45	59	66	0.54%	0.56%
Zambia	44	46	64	0.09%	1.65%
China	41	72	78	1.13%	0.40%
India	35	63	68	1.18%	0.38%
United States	68	77	79	0.25%	0.13%
< <a href="https://www.icloud.com/numbers/0_xavfrB_h">https://www.icloud.com/numbers/0_xavfrB_h</a> >					
< <a href="https://github.com/braddeLong/public-files/blob/master/growth-cross-country-africa-examples.xlsx">https://github.com/braddeLong/public-files/blob/master/growth-cross-country-africa-examples.xlsx</a> >					

# African Institutional Development

## **Sub-Saharan Africa comes late to state-building:**

- Was the fact that state-building had to happen after 1950 a cause of slow growth?
  - Imperialism, its withdrawal, and African state capacity after WWII.
- “Stateless” societies were still common in Africa until after WWII:
  - Somalia
  - The Nuer in South Sudan
  - The Tallensi in northern Ghana
  - The Hadza of Tanzania
  - The San in Botswana
- Philip Curtin: In 1890 a quarter of Africans in “stateless” societies
- Early 1400s: Kongo, Loango, Tio, Luba, Rund
- Since 1000: Ghana, Mali, Songhay
- Great Zimbabwe?
- Nubia, Kush, Axum
- Why might African political centralization have been delayed?:
  - Diamond: Lack of wheat, rice, corn agricultural staples for intensive agriculture—hence low population density
  - Adverse disease environment?
  - Vansina/McIntosh: unique sub-Saharan African sociological matrix inhibits centralization

# Within Sub-Saharan Africa Correlations

## James Robinson: what determines a society's "level of sovereignty" within Africa?:

- Not correlated with agricultural potential
- Not correlated with disease burden
- Correlated with population density
- Social network ties & belief structures?
  - Little robustness
  - (age) x (kinship) x (witchcraft)
- Is sub-Saharan Africa in the agrarian age a success? Society successfully resisting the state?

	Dependent Variable: Levels of Sovereignty (1=Stateless - 4=Highest)				
	(1)	(2)	(3)	(4)	(5)
Agricultural Potential	0.078 (0.024)	0.07 (0.047)	0.063 (0.051)	0.05 (0.053)	0.052 (0.055)
Malaria	0.142 (0.107)	0.047 (0.174)	0.024 (0.180)	0.004 (0.165)	0.133 (0.201)
Trypanosomes	-0.239 (0.152)	0.145 (0.270)	0.222 (0.272)	0.248 (0.252)	0.077 (0.302)
Age Organizations		-0.046 (0.441)	-1.658 (0.882)	-0.884 (0.835)	-1.693 (0.999)
Kinship Organizations		0.264 (0.185)	-0.602 (0.902)	-0.587 (0.913)	-0.743 (0.963)
Witchcraft		0.315 (0.165)			
Age*Kinship			1.14 (0.769)	0.745 (0.791)	1.153 (0.802)
Age*Witchcraft			0.79 (0.698)	0.346 (0.630)	0.693 (0.838)
Kinship*Witchcraft			0.337 (0.285)	0.251 (0.277)	0.322 (0.337)
Age*Kinship*Witchcraft			-0.504 (0.227)	-0.291 (0.224)	-0.463 (0.246)
Checks on Leader's Power				-0.622 (0.155)	
External War - Being Attacked					-0.166 (0.234)
Observations	184	66	66	63	56
R-squared	0.074	0.202	0.26	0.409	0.265

# I Samuel 8:4 ff.

**All the elders of Israel gathered themselves together, and came to Samuel unto Ramah:**

- And said unto him, “Behold, thou art old, and thy sons walk not in thy ways: now make us a king to judge us like all the nations.”...
- And Samuel told all the words of the Lord unto the people that asked of him a king. And he said:
  - “This will be the manner of the king that shall reign over you: He will take your sons, and appoint them for himself, for his chariots, and to be his horsemen; and some shall run before his chariots. And he will appoint him captains over thousands, and captains over fifties; and will set them to ear his ground, and to reap his harvest, and to make his instruments of war, and instruments of his chariots. And he will take your daughters to be confectionaries, and to be cooks, and to be bakers.
  - “And he will take your fields, and your vineyards, and your oliveyards, even the best of them, and give them to his servants. And he will take the tenth of your seed, and of your vineyards, and give to his officers, and to his servants. And he will take your menservants, and your maidservants, and your goodliest young men, and your asses, and put them to his work.
  - “He will take the tenth of your sheep: and ye shall be his servants.
  - “And ye shall cry out in that day because of your king which ye shall have chosen you; and the Lord will not hear you in that day...”

# Slavery in Africa

## Slavery & thralldom common in human history:

- Steal people, rip them out of their social context, and sell them to foreigners
- Then, without social ties or orientation, they can be treated worse than poor third cousins
  - Or things can get much nastier: galleys, mines, plantations
- Genesis 37:23 ff.:
  - When Joseph was come unto his brethren, that they stript Joseph... and cast him into a pit.... And, behold, a company of Ishmeelites came from Gilead with their camels bearing spicery and balm and myrrh, going to carry it down to Egypt. And Judah said unto his brethren, “What profit is it if we slay our brother, and conceal his blood? Come, and let us sell him to the Ishmeelites, and let not our hand be upon him; for he is our brother and our flesh.” And his brethren were content.... They drew and lifted up Joseph out of the pit, and sold Joseph to the Ishmeelites for twenty pieces of silver: and they brought Joseph into Egypt.... And the Midianites sold him into Egypt unto Potiphar, an officer of Pharaoh's, and captain of the guard...”

# Slavery in Africa II

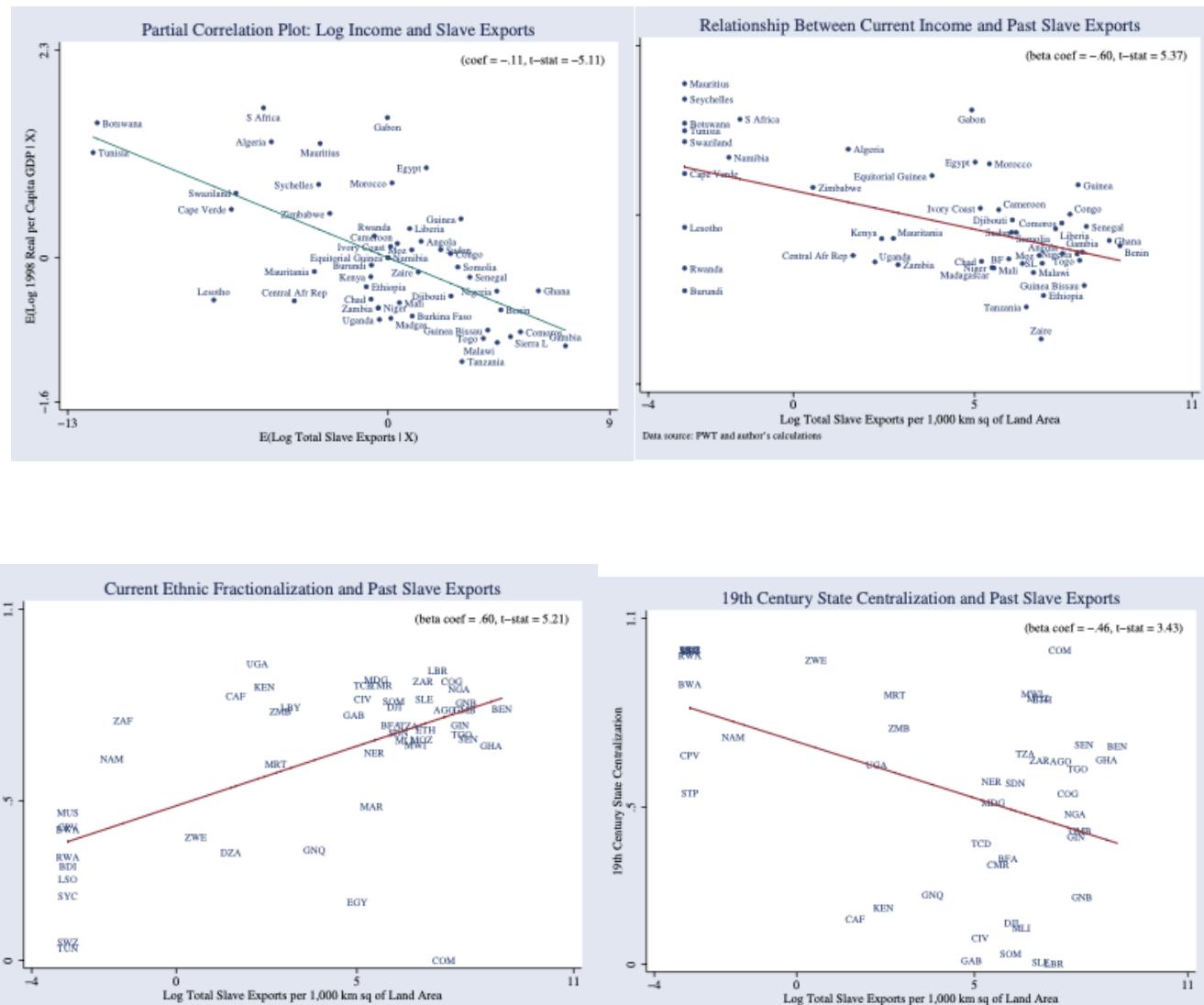
## Slave trades in the past millennium:

- “Black Sea”
- “Barbary Coast”
- Indian Ocean
- Atlantic-Caribbean
- Two moments at which slavery rapidly intensified:
  - Coming of the slavery-driven “Atlantic economy” after 1600
  - Abolition of the slave trade, followed by redeployment of slaves into African plantations to grow export agricultural crops
    - 30% of western Sudanese slaves in 1900? Slavery “abolished” in Sierra Leone in 1928, in Nigeria in 1936, in Mauritania in 1981
- Slave trades: Atlantic 1600-1850: 13M? Indian Ocean 1000-1900: 5M? Internal African 1500-1900: 5M? Trans-Saharan 1200-1900: 3M? Barbary Coast 1500-1800: 1.5M? Black Sea 1400-1750: 3M?
- Population of Africa in 1700: 60M?
  - People born in Africa & surviving to age 5, 1500-1800: 360M?

# Consequences

## Societal disintegration:

- Nathan Nunn has constructed estimates:
  - The negative effects of the slave trade on income per capita in Africa.
  - Shipping records, plantation records, sales receipts, the ethnicity/origin of slaves
  - Intensity of slaving negatively correlated with income today
  - Intensity of slaving negatively correlated with institutional quality.
  - A fall of one standard deviation in the extent of slaving raises income per capita by 50%



# Regression Results

TABLE III  
RELATIONSHIP BETWEEN SLAVE EXPORTS AND INCOME

	Dependent variable is log real per capita GDP in 2000, $\ln y$					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(exports/area)	-0.112*** (0.024)	-0.076*** (0.029)	-0.108*** (0.037)	-0.085** (0.035)	-0.103*** (0.034)	-0.128*** (0.034)
Distance from equator	0.016 (0.017)	-0.005 (0.020)	0.019 (0.018)	0.023 (0.017)	0.006 (0.017)	
Longitude	0.001 (0.005)	-0.007 (0.006)	-0.004 (0.006)	-0.004 (0.005)	-0.009 (0.006)	
Lowest monthly rainfall	-0.001 (0.007)	0.008 (0.008)	0.0001 (0.007)	-0.001 (0.006)	-0.002 (0.008)	
Avg max humidity	0.009 (0.012)	0.008 (0.012)	0.009 (0.012)	0.015 (0.011)	0.013 (0.010)	
Avg min temperature	-0.019 (0.028)	-0.039 (0.028)	-0.005 (0.027)	-0.015 (0.026)	-0.037 (0.025)	
ln(coastline/area)	0.085** (0.039)	0.092** (0.042)	0.095** (0.042)	0.082** (0.040)	0.083** (0.037)	
Island indicator		-0.398 (0.529)	-0.150 (0.516)			
Percent Islamic			-0.008*** (0.003)	-0.006* (0.003)	-0.003 (0.003)	
French legal origin			0.755 (0.503)	0.643 (0.470)	-0.141 (0.734)	
North Africa indicator			0.382 (0.484)	-0.304 (0.517)		
ln(gold prod/pop)				0.011 (0.017)	0.014 (0.015)	
ln(oil prod/pop)					0.078*** (0.027)	0.088*** (0.025)
ln(diamond prod/pop)					-0.039 (0.043)	-0.048 (0.041)
Colonizer fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number obs.	52	52	42	52	52	42
R <sup>2</sup>	.51	.60	.63	.71	.77	.80

TABLE IV  
ESTIMATES OF THE RELATIONSHIP BETWEEN SLAVE EXPORTS AND INCOME

	(1)	(2)	(3)	(4)
Second Stage. Dependent variable is log income in 2000, $\ln y$				
ln(exports/area)	-0.208*** (0.053)	-0.201*** (0.047)	-0.286* (0.153)	-0.248*** (0.071)
	[-0.51, -0.14]	[-0.42, -0.13]	[ $-\infty$ , $+\infty$ ]	[-0.62, -0.12]
Colonizer fixed effects	No	Yes	Yes	Yes
Geography controls	No	No	Yes	Yes
Restricted sample	No	No	No	Yes
F-stat	15.4	4.32	1.73	2.17
Number of obs.	52	52	52	42
First Stage. Dependent variable is slave exports, ln(exports/area)				
Atlantic distance	-1.31*** (0.357)	-1.74*** (0.425)	-1.32* (0.761)	-1.69** (0.680)
Indian distance	-1.10*** (0.380)	-1.43*** (0.531)	-1.08 (0.697)	-1.57* (0.801)
Saharan distance	-2.43*** (0.823)	-3.00*** (1.05)	-1.14 (1.59)	-4.08** (1.55)
Red Sea distance	-0.002 (0.710)	-0.152 (0.813)	-1.22 (1.82)	2.13 (2.40)
F-stat	4.55	2.38	1.82	4.01
Colonizer fixed effects	No	Yes	Yes	Yes
Geography controls	No	No	Yes	Yes
Restricted sample	No	No	No	Yes
Hausman test (p-value)	.02	.01	.02	.04
Sargan test (p-value)	.18	.30	.65	.51

# Why Trade Slaves?

## Astonishingly “Inefficient”:

- 20% of captives died en route between Africa and the Americas.
- Far more died in the violence of capture or on the way to be sold
  - (Joseph Miller estimated that 50% of the slaves caught in the interior of Angola died before being sold at the coast)
- Low African population density
- Slavery worthwhile by elites to avoid paying high wages
- But that means slaves would have been very productive kept in Africa
  - (Slave exports from Bali, and the 1815 Mt. Tambora explosion)
- Lack of centralized states meant maintaining domination not easy
- Sell slaves to Europeans, & maintaining domination then becomes their problem

# Did European Colonialism Underdevelop Africa?

## Cheerleaders for colonialism:

- What Dell calls the “eccentric consensus”: colonial officials and academics such as Peter Bauer and Niall Ferguson agree with Marxists like Lenin and Bill Warren’s *Imperialism: Pioneer of Capitalism* that colonialism stimulated economic growth in Africa:
  - Modern institutions and organizational forms...
  - Technologies such as railways and mines...
  - Integration into increasingly globalized world economy
  - Research into curing “tropical” diseases...
- But: resource expropriation
- Melissa Dell’s calculation of the effects of the Natives Land Act of 1913 in South Africa
  - Expropriating 93% of the land
  - For a wage share of 2/3, generates a 59% decline in African living standards
  - To some degree elite replacement, but still...

# Balance of the Evidence

## **Pre-colonial polities, European settlement, all other:**

- Pre-colonial polities: colonialism stopped the existing dynamics of centralization, severed links of accountability (indirect rule) and in many cases created/intensified conflict
- Large-scale European settlement: mass immigration associated with land expropriation, creation of huge inequalities, institutionalized racism
- Others: European contact brings much greater social connectivity and economic integration
  - But was colonialism the best way to do that?
  - Johannes Fedderke & al.: colonialism does not bring higher-quality property rights

# Colonialism: Ghana

## The Asante as a “martial race”:

- Asante chiefs were made into the tools of indirect rule.
- Post-independence politics dominated by Nkrumah and an anti-Asante coalition initiating a cycle of anti-Asante and pro-Asante regimes. Today the two main political parties revolve around this cleavage.
- The fight for power after 1957 led to political instability, coups, military rule, the expropriation of the cocoa farmers. The nature and structure of this conflict was entirely a legacy of the colonial state.
- A plausible counter-factual is that Asante would have expanded and formed a “nation state”. This might not have been developmental, but it would have avoided indirect rule and the political instability which undermined the economy.
- Economic growth during the colonial period was a purely African development which would plausibly have occurred without British intervention (Hill, 1963, Austin, 2005).
- The allocation and regulation of land were made less efficient by indirect rule (Colson, 1971, Goldstein and Udry, 2008).
- Location of infrastructure was determined by the desire to rule as much as develop and the only reason that Asante had not previously built a railway to the coast was because the British colonial office had blocked it (Chaves, Engerman and Robinson, 2012).
- Missionaries were the driving force behind educational expansion in British colonies and a reasonable counterfactual is that absent colonization the missionaries would have come anyway.

# Institutions: Sierra Leone

## In 1787 Freetown founded

- Home for London's 'Black poor' and repatriated slaves
- After 1807 Freetown was an important base for the British anti-slave trade squadron
- No large centralized state like the Asante Empire
- In the second half of the 19th century the interior was expropriated by the British via a sequence of treaties with individual chiefs
- Frederick Cooper proposed the notion of the 'Gatekeeper State' in Africa - colonial powers sat on the coast and developed the minimal amount of infrastructure necessary to keep order and extract natural resources: Sierra Leone looks like a good example for him:
  - Indirect rule and Paramount Chiefs
  - The British often interfered with the legitimacy of the traditional powerholders.
  - Instead of their authority coming from the people, the authority of chiefs now came from the colonial state
  - Severed linkages between the chiefs and their people
  - Extraction of taxes and unpaid labor on the farms of chiefs increased as a result

# After Independence: Sierra Leone

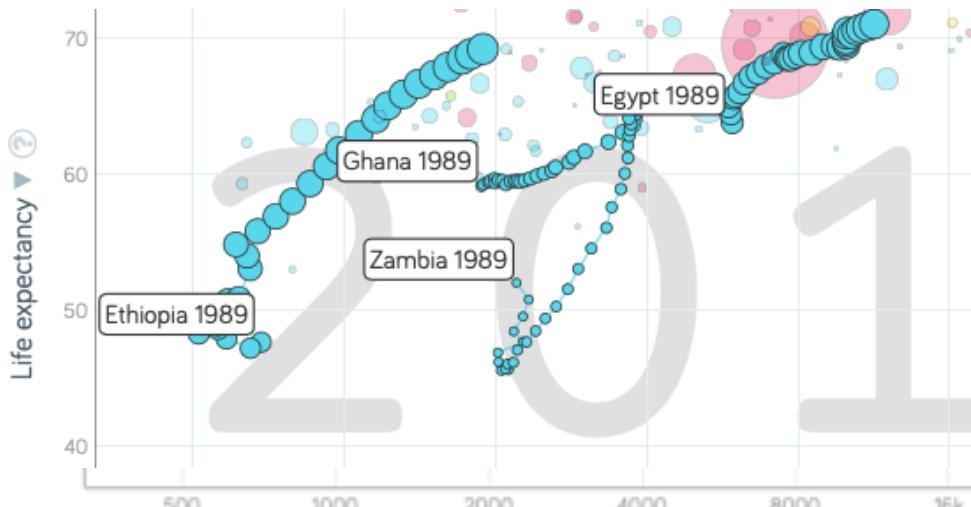
**In 1961 British handed power to Sir Milton Margai and his Sierra Leone People's Party (SLPP):**

- Support primarily in the South (Mendeland) and East
- In 1967 the SLPP narrowly lost a hotly contested election to Siaka Stevens' All Peoples Congress party (APC).
  - Anti-Stevens military coup led by Mende officers (who dominated the higher ranks of the military)
  - Pro-Stevens counter-coup led by northern junior officers
- Siaka Stevens: President of Sierra Leone 1967-1985
  - Favorite Aphorism—"The cow eats where it's tethered"
  - Pull up the railroad to isolate and undermine the economy of the East and the rural support for the SLPP.
  - But this also crippled the coffee farmers
  - One-party state
  - Patrimonial and violent: Sam Bangura—Governor of the Central Bank—was thrown off the roof
  - The economy and state collapsed
- Paramount Chiefs as local despots:
  - Must come from ruling families
  - More ruling families, more potential political competition
- Moving from 1 ruling family to the mean of 4:
  - increases literacy by one standard deviation, or 6 percentage points
  - increases non-agricultural employment by 1 percentage point, from a base of only 3 percent

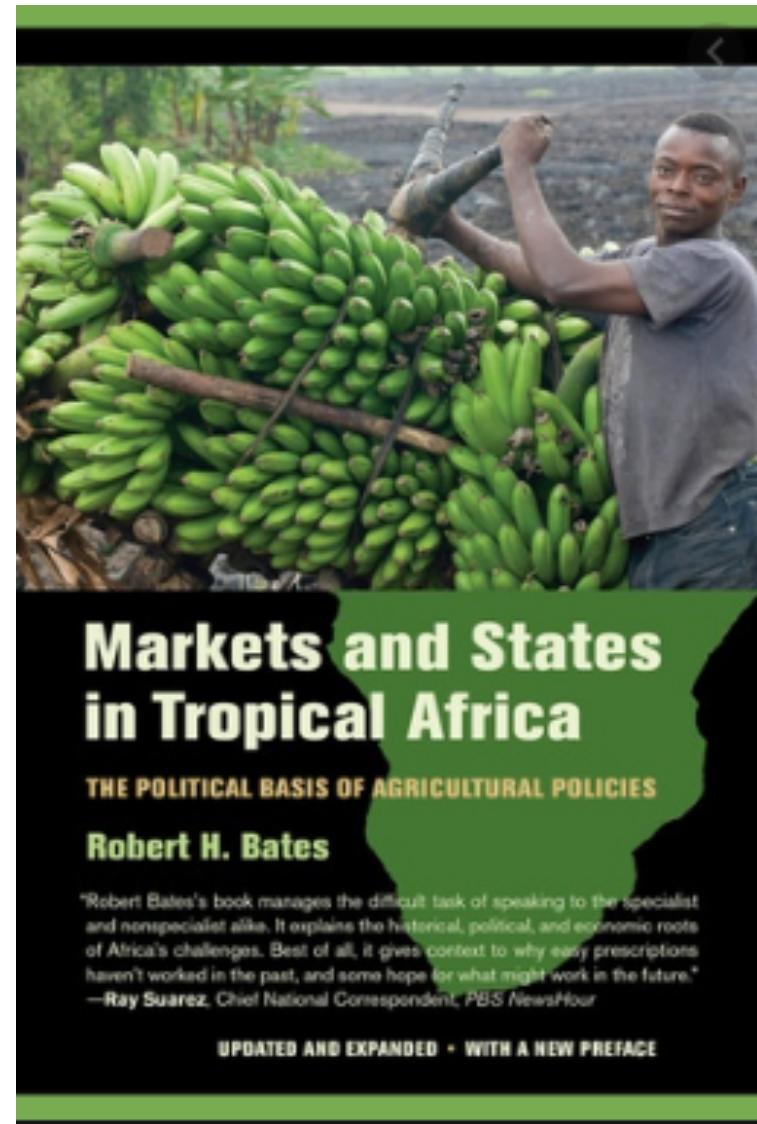
# Markets and States in Tropical Africa

## Robert Bates's classical statement of the problem:

- Written long before predatory post-colonial African states had reached their peak
- But do not think that slave-raiding and colonial heritage patterns have doomed Africa
- Since 2000, African growth has gotten itself in gear
- Prosperity doubling times for Ethiopia, Ghana, and Zambia of 12, 20, and 26 years respectively—impressive...



1:00



# **Big Ideas: Lecture 21b: African Retardation**

**Takeaways from this class:**

# Roadmap for the Next Two Weeks...

## 21. Th Apr 16: 5.5. South Asia & Middle East

- **Read Before:** Sevkut Pamuk (2014): Institutional Change and Economic Development in the Middle East, 700-1800 <<https://delong.typepad.com/files/pamuk.pdf>>
- **Slides:** <<https://github.com;braddelong/public-files/blob/master/econ-135-lecture-21.pptx>>

## 6. Policy Issues

### 22. Tu Apr 21: 6.1. "Deep Roots" vs. Path Dependence

- **Read Before:** Nathan Nunn (2012): Culture and the Historical Process <<https://delong.typepad.com/files/nunn-culture.pdf>>
- **Read Before:** Melissa Dell (2015): Path Dependence in Development: Evidence from the Mexican Revolution <<https://scholar.harvard.edu/files/dell/files/revolutiondraft.pdf>>
- **Slides:** <<https://github.com;braddelong/public-files/blob/master/econ-135-lecture-22.pptx>>

### 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](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>>

# Roadmap Following...

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>>

## 7. Conclusion

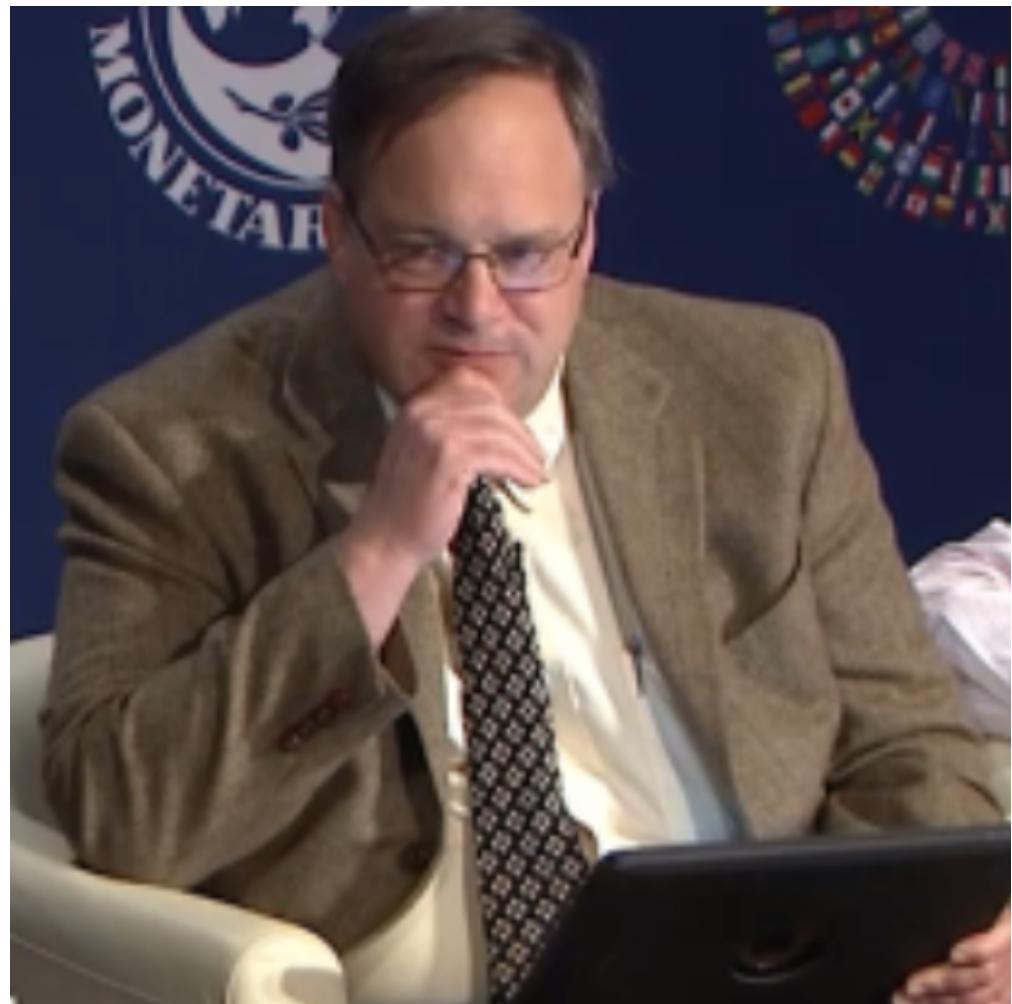
Th May 7: 7. Conclusion: The Future?

- **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  $\beta$
  - Re-express the model in terms of  $\beta$  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  $\beta$
  - Re-express the model in terms of  $\beta$  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/0FzRFAnAOoiAin4V.IWYWIWICQ>

Coronavirus Case



United States

**1,342,235**

[view by country](#)

Coronavirus Cases:

**364,059**

Deaths:

**74,554**

Deaths:

**10,792**

Recovered:

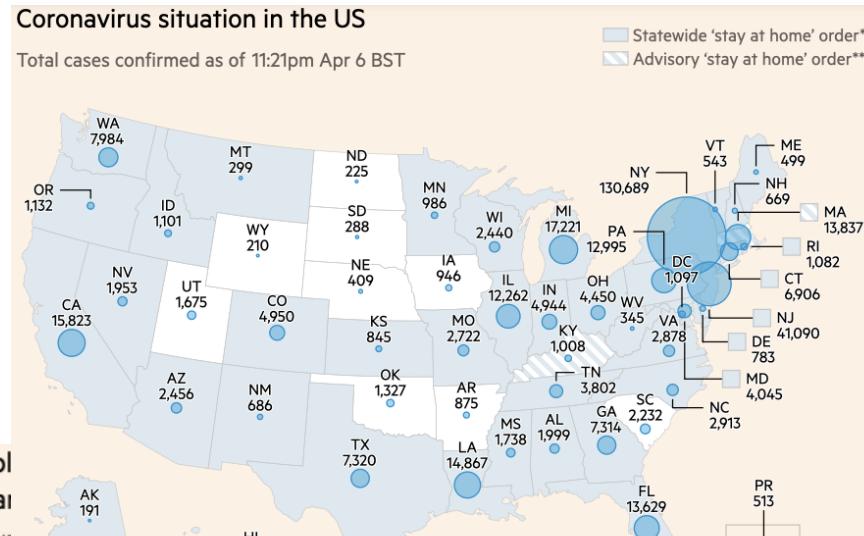
**278,182**

Recovered:

**19,536**

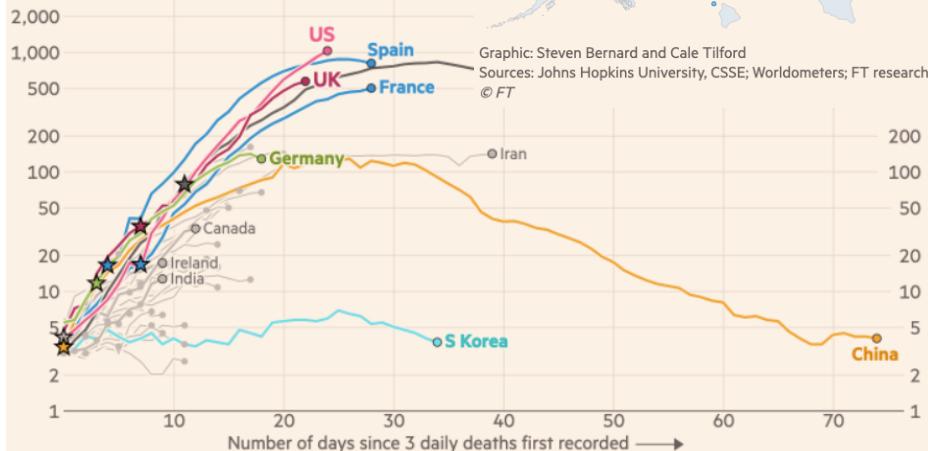
USA State	Tot Cases/ 1M pop	Deaths/ 1M pop
USA Total	1,100	33
New York	6,662	243
New Jersey	4,626	113
Michigan	1,729	73
California	404	10
Louisiana	3,188	110
Massachusetts	2,026	38
Florida	662	12
Pennsylvania	1,016	13
Illinois	956	24
Washington	1,095	46
Texas	263	5
Georgia	710	22

# Financial Times Graphs Blown Up...



Italy and Spain's daily death tolls are plateauing, while the US and UK are still 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



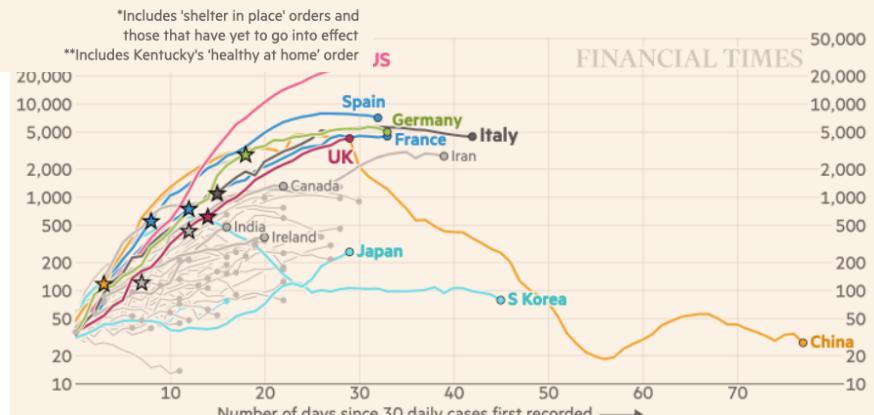
FT graphic: John Burn-Murdoch / @jburnmurdoch

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

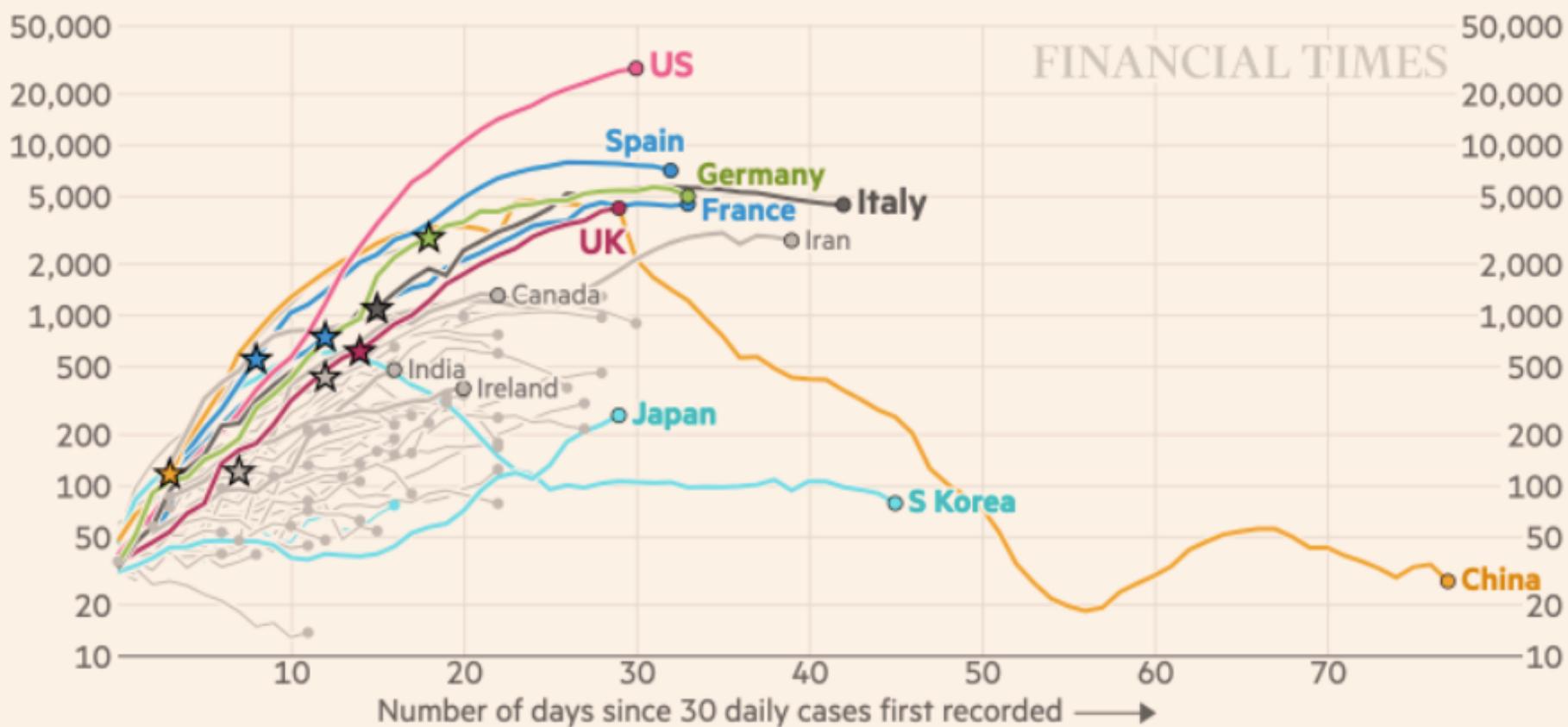
Source: FT analysis of European Centre for Disease Prevention and Control; Worldometers; FT research. Data updated April 06, 19:00 GMT

© 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 ★



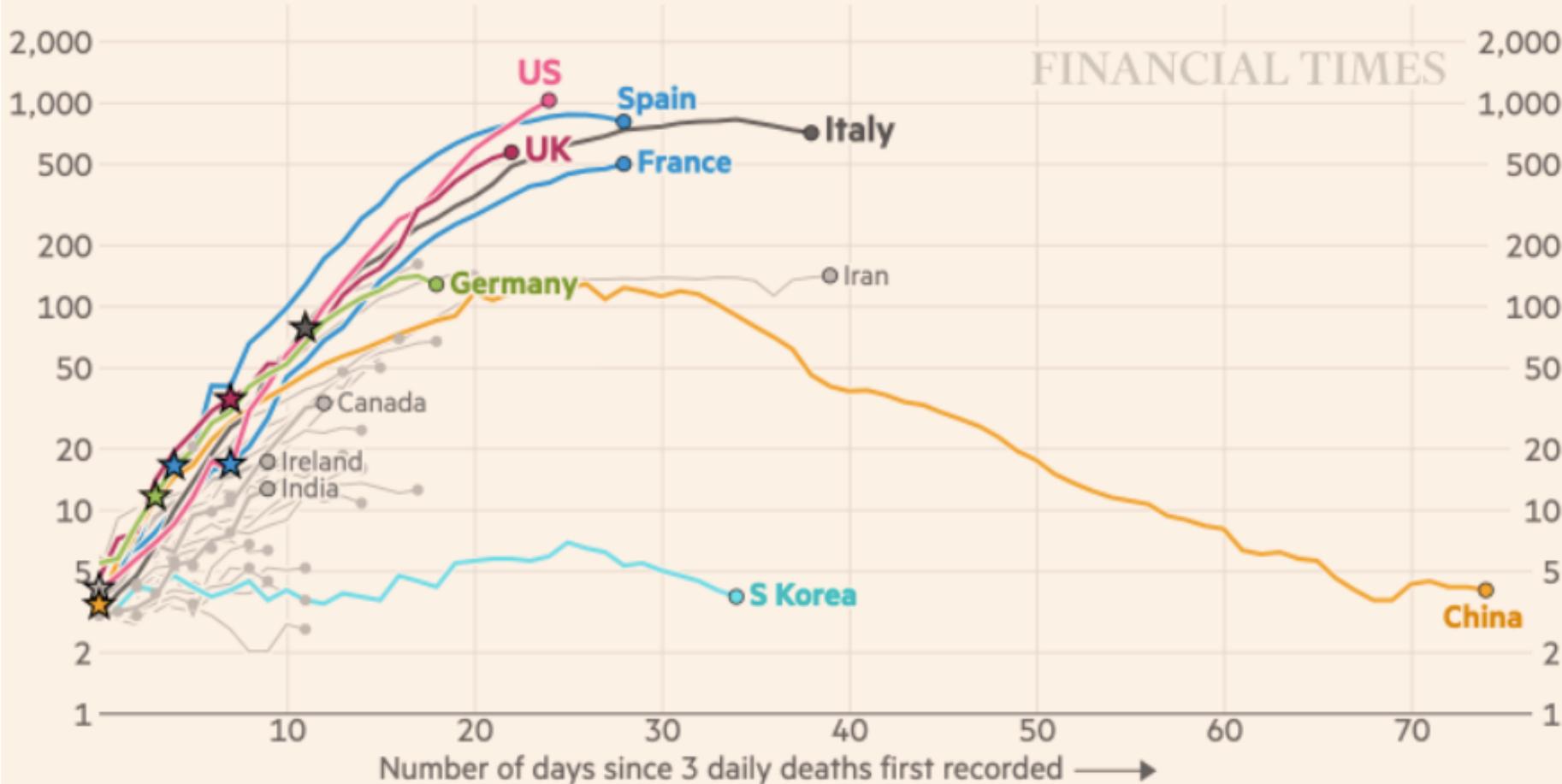
FT graphic: John Burn-Murdoch / @jburnmurdoch

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

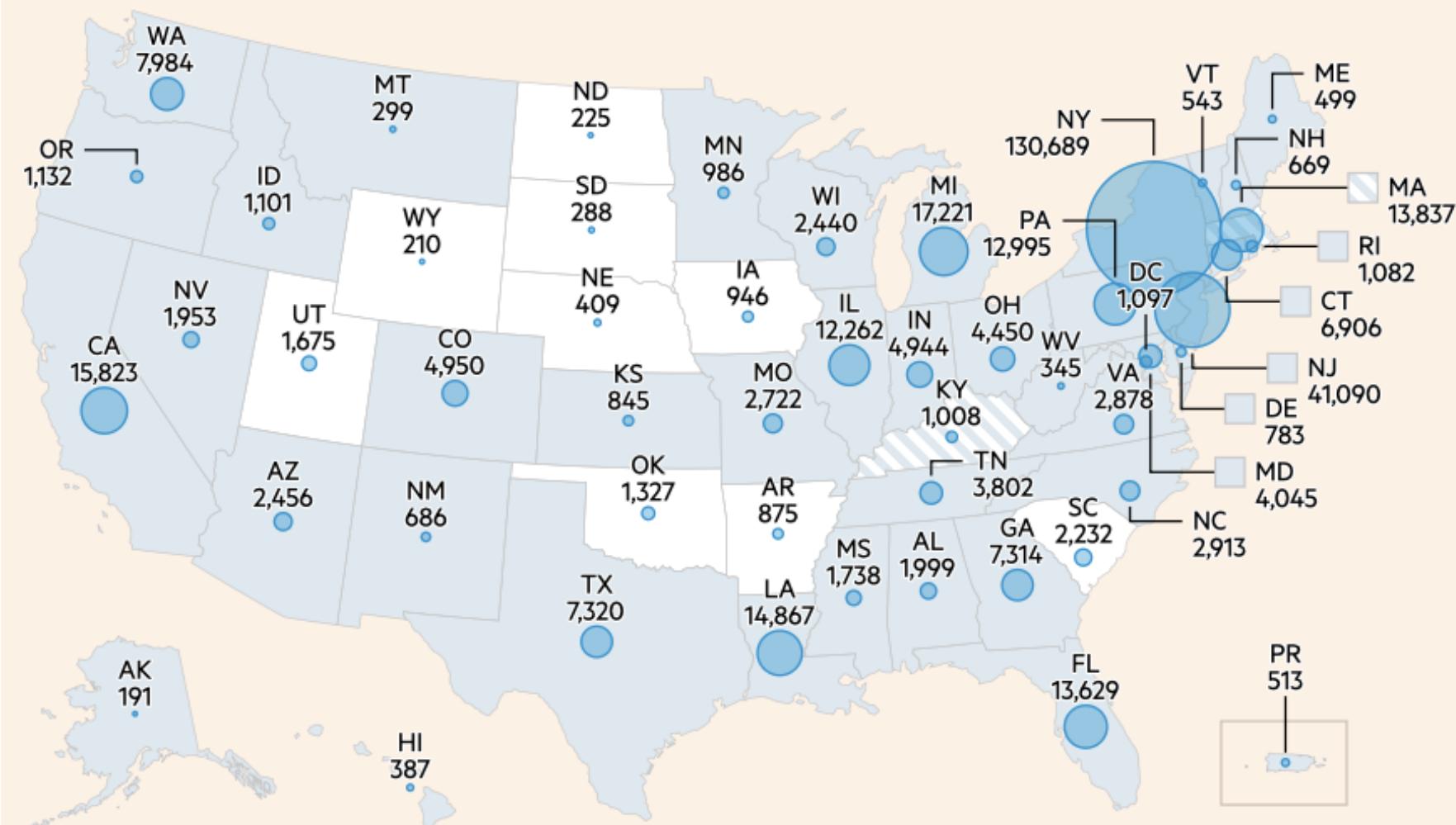
Source: FT analysis of European Centre for Disease Prevention and Control; Worldometers; FT research. Data updated April 06, 19:00 GMT

© 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>>:

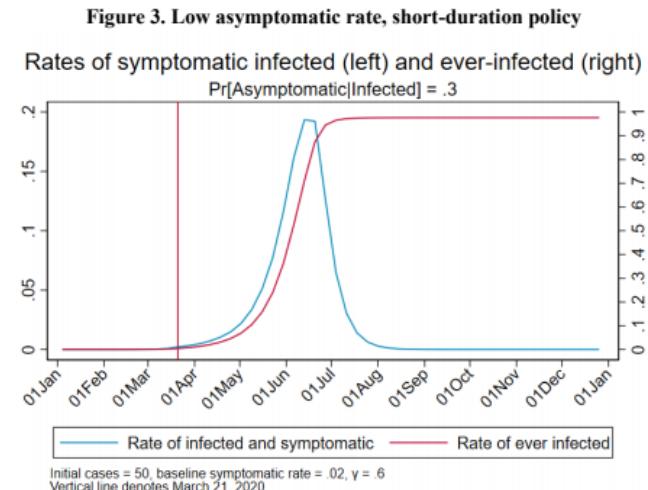
- Susceptible, Infected, Recovered (& immune), transmission rate  $\beta$ , recovery rate  $\gamma$ , reproduction number  $R_0$ , asymptomatic hence non-tested rate  $\pi_0$
- Calibration: half-life of infection one week:  $\gamma = 0.5$ ,  $s_0 = 0.02$ , 50 cases on Jan 24
- For March 21, 2020, the positive test rate in the United States is approximately 10%...

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

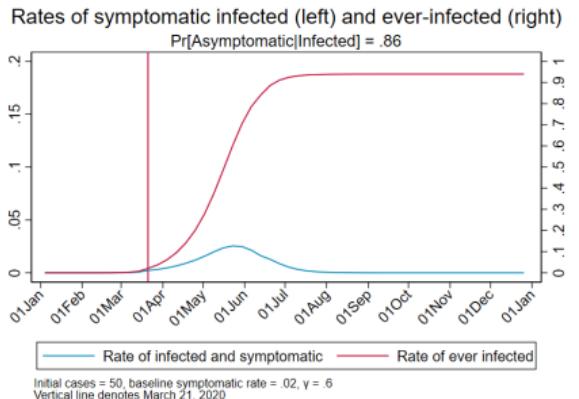
$$\Delta R_t = \gamma I_{t-1},$$

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

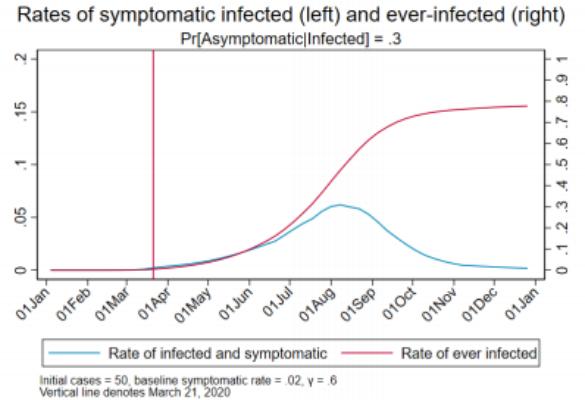
<<https://drive.google.com/file/d/12MV466ZZy5xHir4xdPhoTrL1oO8CbZU-/view>>



**Figure 2. High asymptomatic rate, short-duration policy**

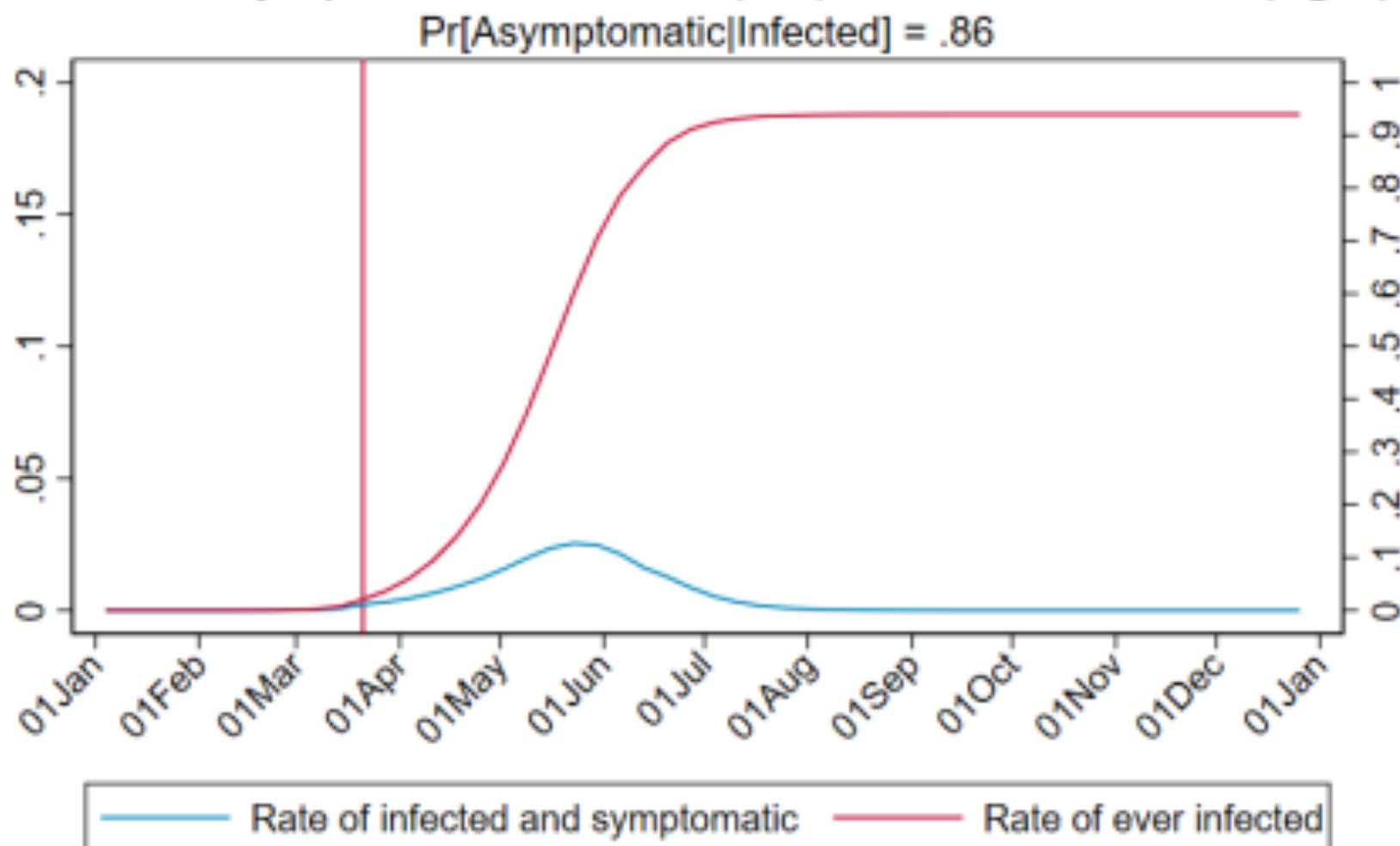


**Figure 4. Low asymptomatic rate, severe long-duration policy**



**Figure 2. High asymptomatic rate, short-duration policy**

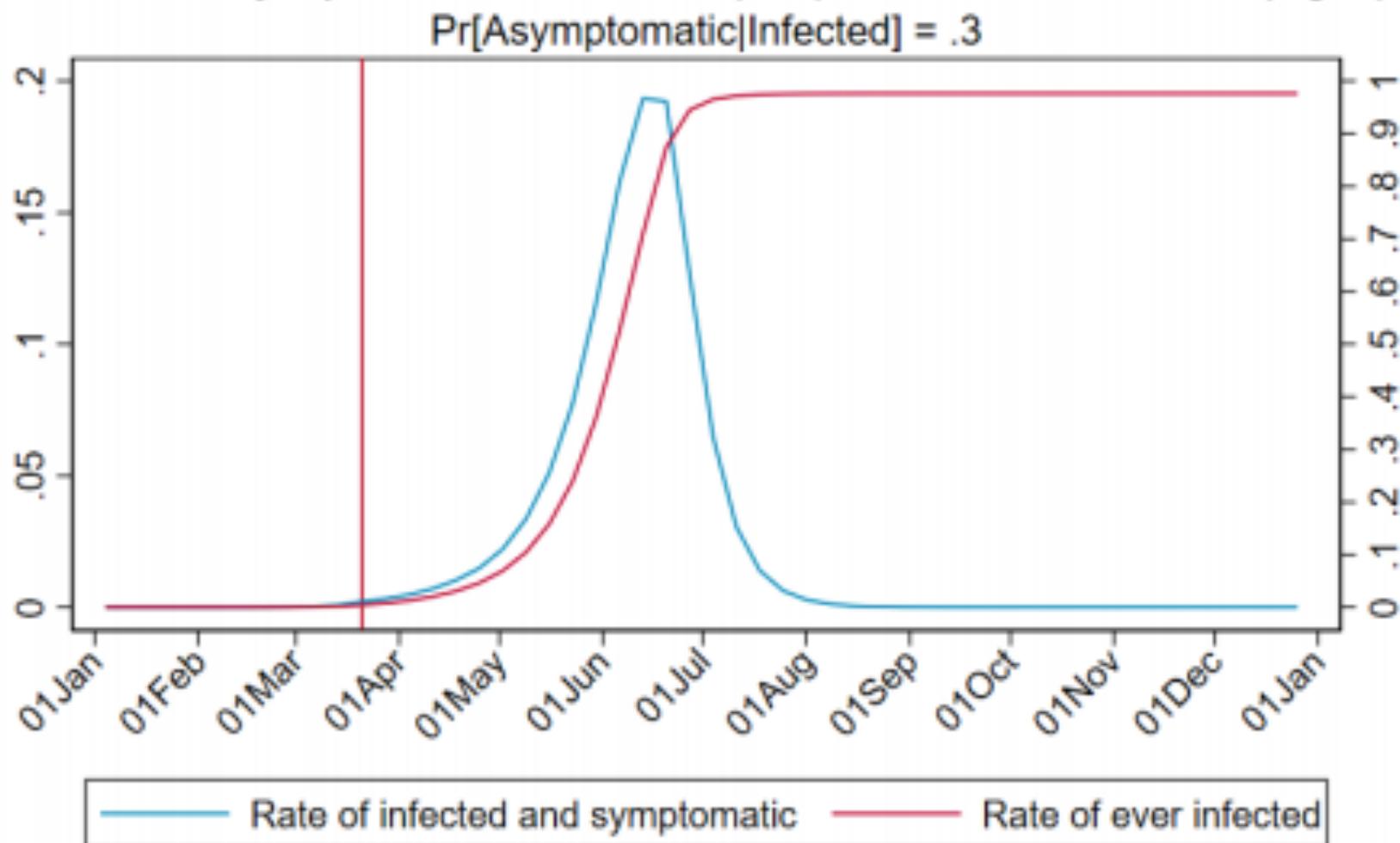
Rates of symptomatic infected (left) and ever-infected (right)



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)

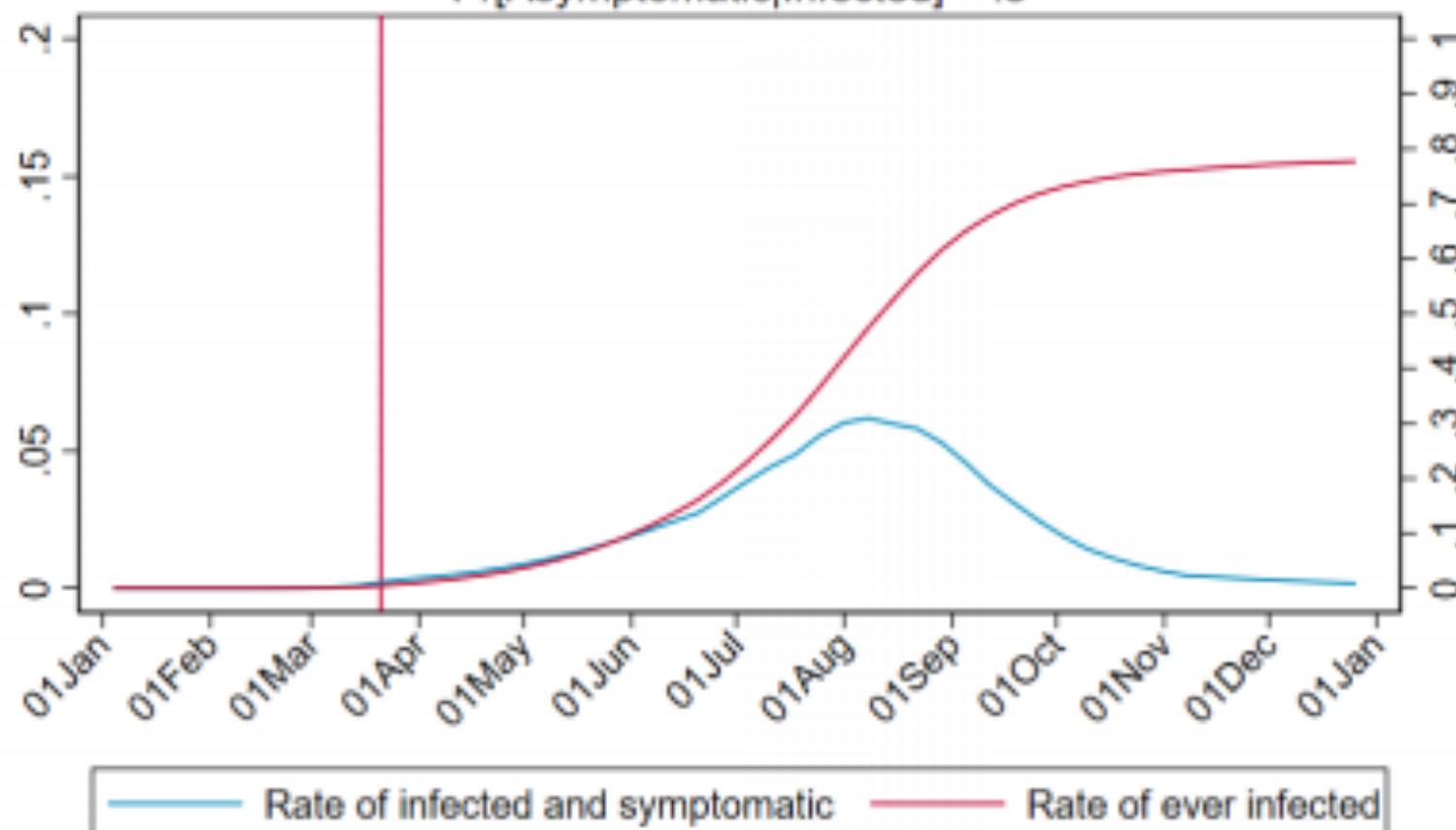


Initial cases = 50, baseline symptomatic rate = .02,  $\gamma = .6$   
Vertical line denotes March 21, 2020

**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](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?

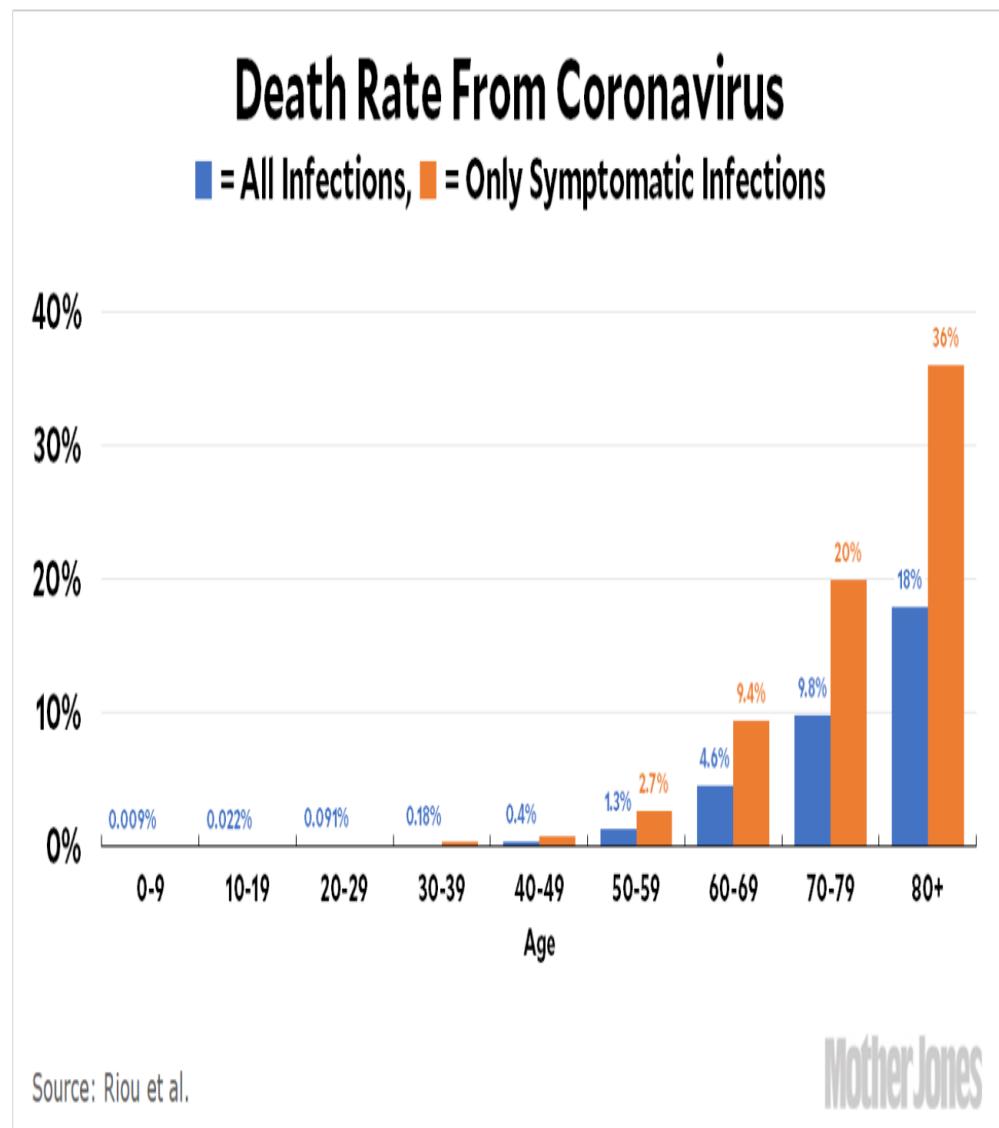
**Plus: distributional issues**

**Plus: bankruptcy and credit chain issues**

# MOAR Coronavirus!

## Death for Geezers!

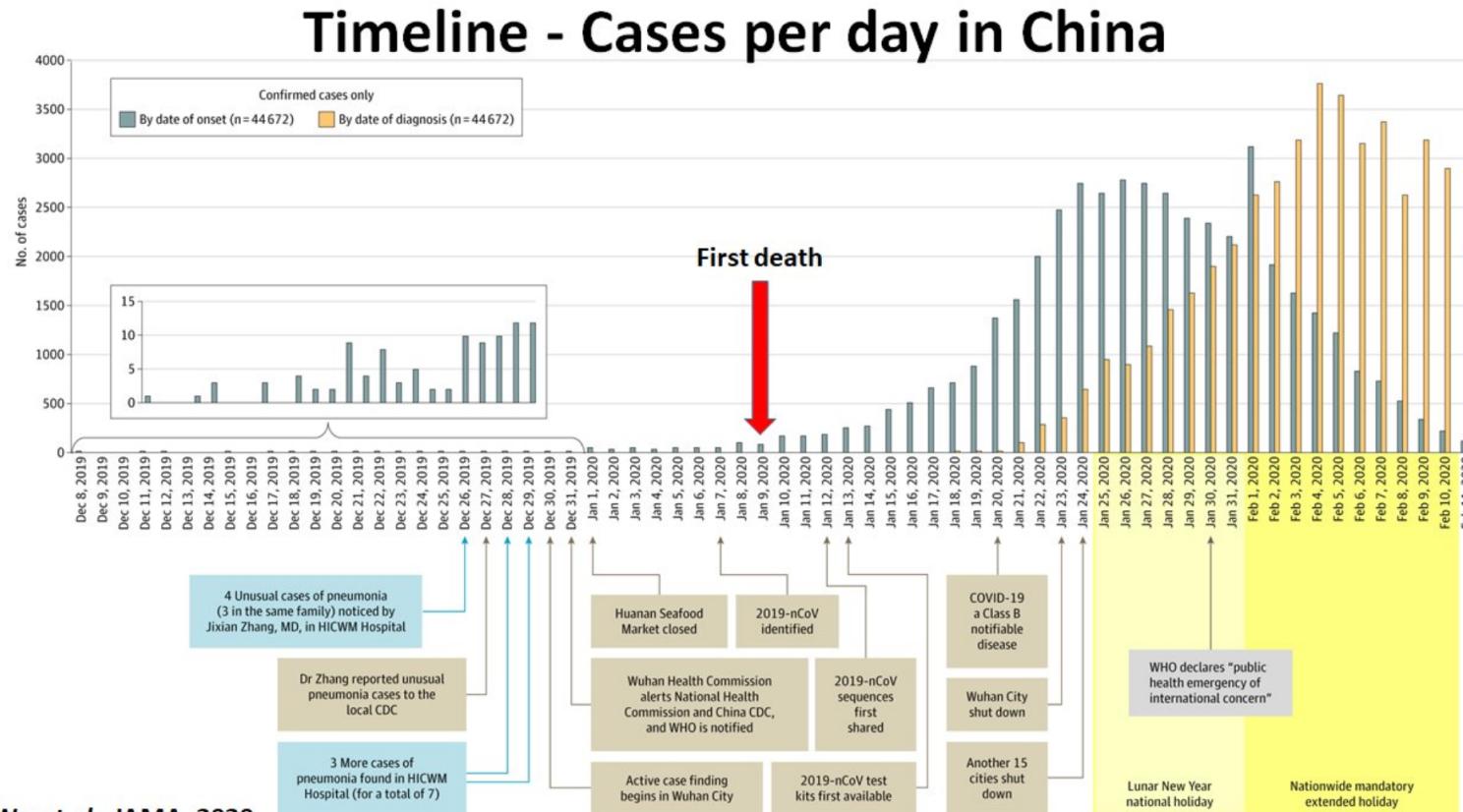
- Mortality for the Youngs very low...
- It's the flu for them—for you...
- And an extra doubling—or is it 5%?—mortality for the asthmatic
- And an extra doubling—or is it 5%?—mortality for the overweight



# What We Think Happened in Wuhan

China beat it quickly & relatively easily!

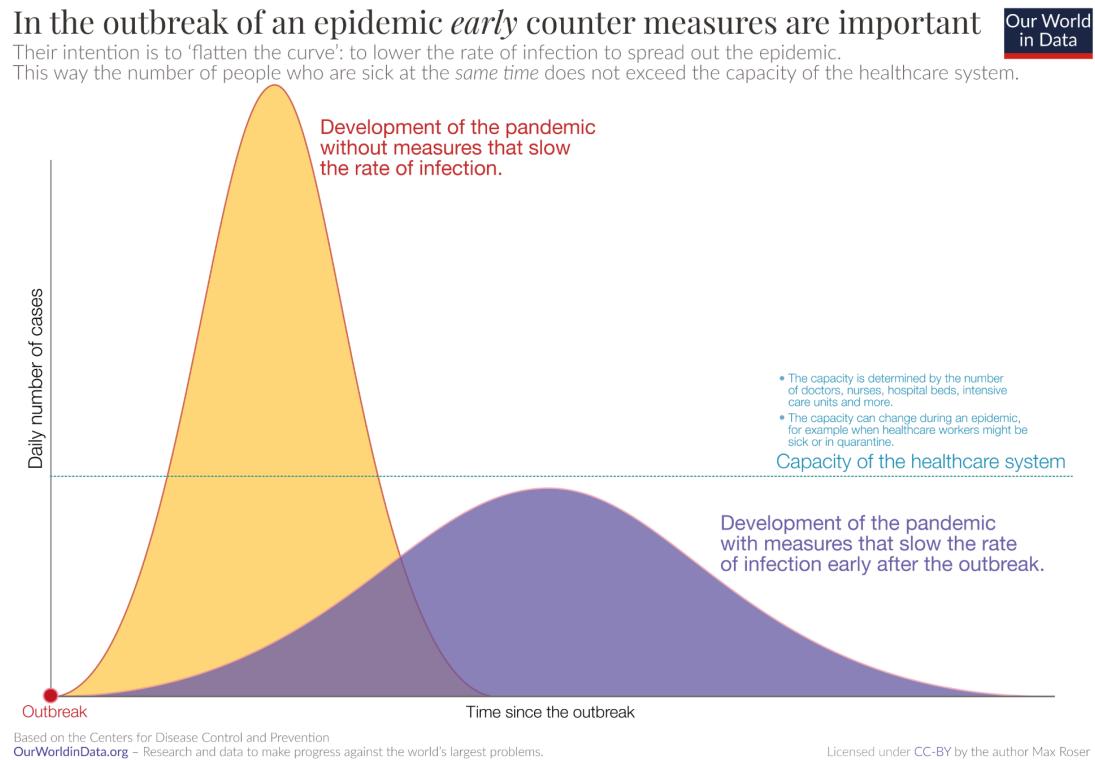
- We think
- Shut down Wuhan when 200 cases per day
- That seems to have been a good decision



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

Coronavirus Cases:

**179,836**

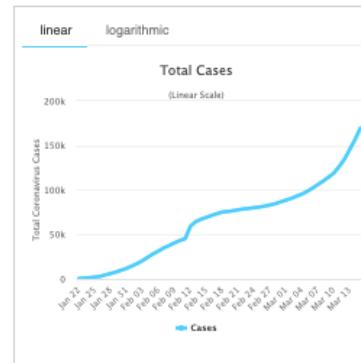
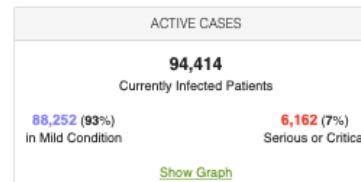
[view by country](#)

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**

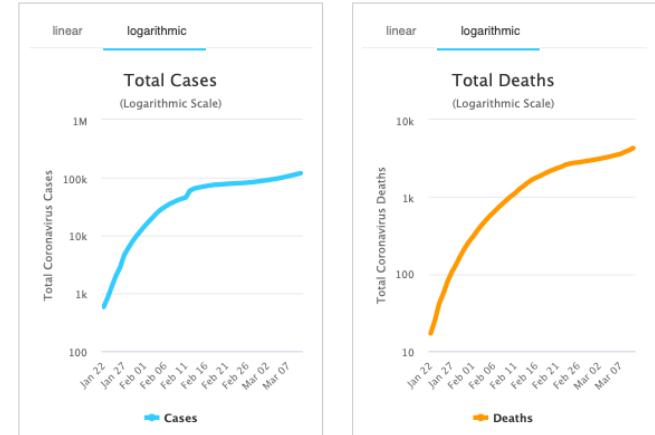
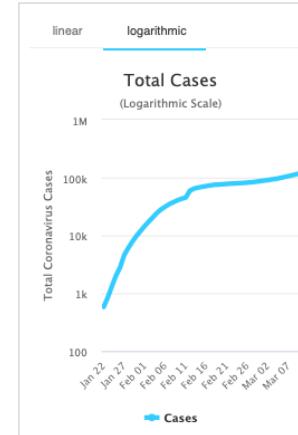
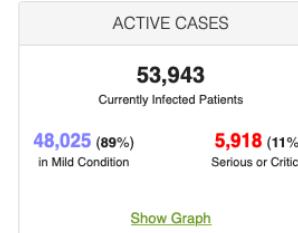
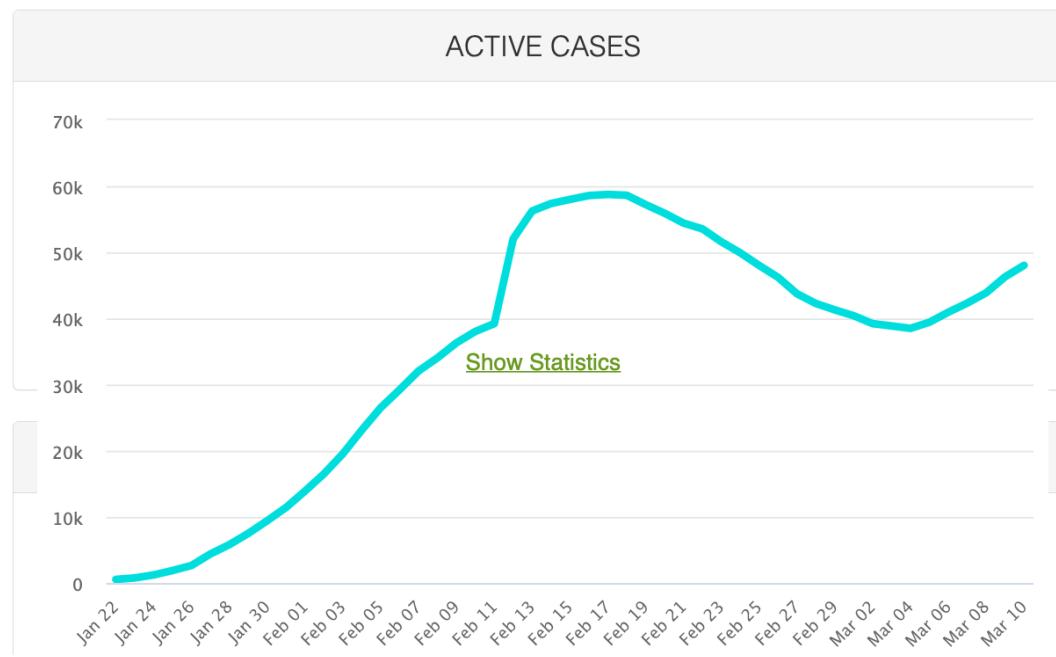
[view by country](#)

Deaths:

**4,605**

Recovered:

**67,051**



# Notes

