Lecture 16

Economic Growth, Information and Cities

16.2 The link between urbanization and economic growth

IUS 9.2

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Recall:

Economic Growth

where do economic growth rates come from?

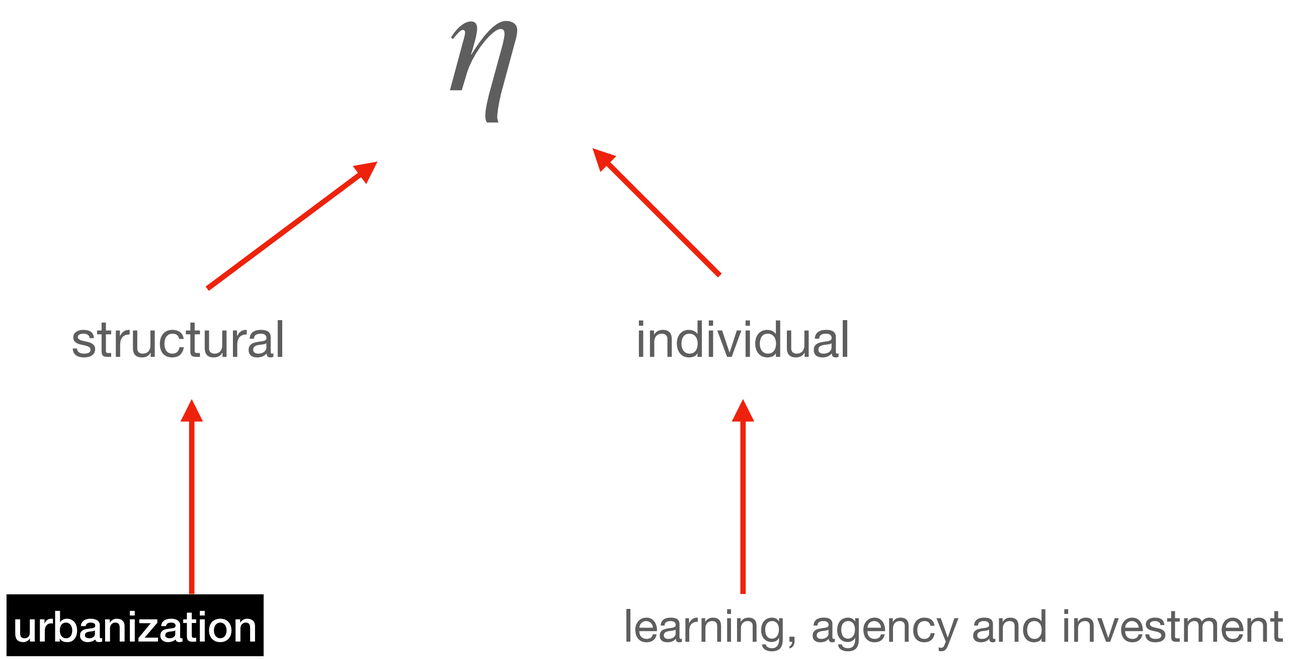
$$\frac{dY}{dt} = \eta Y$$

Exponential Growth: 2-3% a year for USA

noisy, scale dependent, variable

inequality

What creates growth?

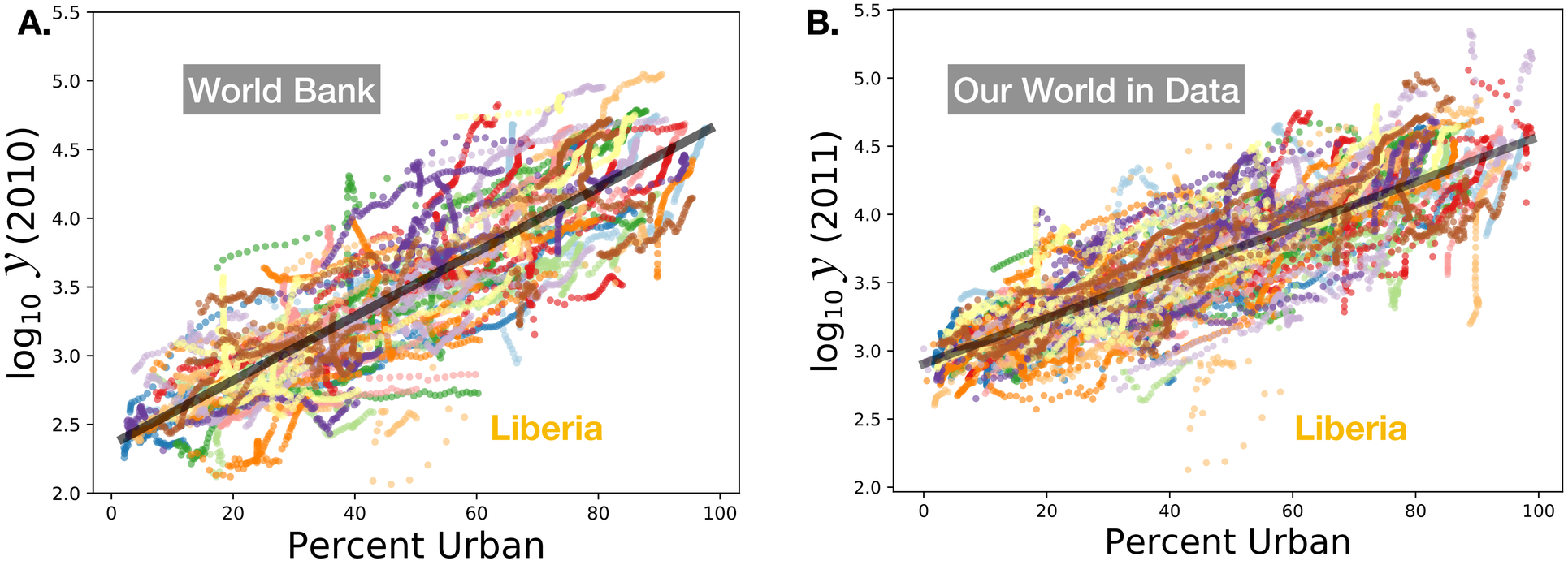


Urbanization and Economic Growth

How can we explain this association? What does it tell us about economic growth? and Cities?

https://databank.worldbank.org/source/world-development-indicators

https://ourworldindata.org/grapher/urbanization-vs-gdp



Fit: $\log_{10} y(u) = \log_{10} y(0) + a_y u$

$235/year

$a_y \simeq 0.02$

$y = y_0 10^{a_y u} = y_0 e^{a_y \ln 10\, u}$ $\quad a'_y = a_y \underbrace{\ln 10}_{\simeq 2.3} \simeq 4 - 5\,\%$

spectacular !!

Growth rate of GDP/capita with urbanization is : $a'_y = a_y \ln 10 \simeq 4 - 5\,\%$

The puzzle here is that there is no “time”: this suggests a purely structural transition

This also holds for each year across nations

https://databank.worldbank.org/source/world-development-indicators

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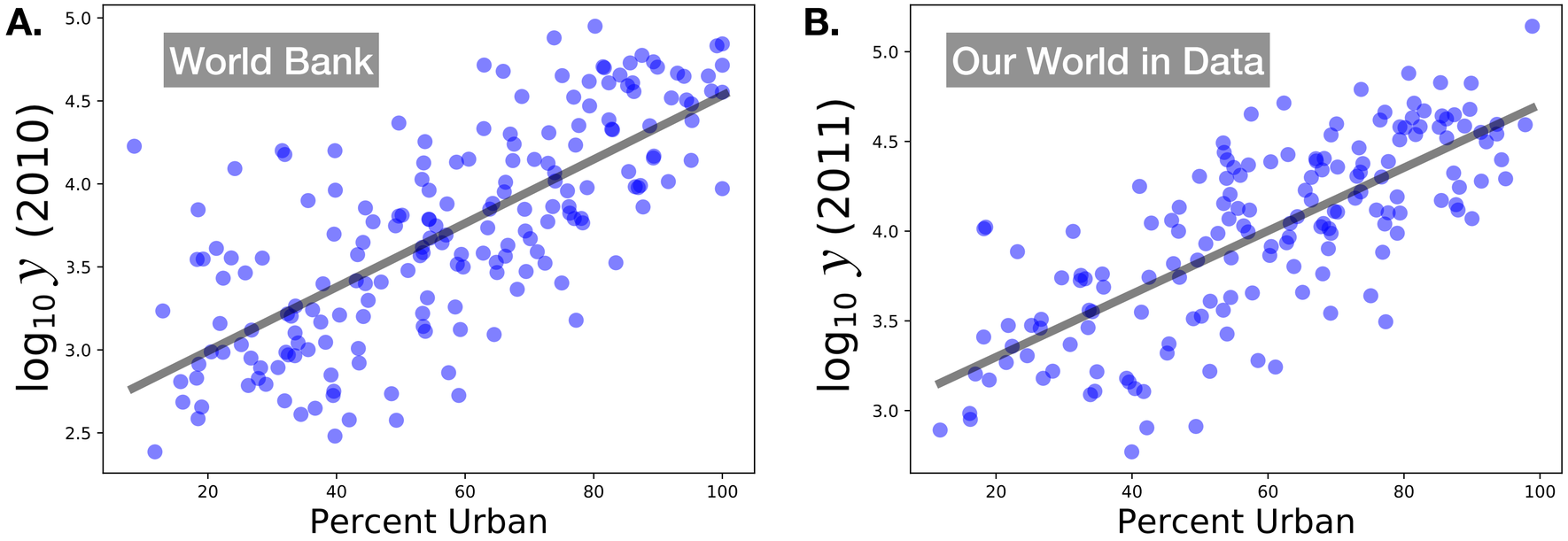
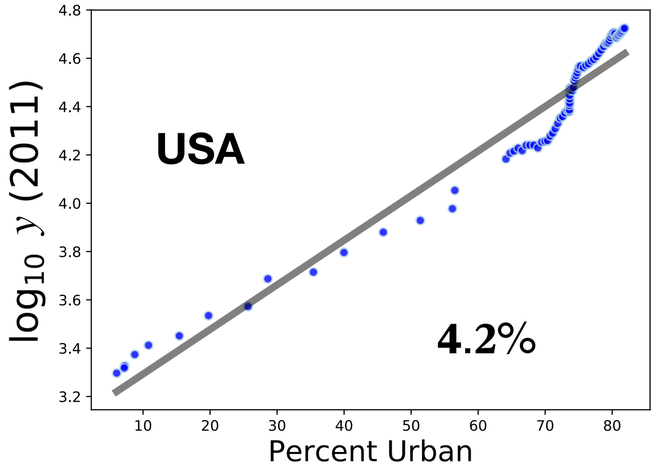
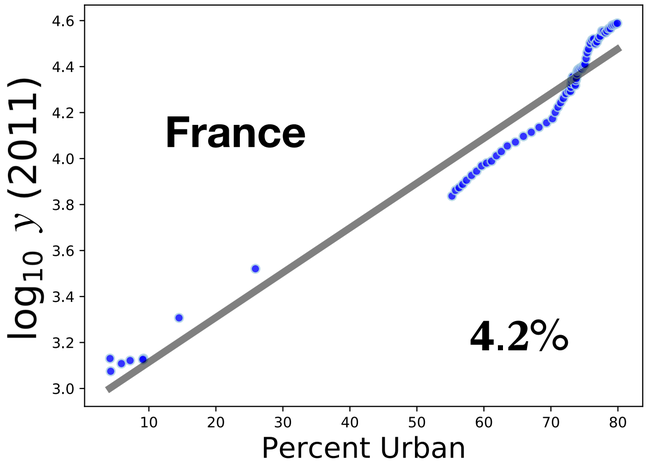
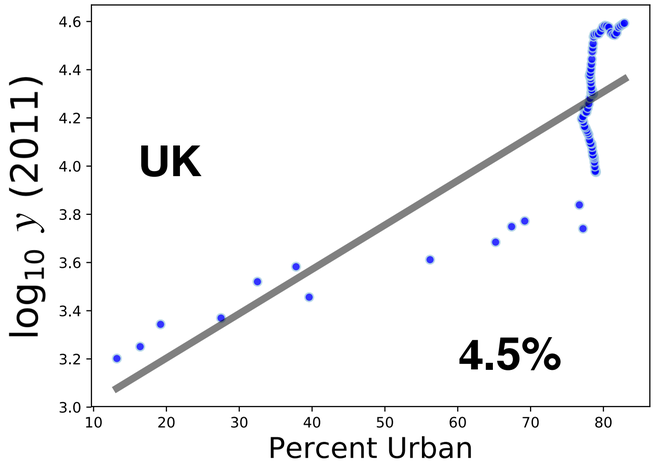


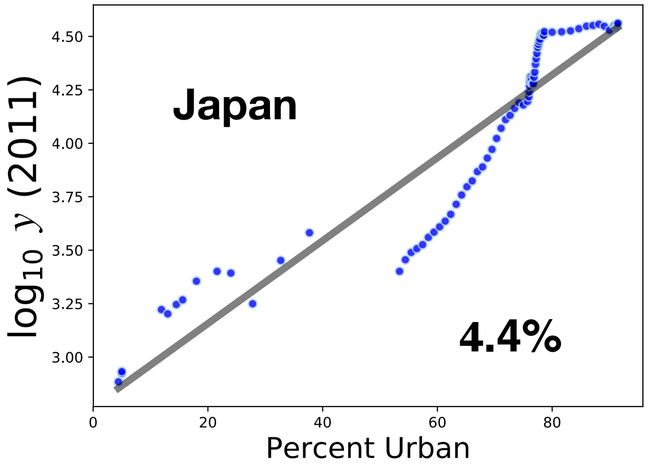
similar fits to that across nations and time

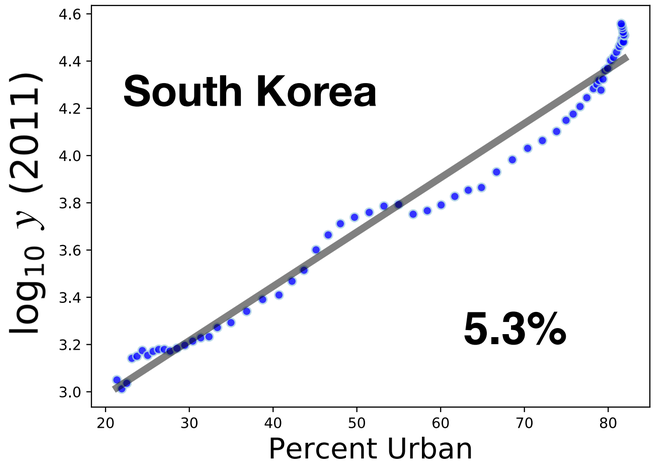
And more roughly over time in each nation

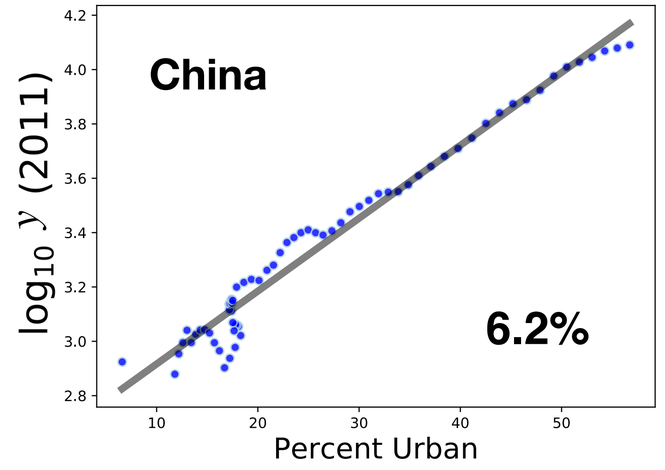












How to get rid of time?

$$\log_{10} y = \frac{1}{\ln 10} \int^{t} dt' \frac{d}{dt'} \ln y(t')$$

$$\ln y \simeq \gamma_y (t - t_0)$$

define the average growth rate of the GDP per capita, averaged over some time period:

$$\gamma_y = \frac{1}{t - t_0} \int_{t_0}^{t} dt' \frac{d}{dt'} \ln y(t') \longrightarrow \ln y(t) = \frac{1}{\ln 10} \log_{10} y = \gamma_y (t - t_0)$$

The log of GDP/capita is the average growth rate times time.

need to express both γ_y and $t - t_0$ as functions of urbanization rate, u

Nations urbanize in the same way but at very different speeds

$$u(t) = \frac{u_M}{1+e^{-s_U(t-t_0)}},$$

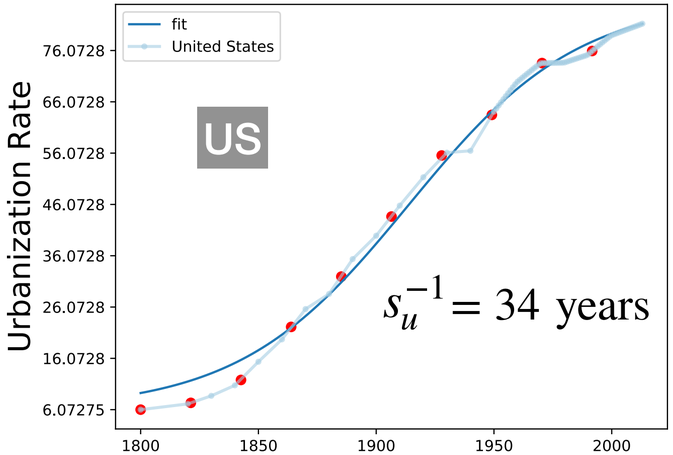
logistical growth

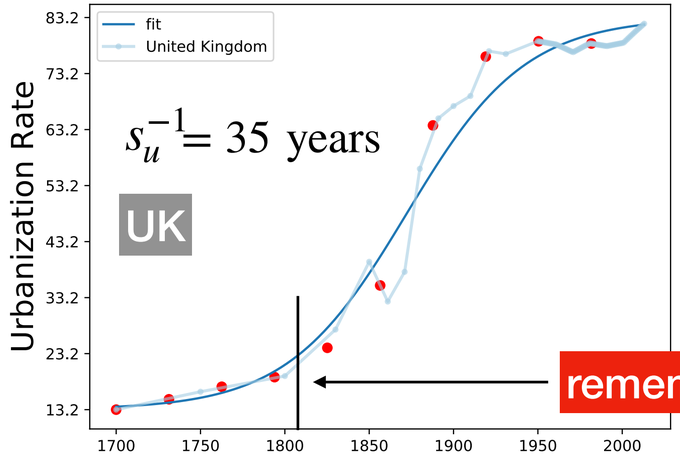
which allows us to **trade time for urbanization**:

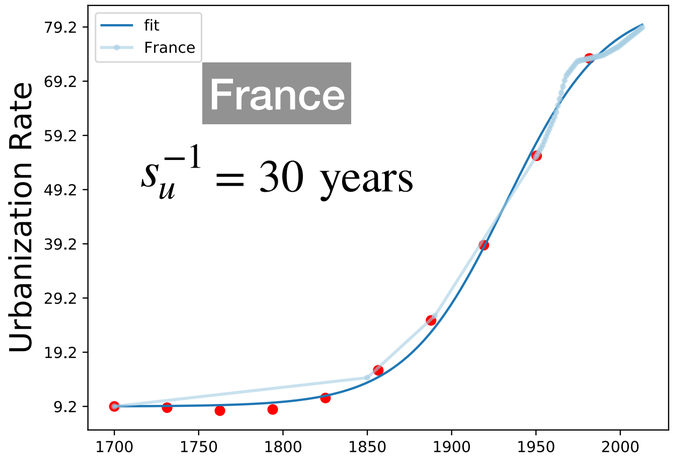
$$t = t_0 + \frac{1}{s_U} \ln \frac{u}{u_M - u}$$

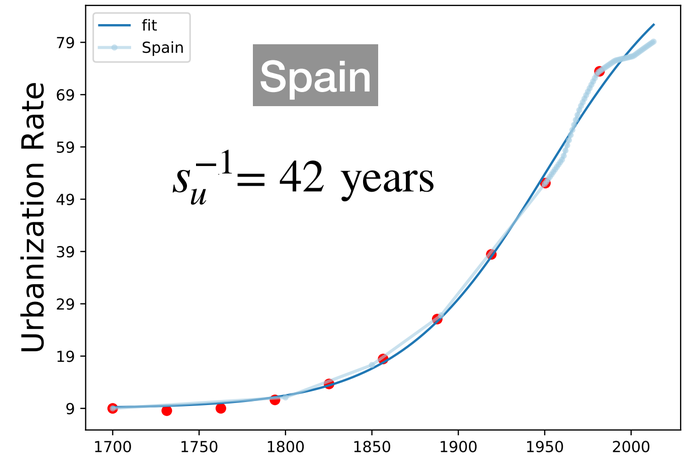
This is a very slow function of u

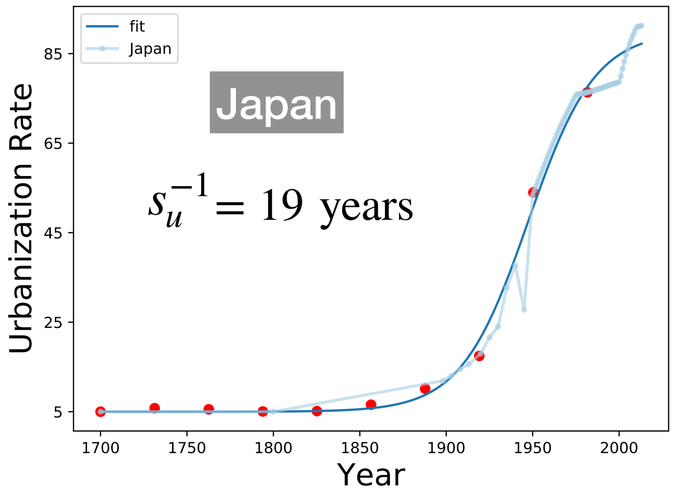
only speeds up near zero or the maximum

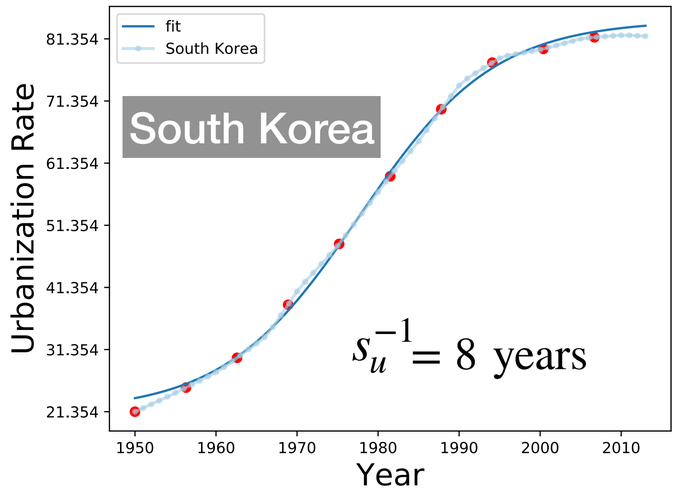












How about γ_y?

Two effects at play

selection into more urban environments

differentials in population growth and migration

endogenous growth

local learning and innovation

divide the population between urban and rural with rates

$$n_U = u,\ n_R = 1 - u$$

fraction of urban population

fraction of rural population (subsistence)

$$\ln y' = \ln y(t + \Delta t) = n_U(t + \Delta t)\ln y_U(t + \Delta t) + n_R(t + \Delta t)\ln y_R(t + \Delta t)$$

national income is an average of urban and rural

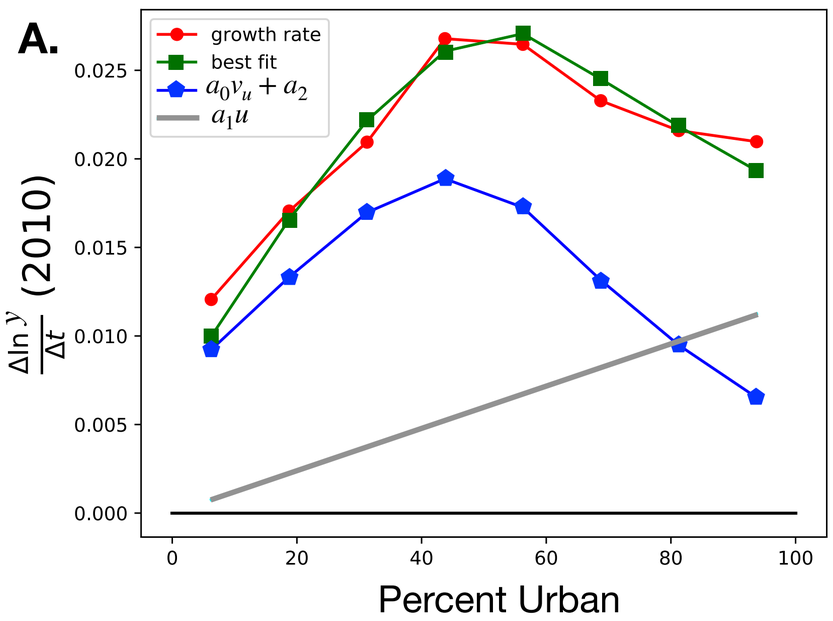
$$\ln y = \ln y(t) = n_U(t)\ln y_U(t) + n_R(t)\ln y_R(t)$$

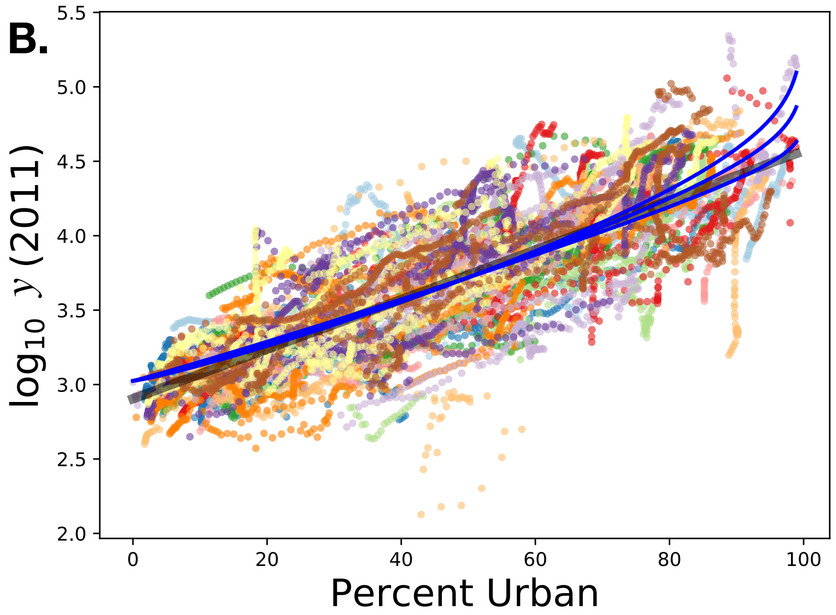
$$\gamma_y = \frac{\Delta \ln y}{\Delta t} = \frac{\ln y' - \ln y}{\Delta t} = \sum_{i=U,S} \frac{\Delta n_i}{\Delta t} \ln y_i(t) + n_i(t)\frac{\Delta \ln y_i}{\Delta t}$$

selection into/out of urban environments

endogenous growth in urban and rural

GDP growth rate per year





urbanization speed boost

$$\frac{\Delta \ln y}{\Delta t} = \frac{\Delta \ln y_S}{\Delta t} + u \left[\frac{\Delta \ln y_U}{\Delta t} - \frac{\Delta \ln y_S}{\Delta t} \right] + \frac{\Delta u}{\Delta t} \left[\ln y_U - \ln y_S \right].$$

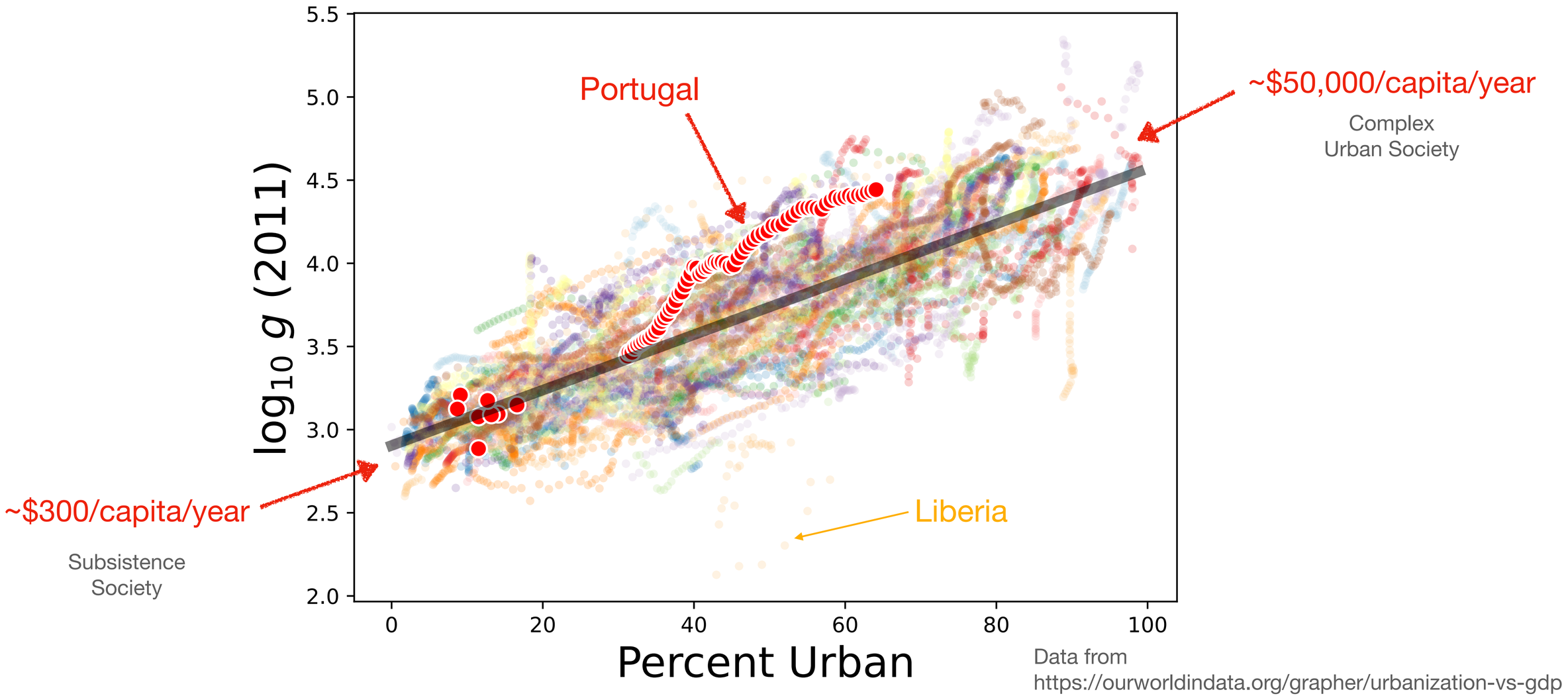
$$\frac{\Delta u}{\Delta t} = v_u$$

$$\frac{\Delta \ln y}{\Delta t}(t) = a_0\, v_u(t) + a_1 \left[u(t) + v_u(t)\,(t - t_0) \right] + a_2, \quad a_0 = \ln \frac{y_U(t_0)}{y_S(t_0)}, a_1 = \gamma_U - \gamma_S,\ a_2 = \gamma_S \simeq 0$$

Most of the Effect is due to fast migration from rural environments to larger cities

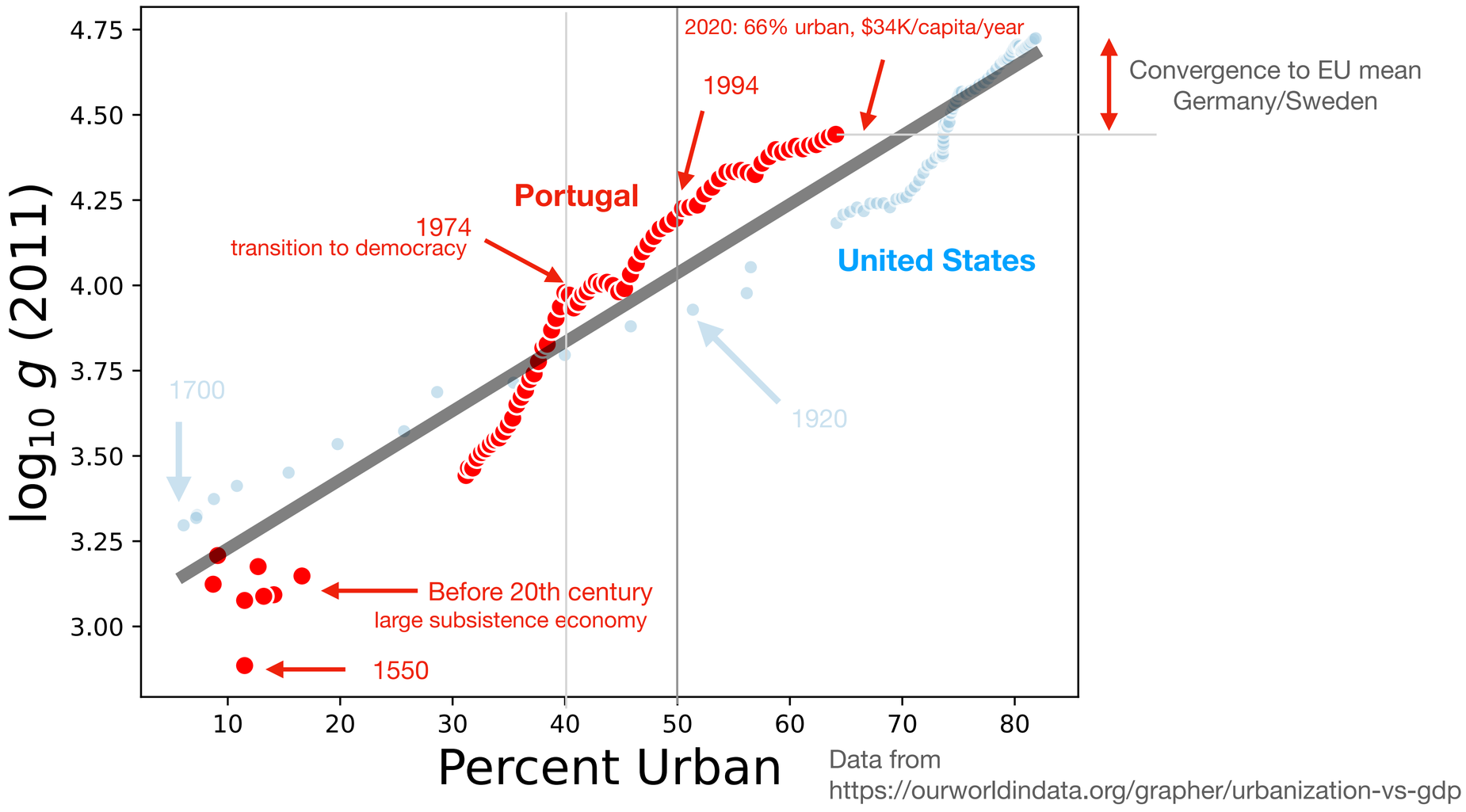
There is a few percent GDP/capita speed up in annual growth rate around 50% urbanized

The general connection between urbanization and development:



Data from
https://ourworldindata.org/grapher/urbanization-vs-gdp

On average, every 1% rise in urbanization leads to a ~4% increase in real GDP/capita!

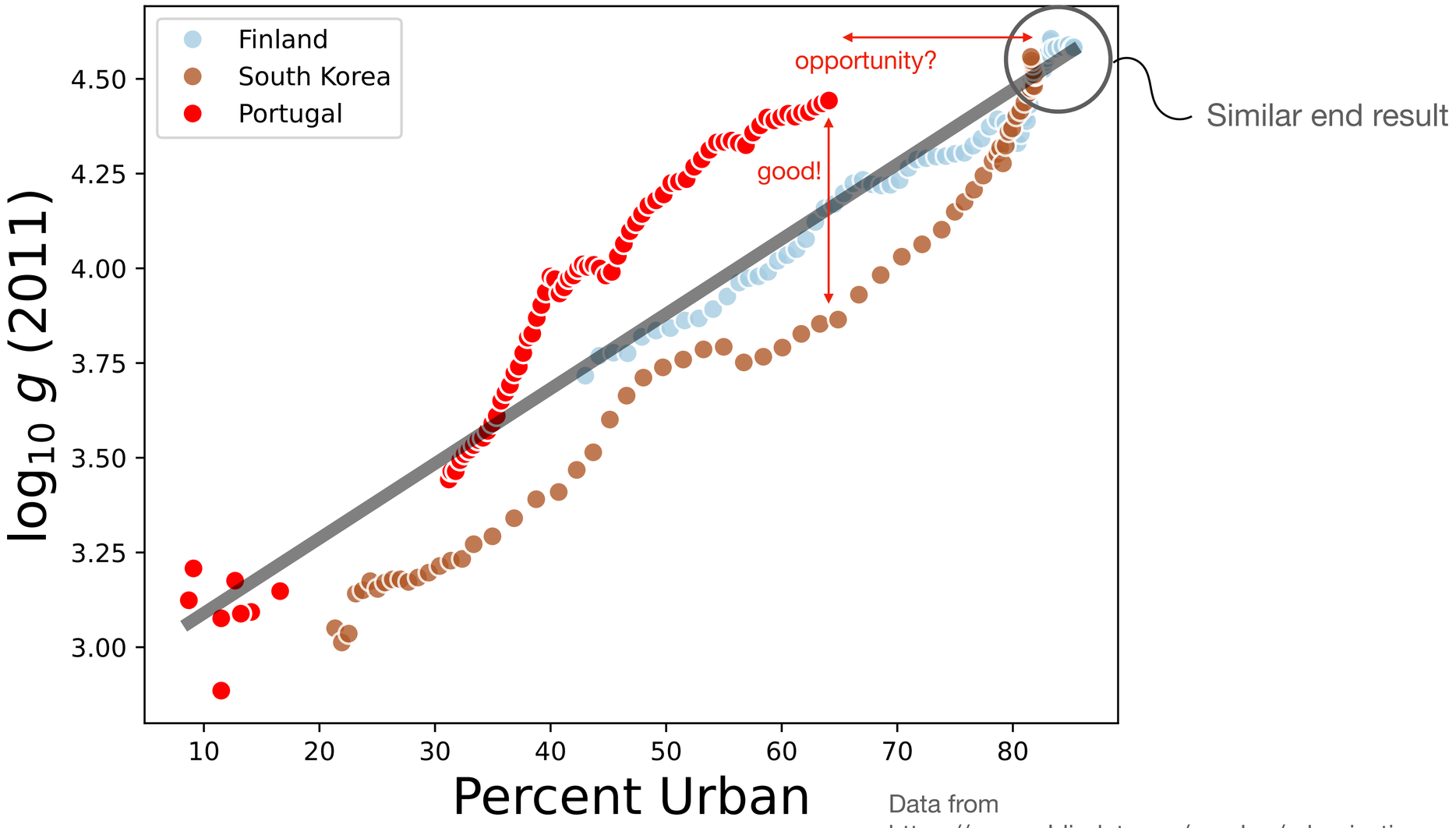


Data from
https://ourworldindata.org/grapher/urbanization-vs-gdp

Portugal: every 1% rise in urbanization leads to a ~4.6% increase in real GDP/capita!

What can we do with 20% of urbanization still to go?

Two other successful “fast urbanizers”



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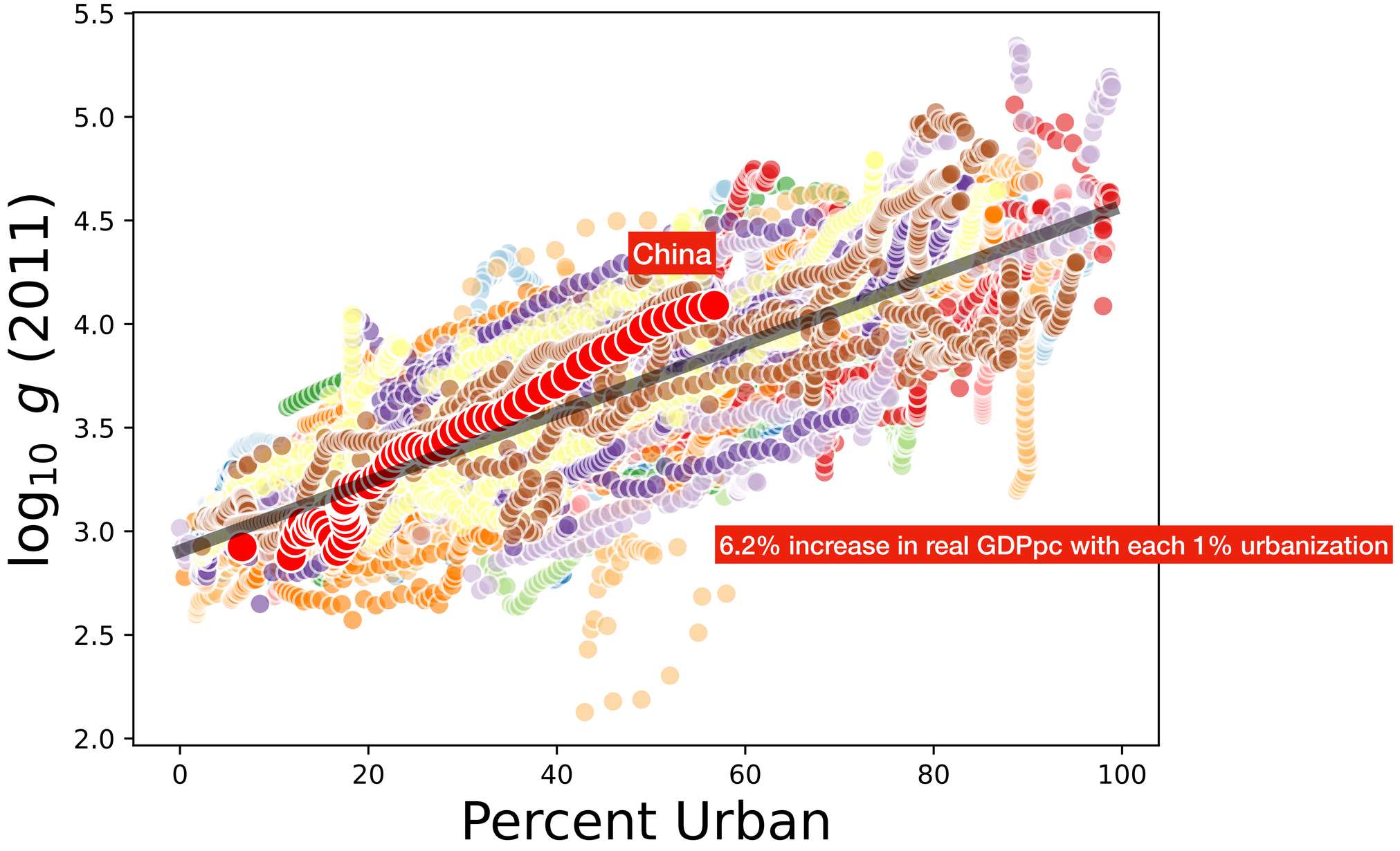
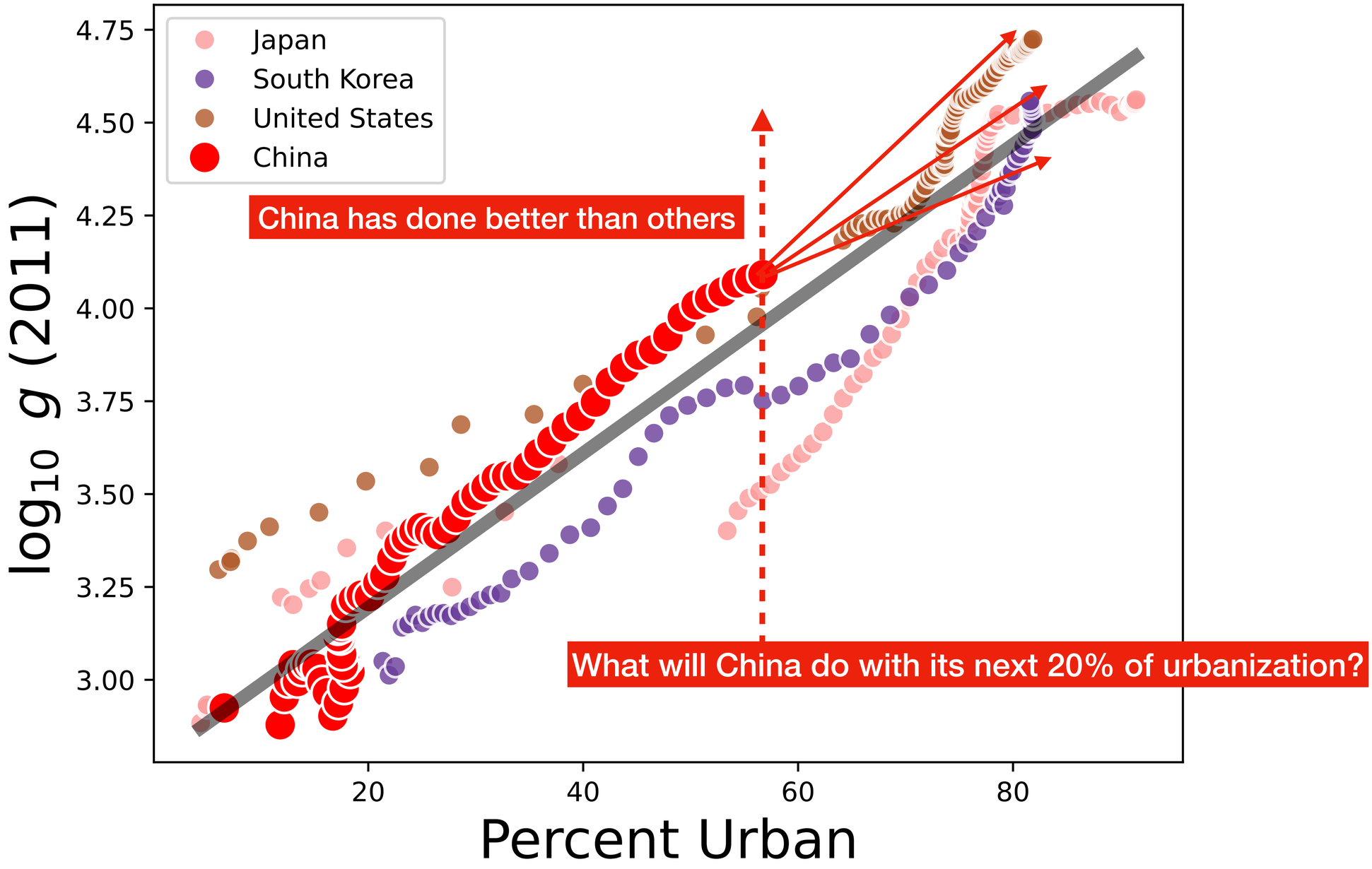

5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
log10 g (2011)
0
20
40
60
80
100
Percent Urban
China
6.2% increase in real GDPpc with each 1% urbanization


Japan
South Korea
United States
China
China has done better than others
What will China do with its next 20% of urbanization?
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
20
40
60
80
log10 g (2011)
Percent Urban

Urbanization begets its impact on economic growth per capita by

taking people from

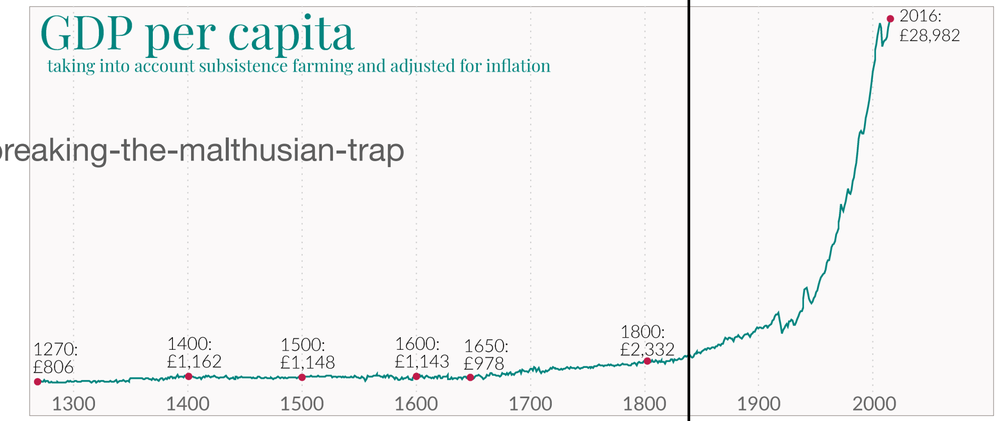
low GDP situations (rural subsistence) to high GDP situations (large cities)
(structural change)

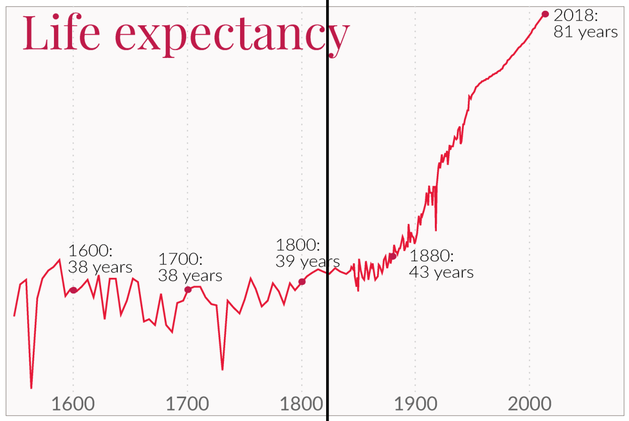
endogenous economic growth (at the “frontier”) is slower

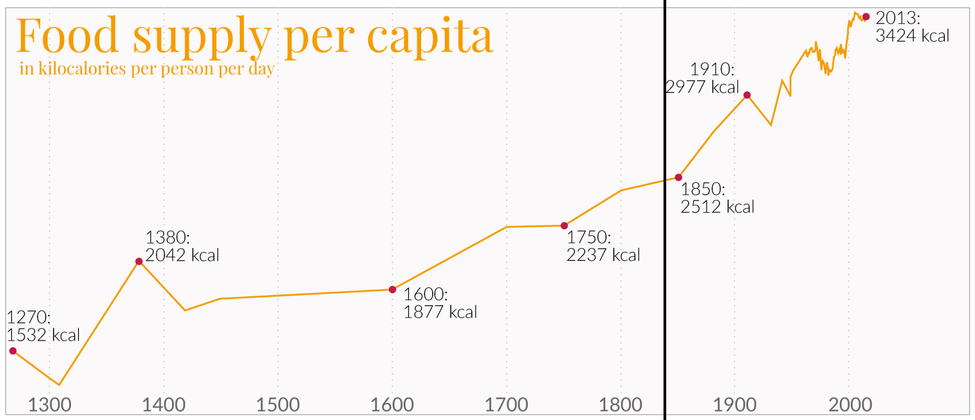
The history of living conditions in England

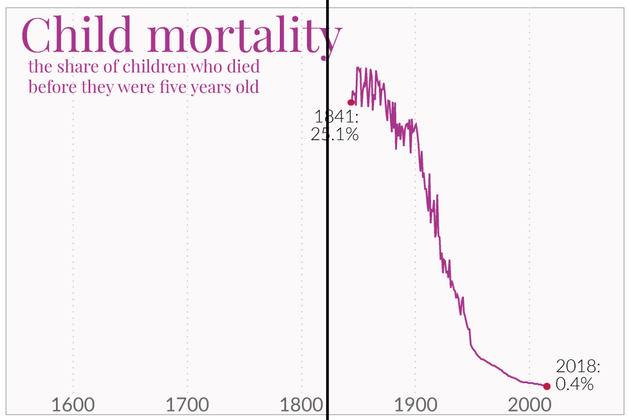
Our World in Data

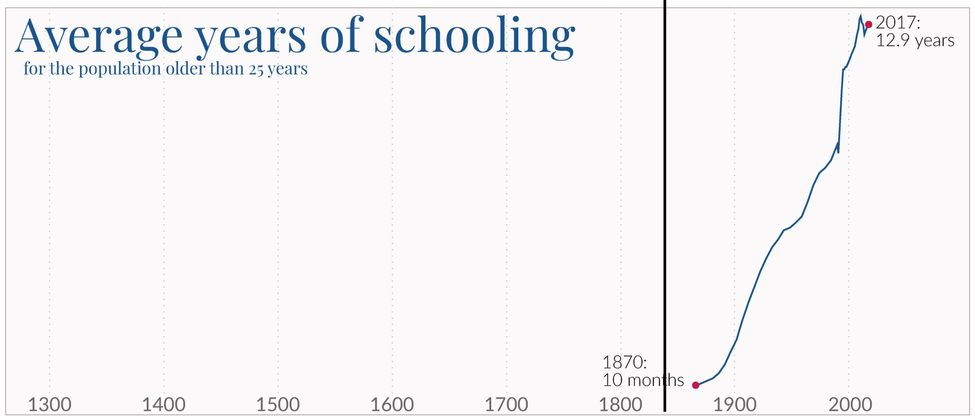
https://ourworldindata.org/breaking-the-malthusian-trap

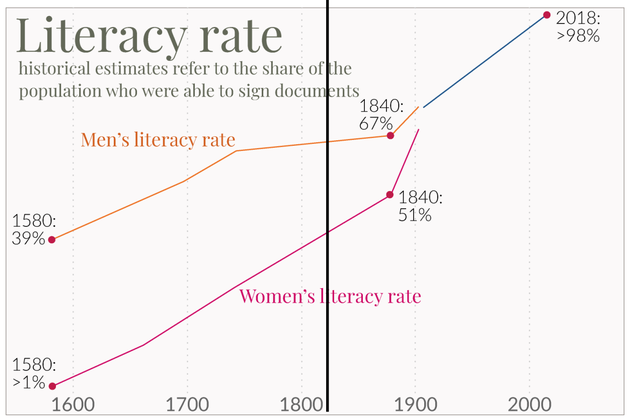












Data: Broadberry et al Life expectancy: Clio Infra and UN; Child mortality: Brian Mitchell and UN, Literacy: Schofield (1973, Houston (1982), Cressy (1980), Broadberry and O'Rourke (2010), and CIA. Food provision: Broadberry et al (2015) and UN; Lee and Lee (2016) and UNDP. All of the shown data relates to England, but some measures relate to the UK (that England is a part of) or England & Wales.

OurWorldinData.org – Research and data to make progress against the world's largest problems.

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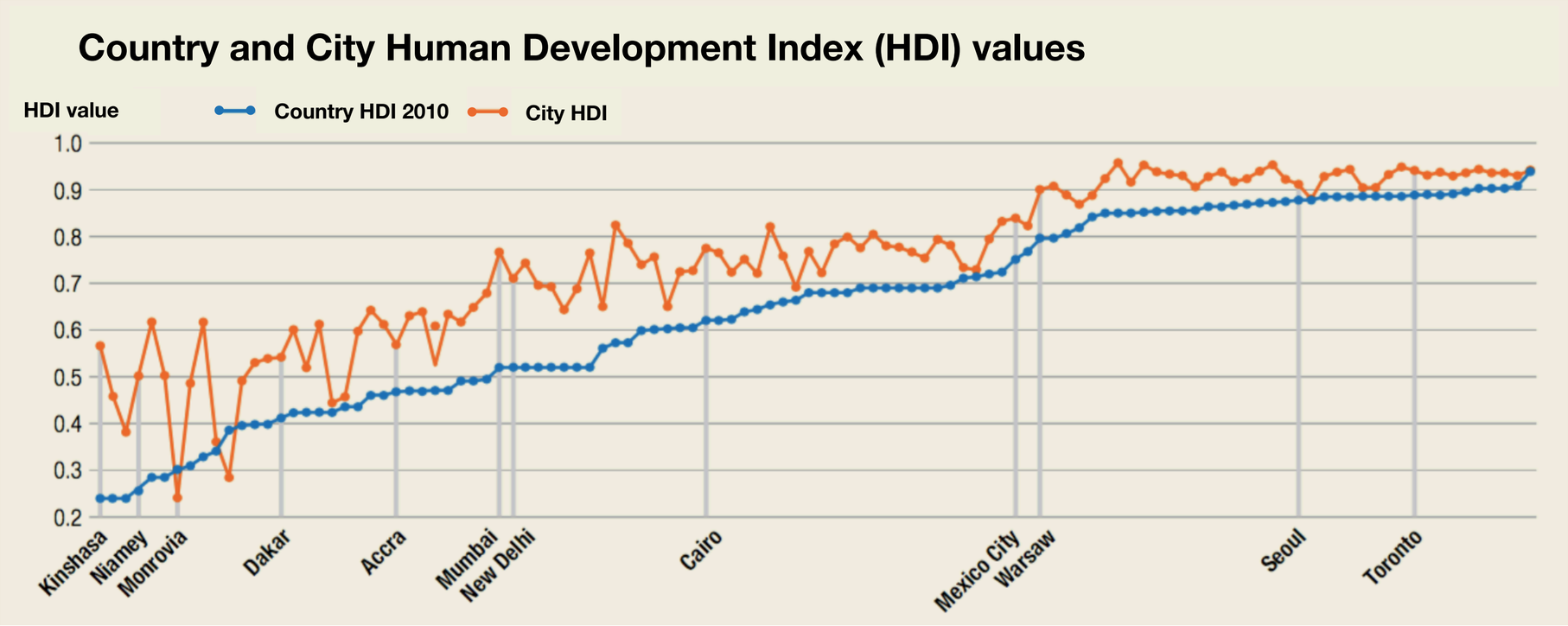
Broad Human Development is a Feature of Larger Cities ！



credit: UNDP Human Development Report 2013

(Led by Pedro Conceição, Director and lead author)