

Lecture 16

Economic Growth, Information and Cities

16.2 The link between urbanization and economic growth

IUS 9.2

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?

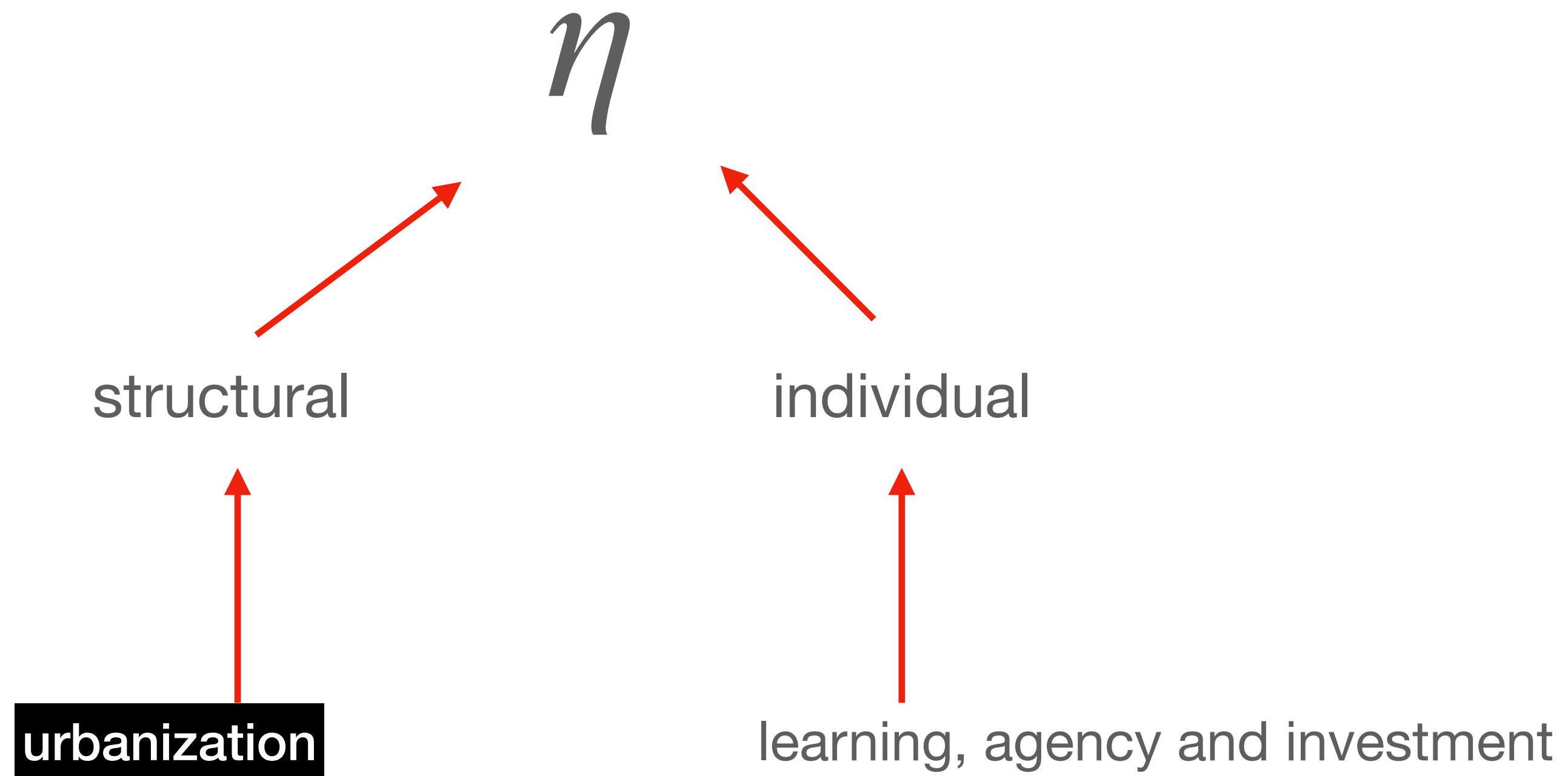
η

structural

individual

urbanization

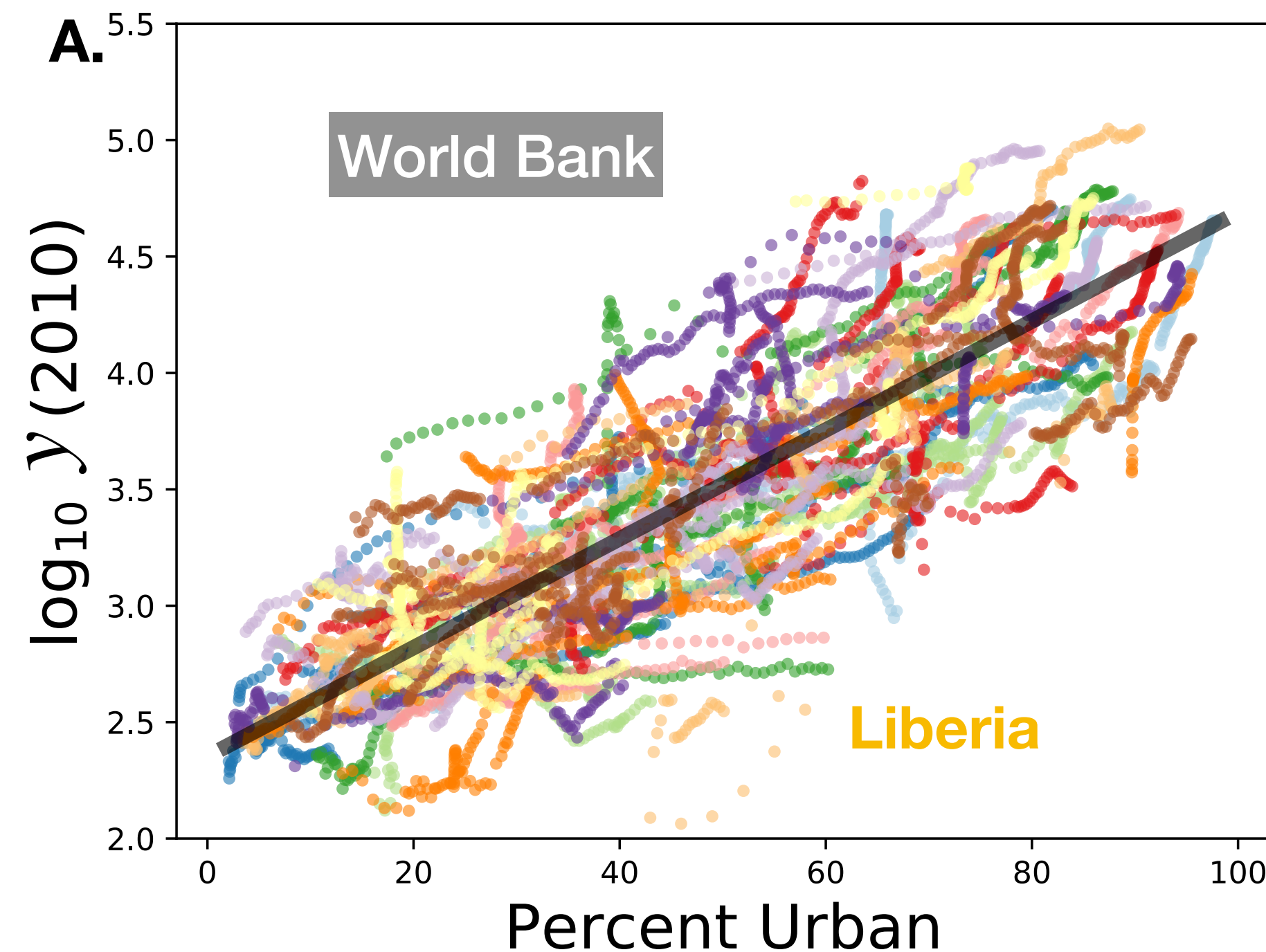
learning, agency and investment



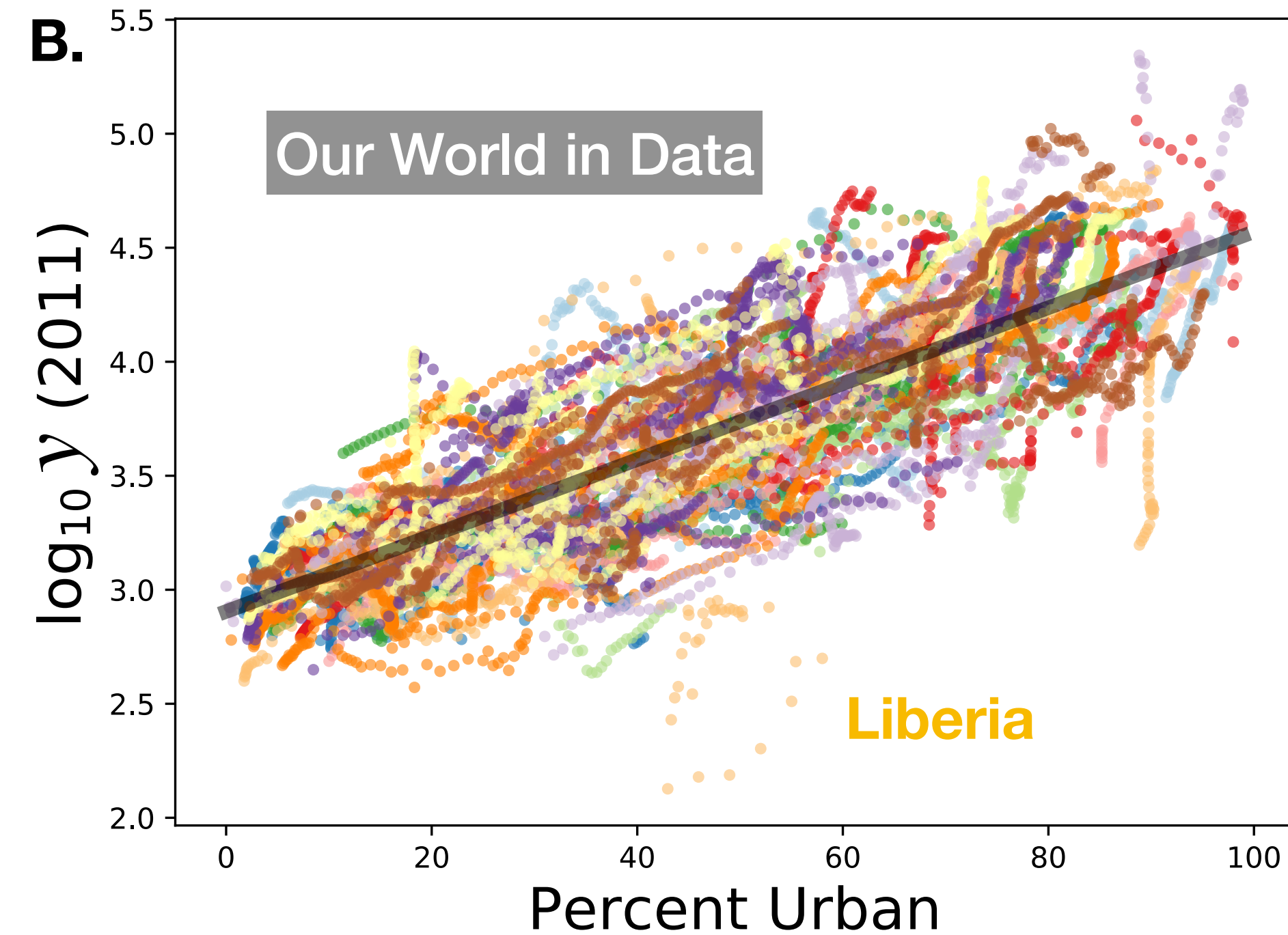
Urbanization and Economic Growth

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

$$a_y \simeq 0.02$$

spectacular !!

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

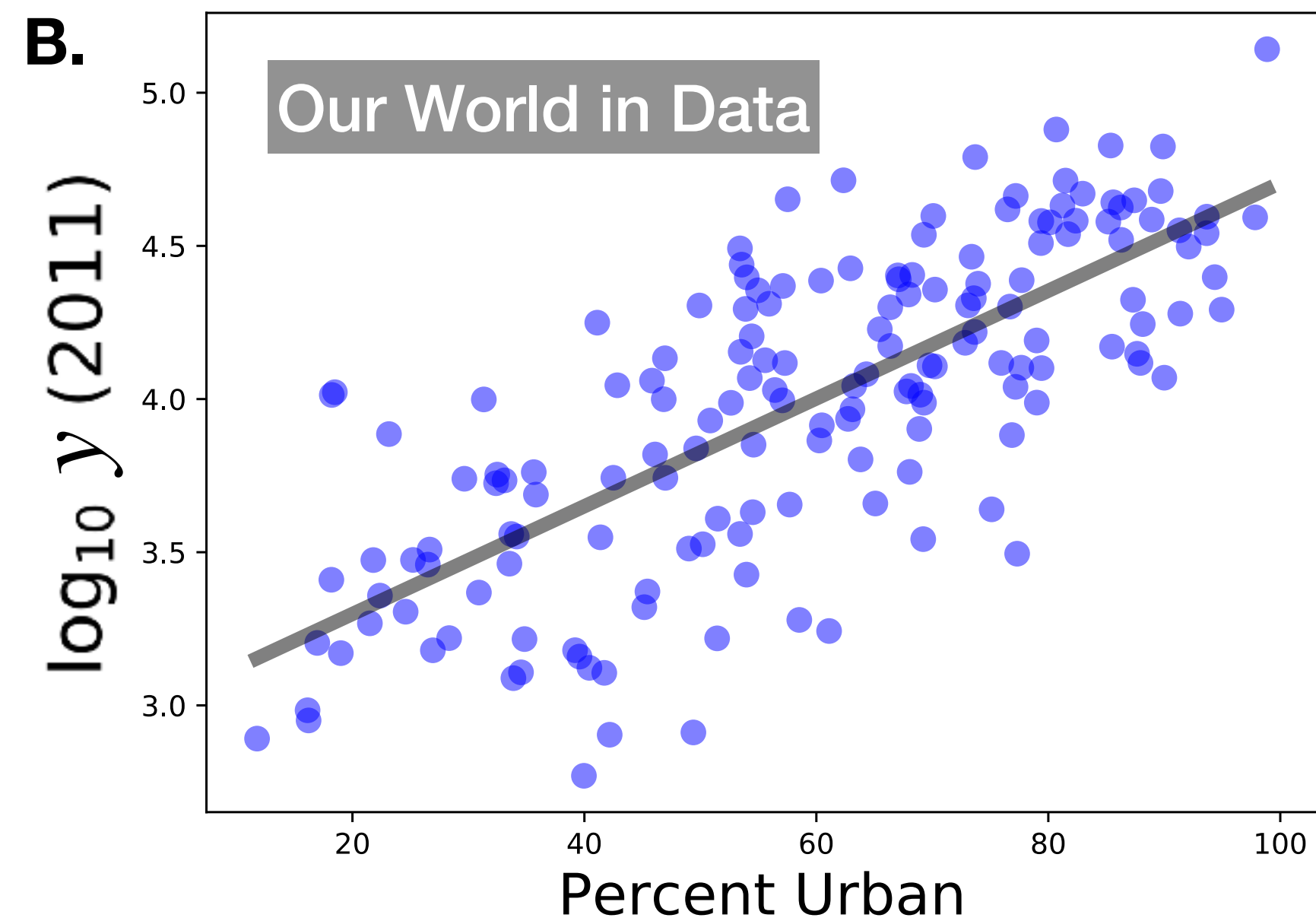
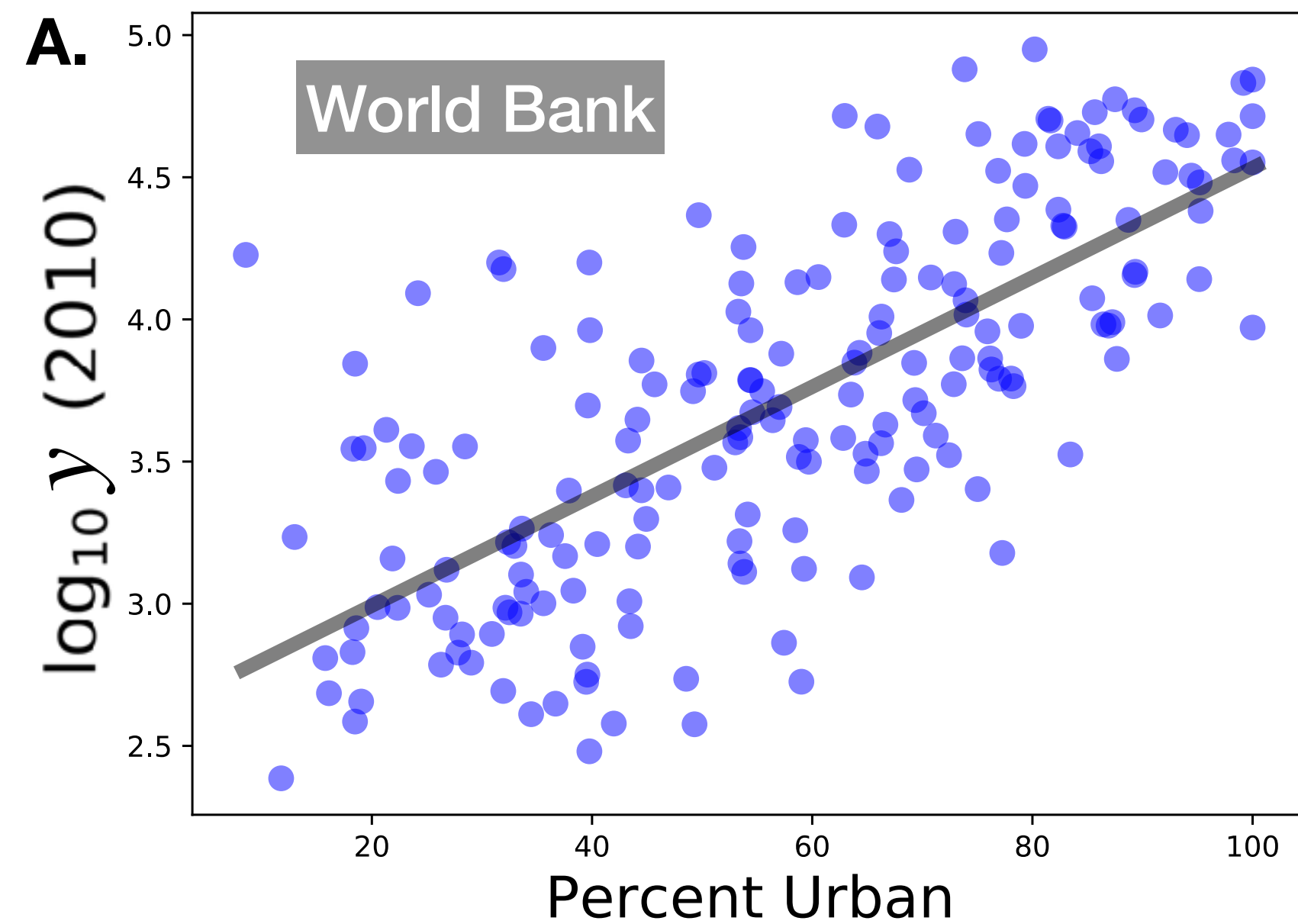
$$y = y_0 10^{a_y u} = y_0 e^{a_y \ln 10 u} \quad a'_y = a_y \underbrace{\ln 10}_{\simeq 2.3} \simeq 4 - 5 \%$$

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

This also holds for each year across nations

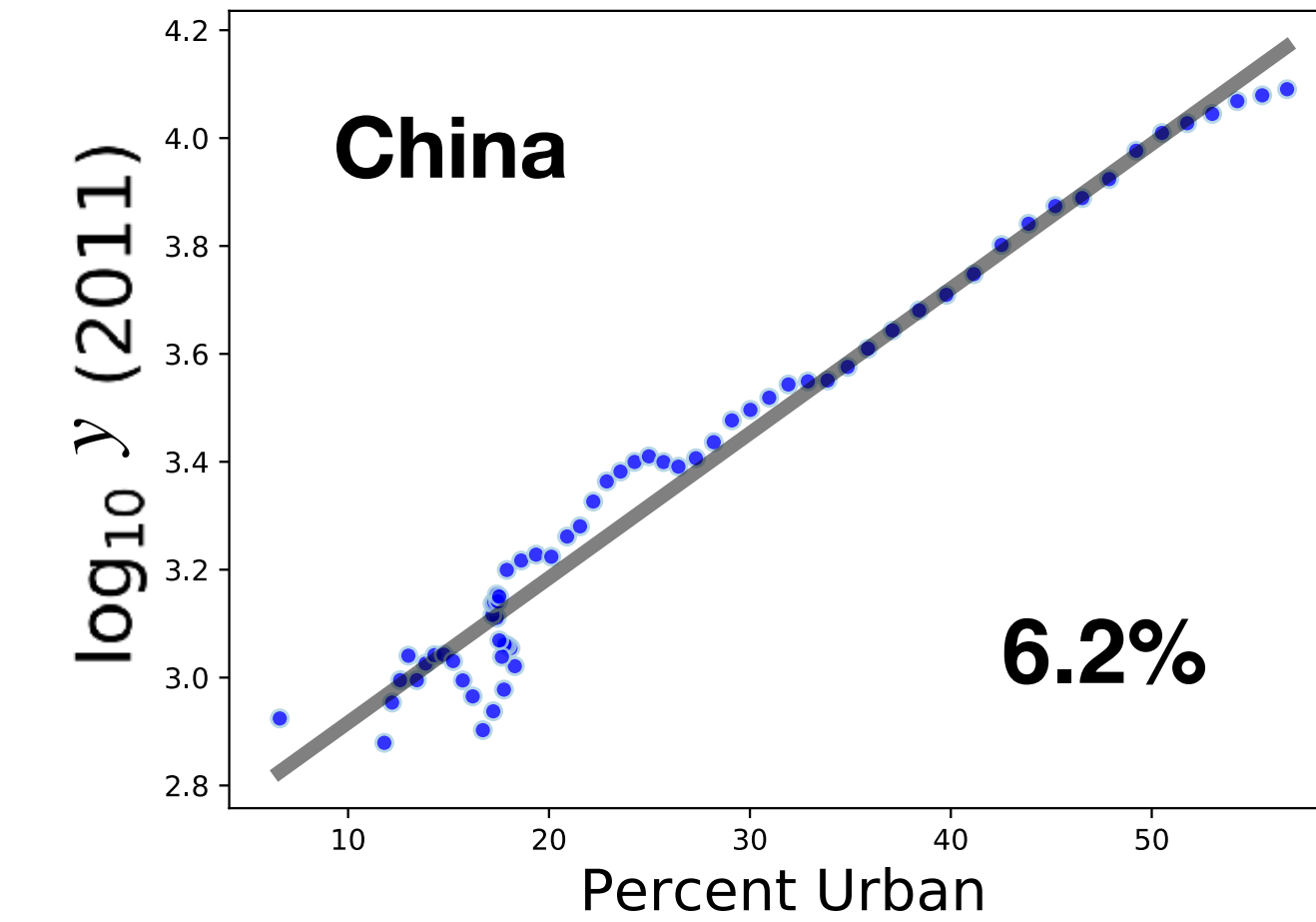
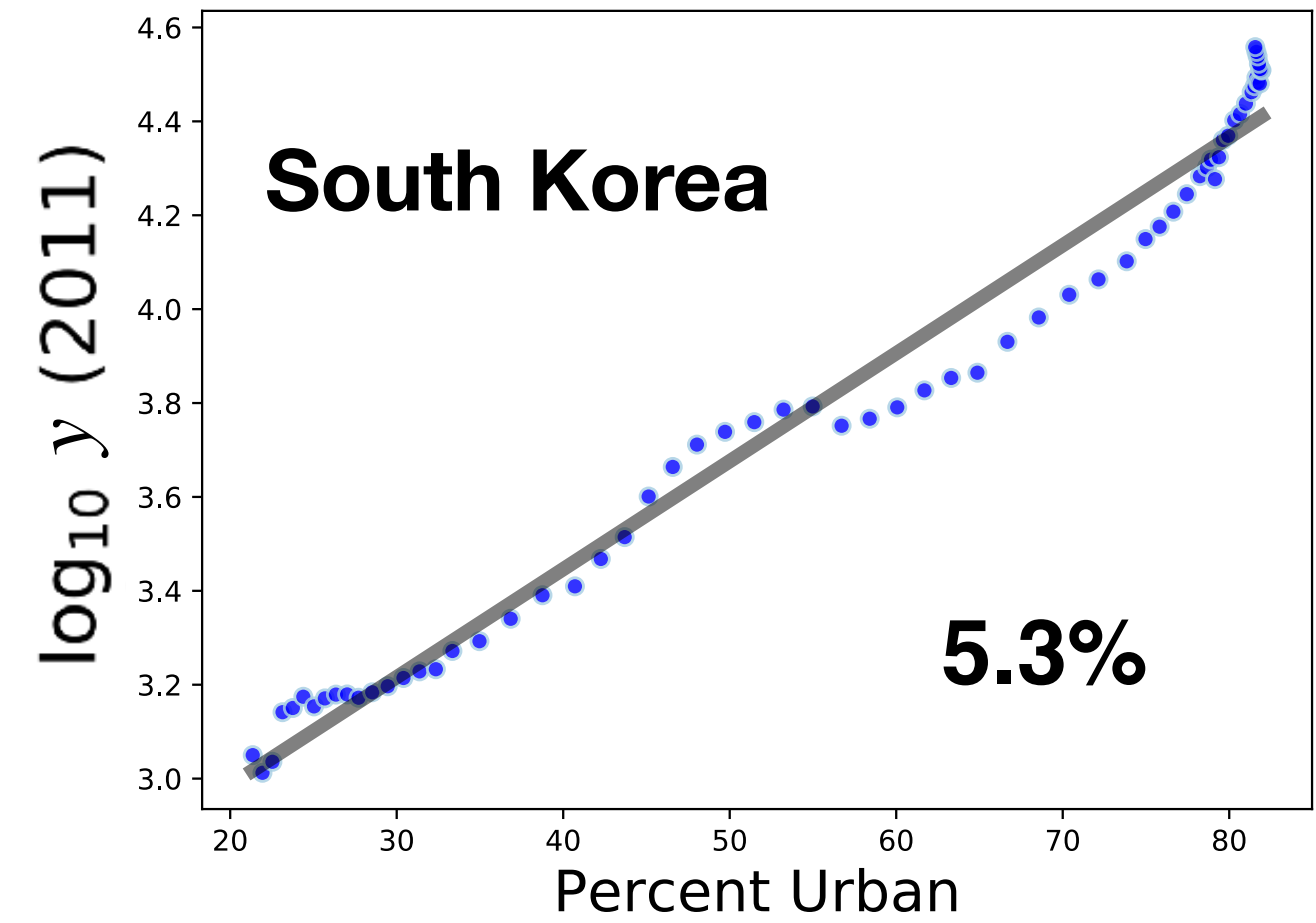
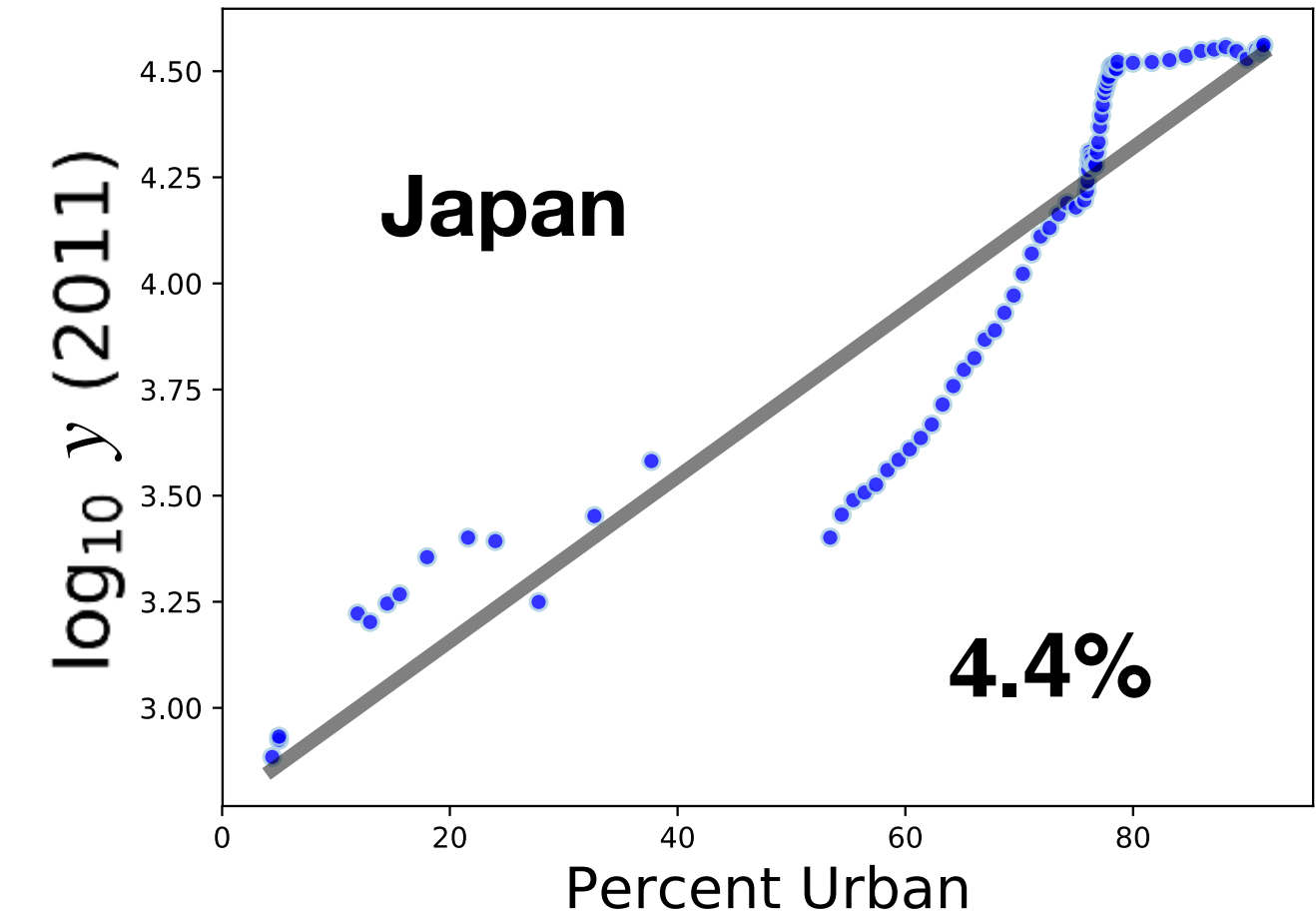
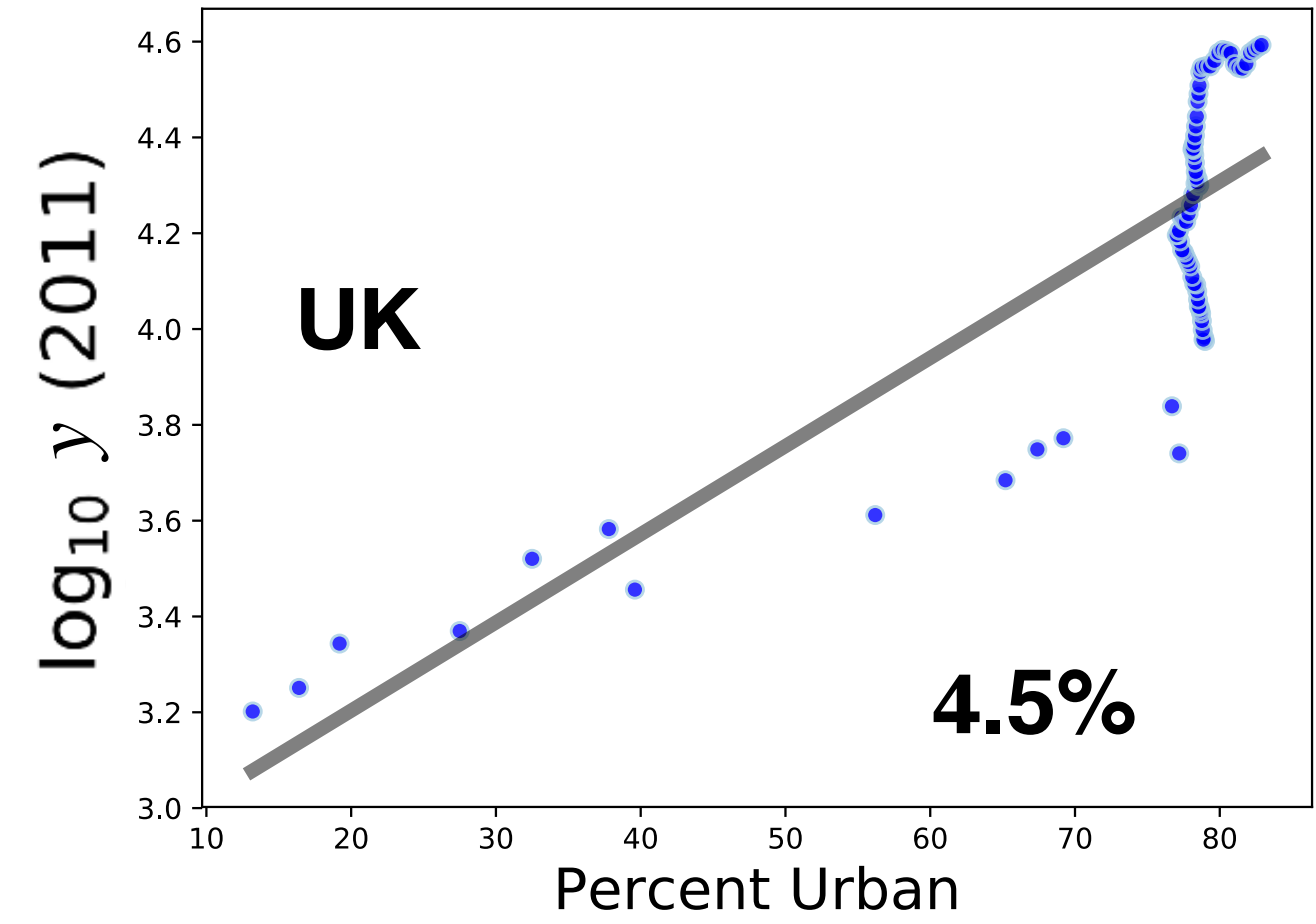
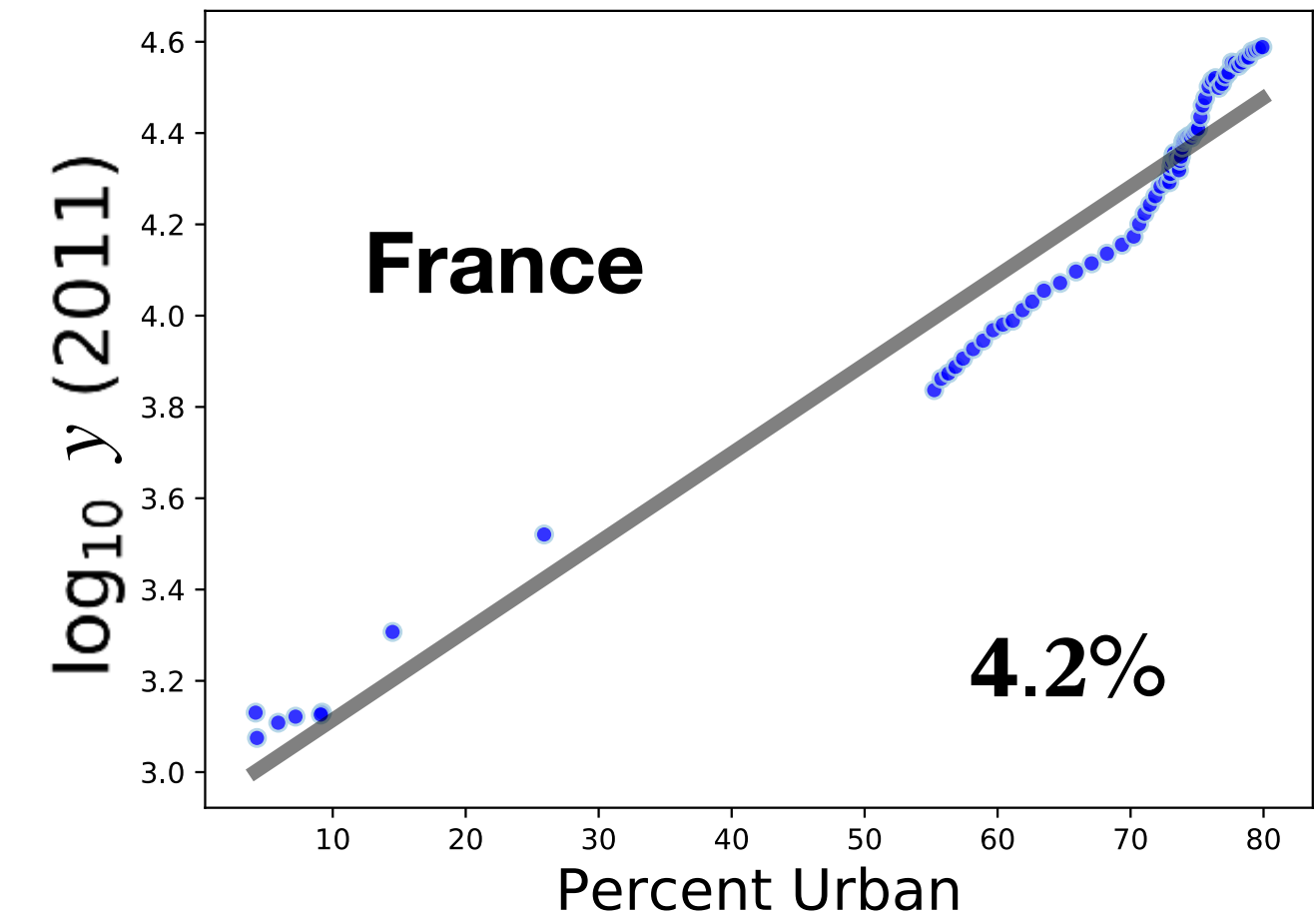
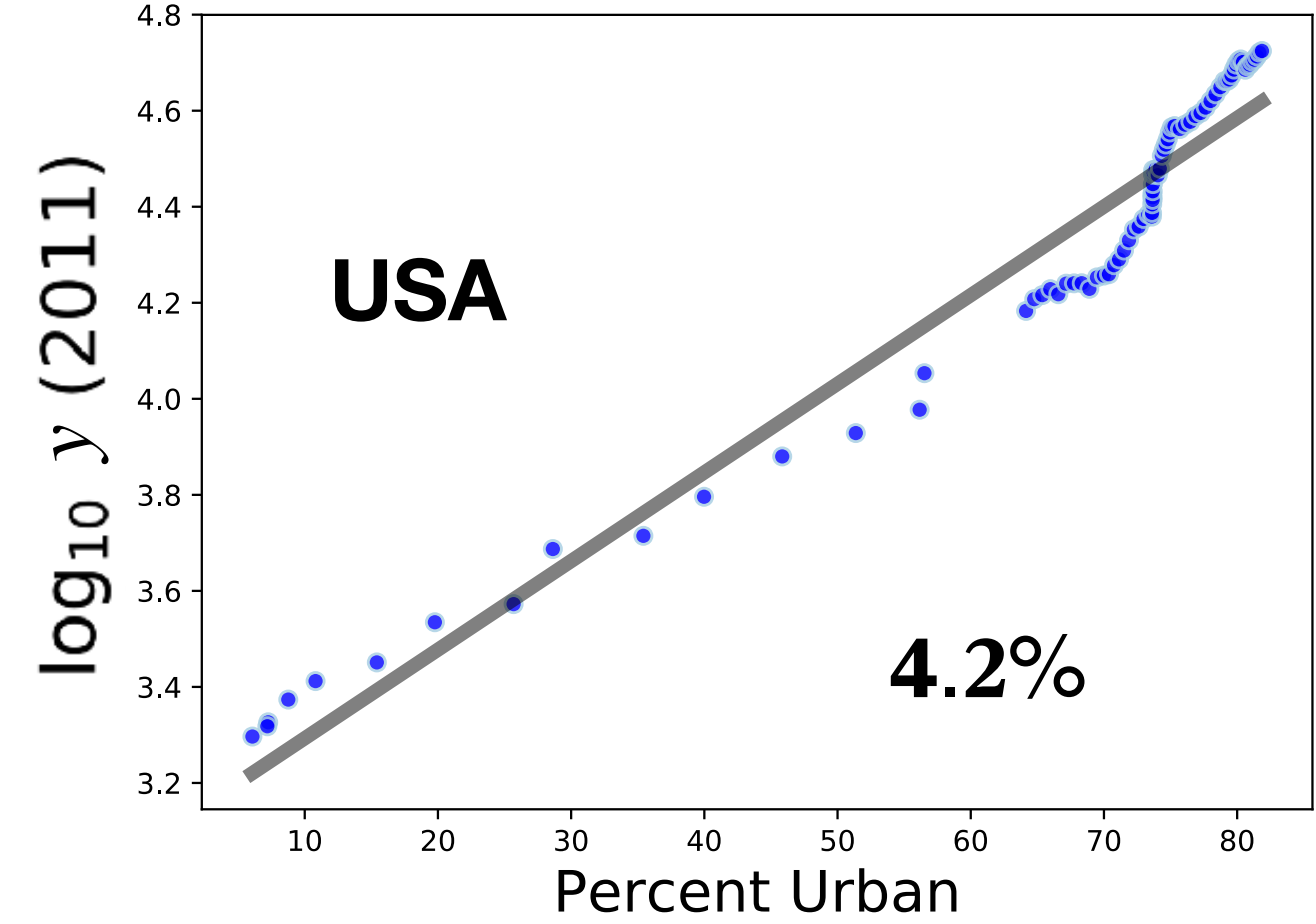
<https://databank.worldbank.org/source/world-development-indicators>

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



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:

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

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

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

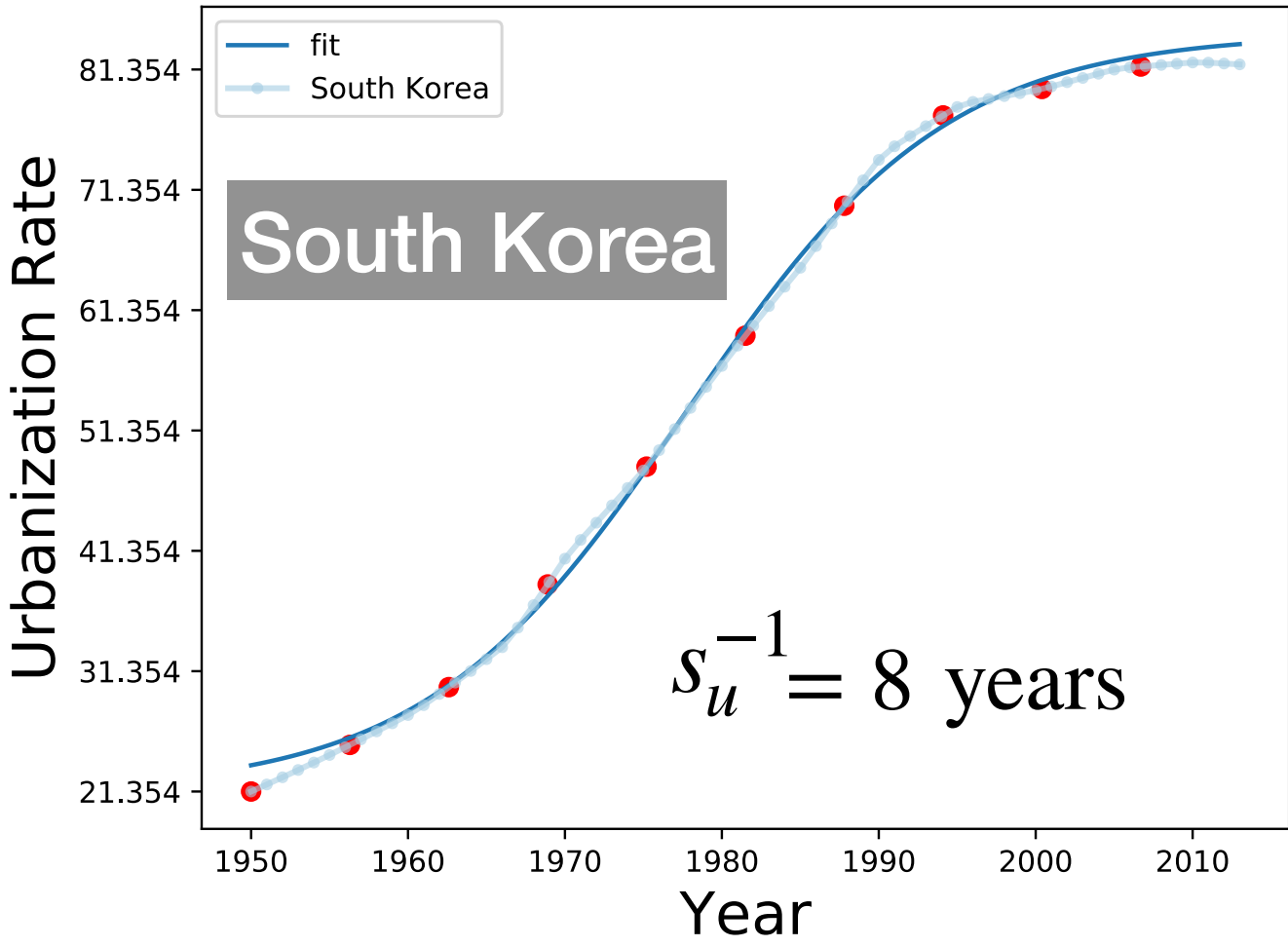
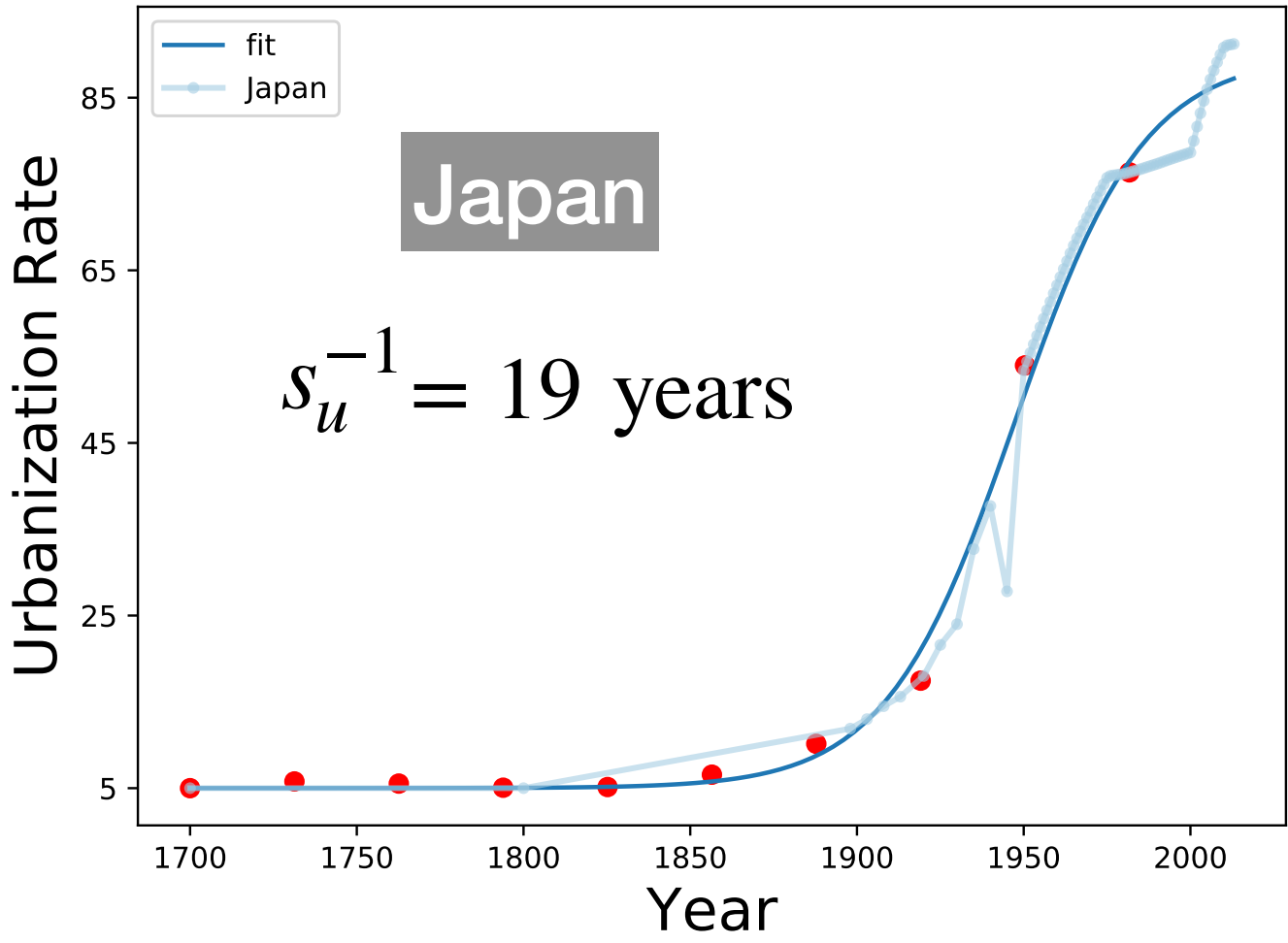
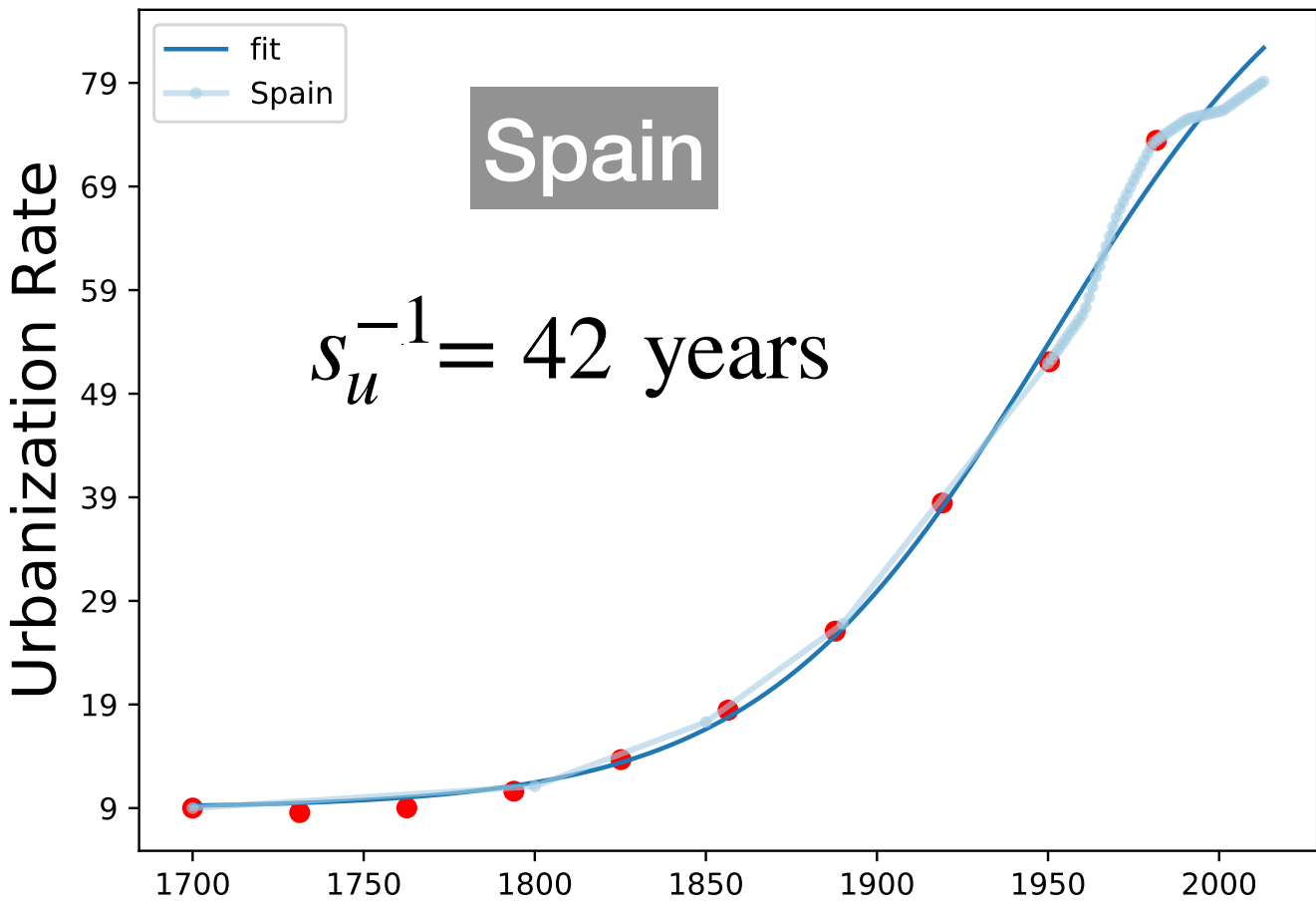
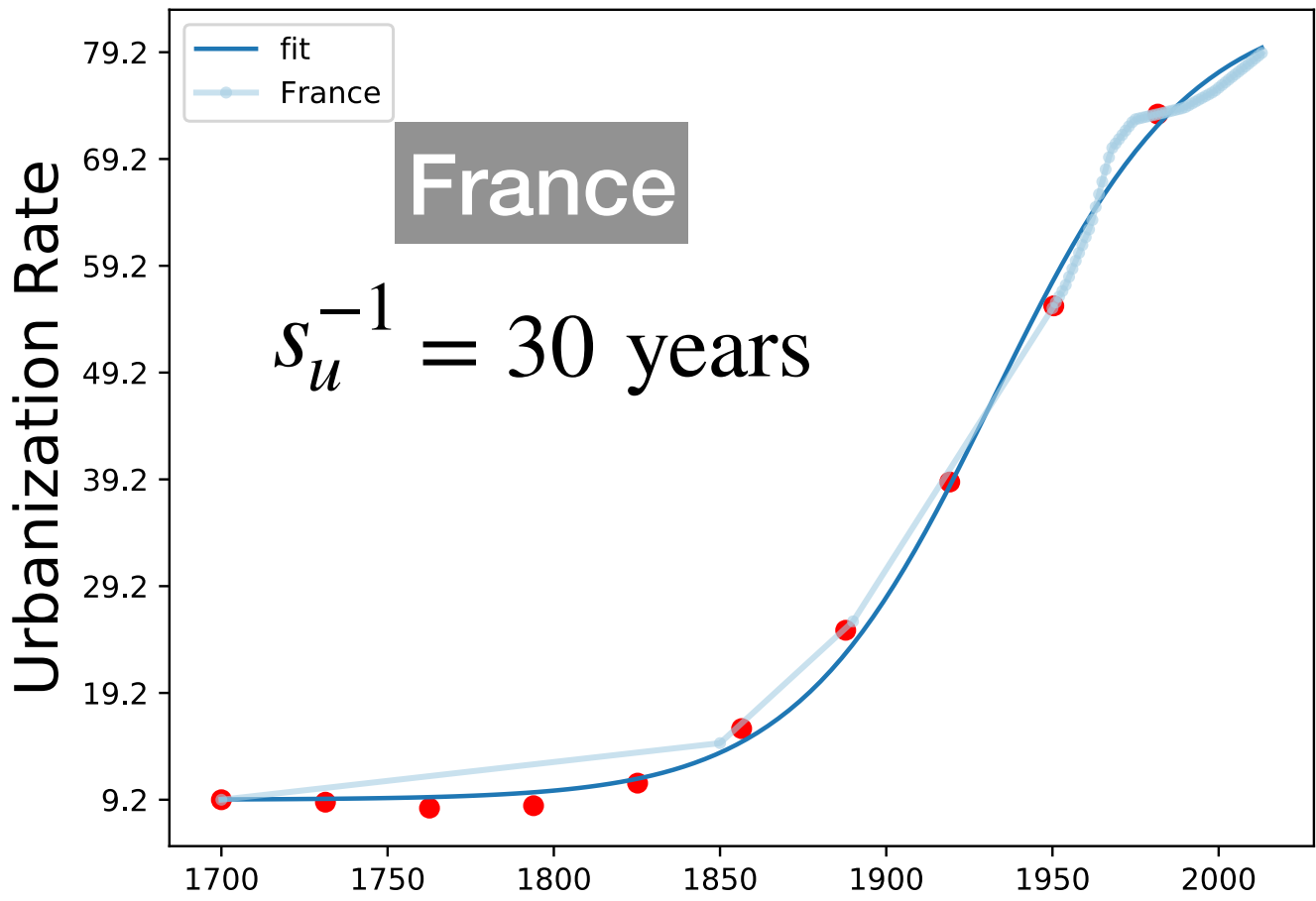
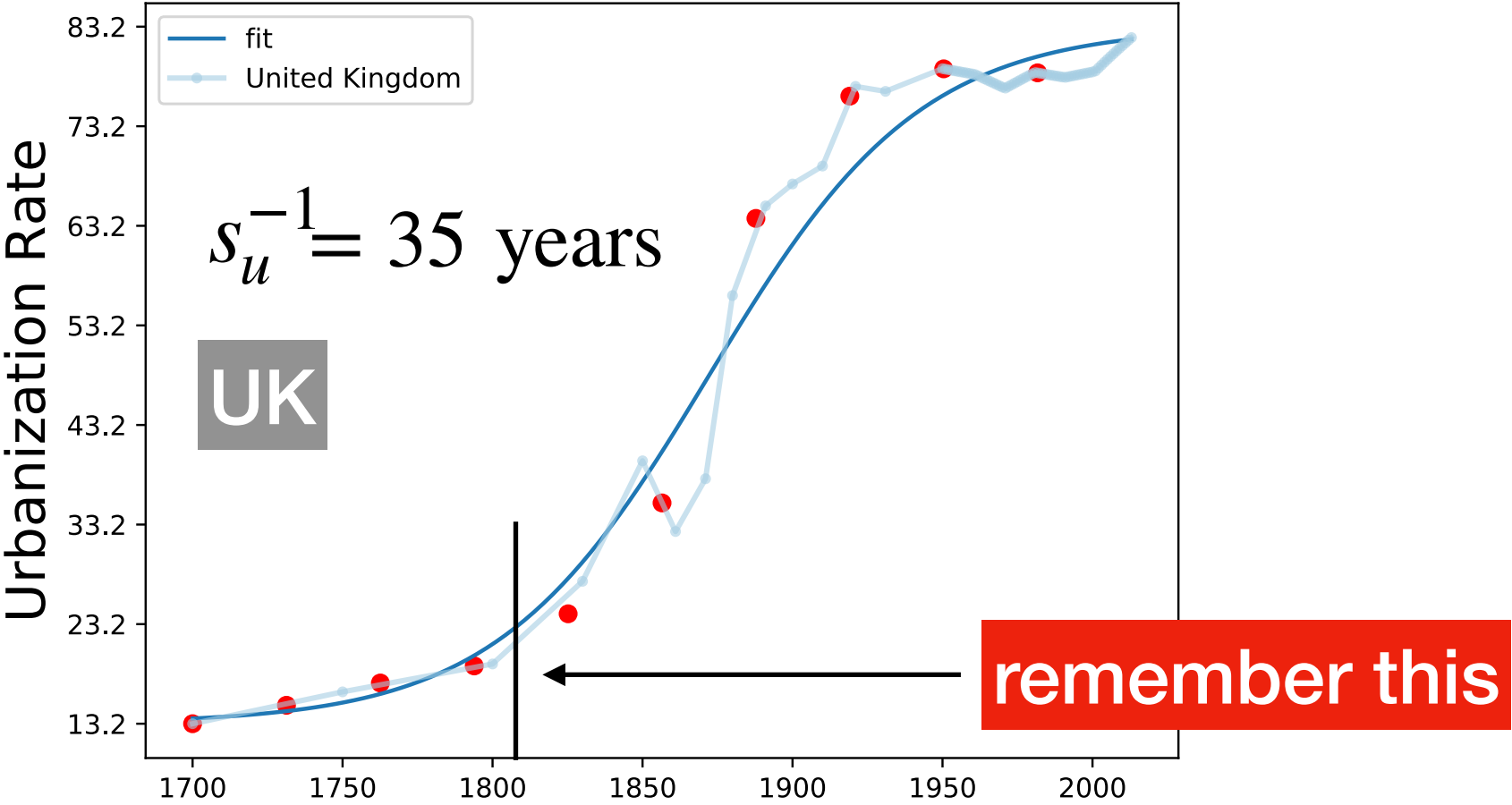
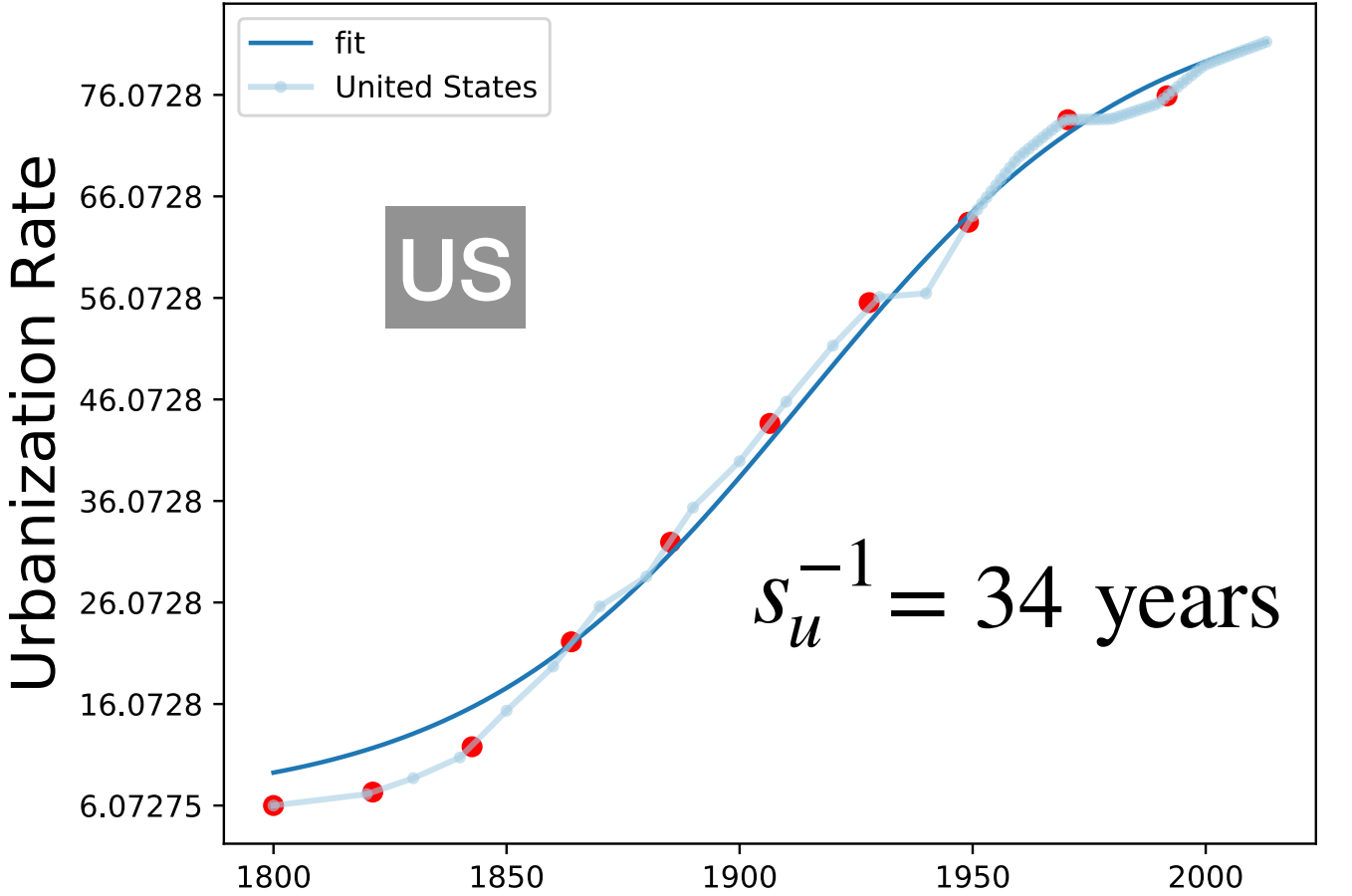
logistical growth

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)

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

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

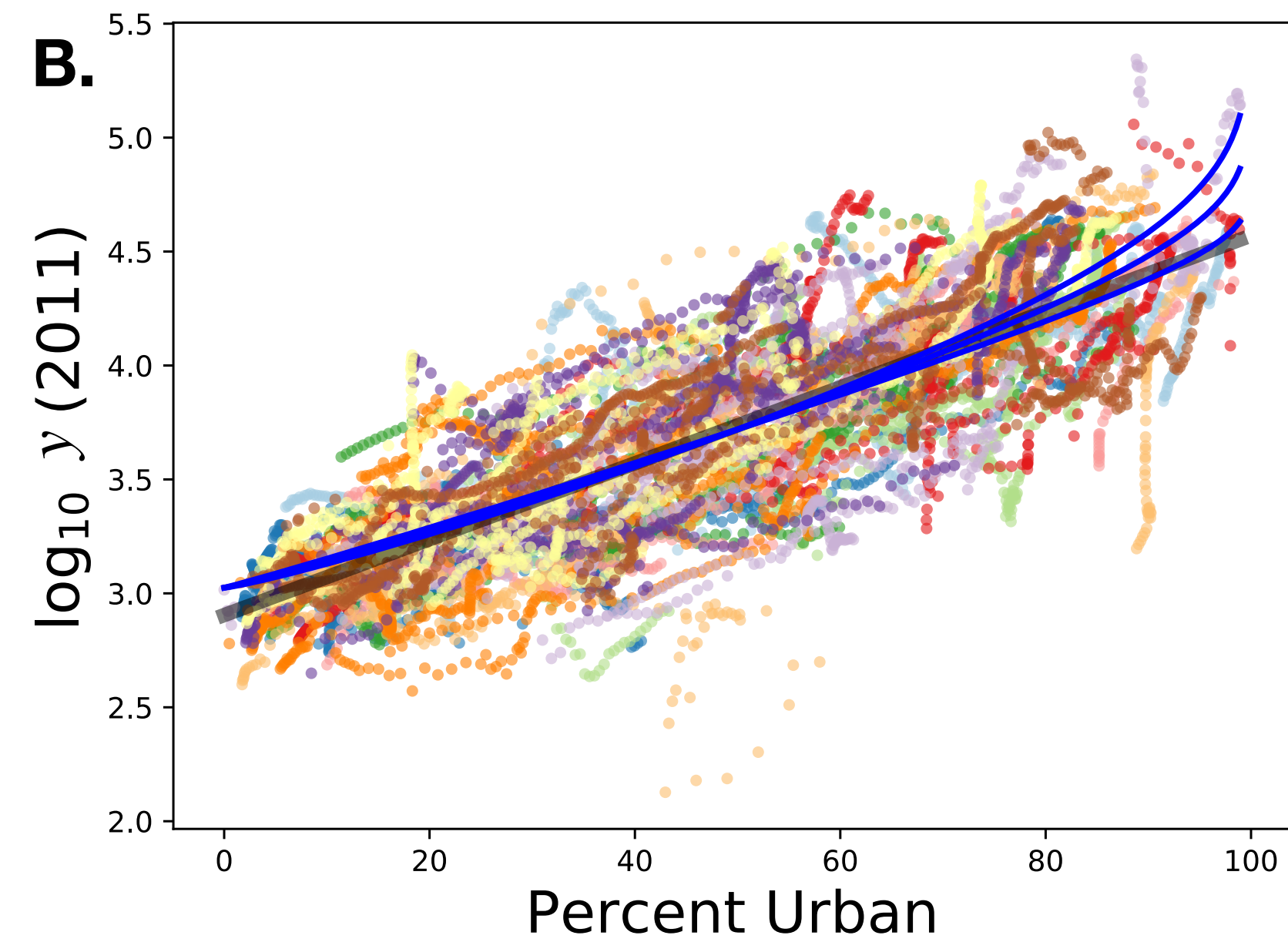
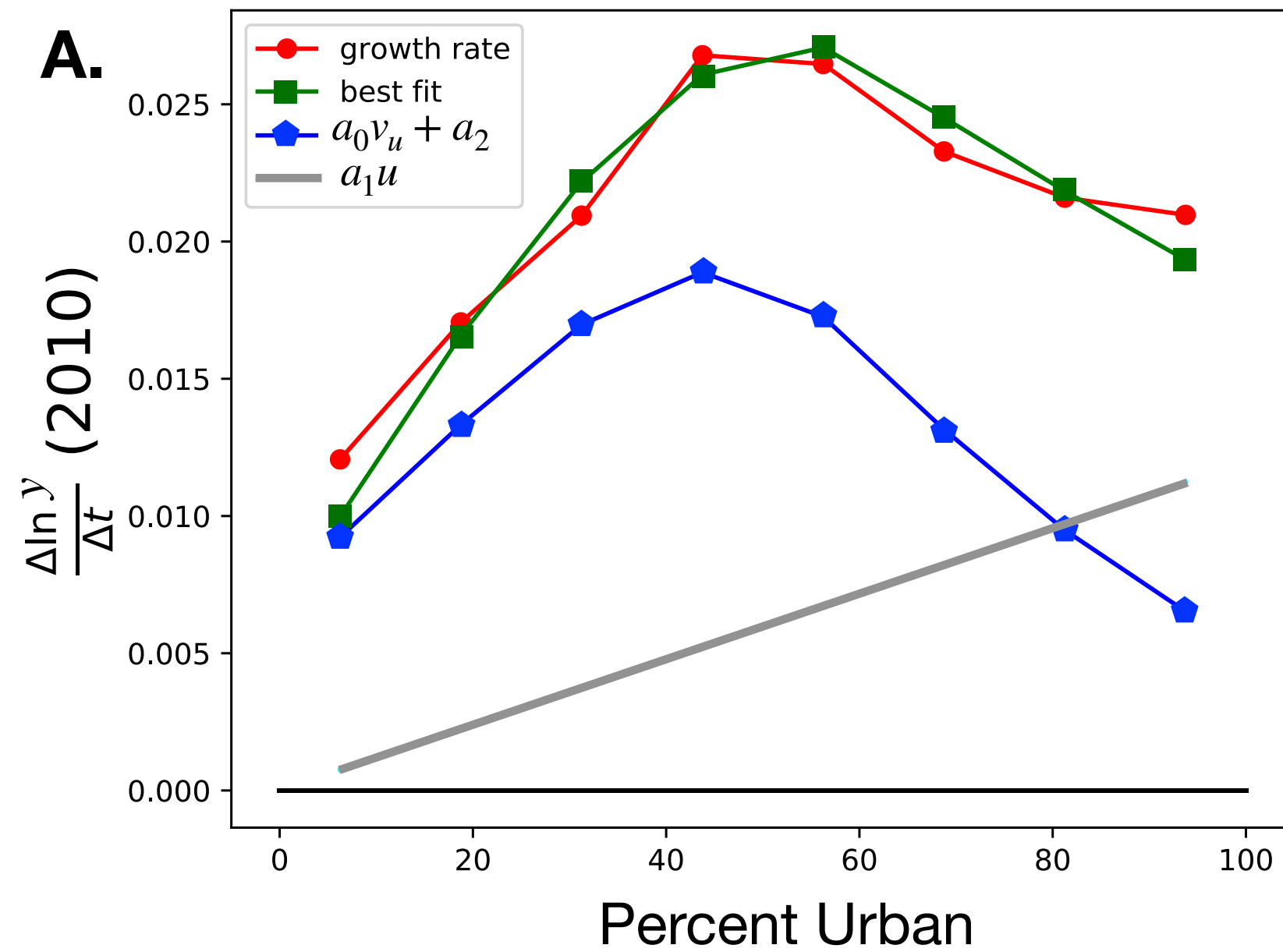
national income is an average
of urban and rural

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

selection into/out of urban environments

endogenous growth in urban and rural

GDP growth rate per year



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

urbanization speed boost

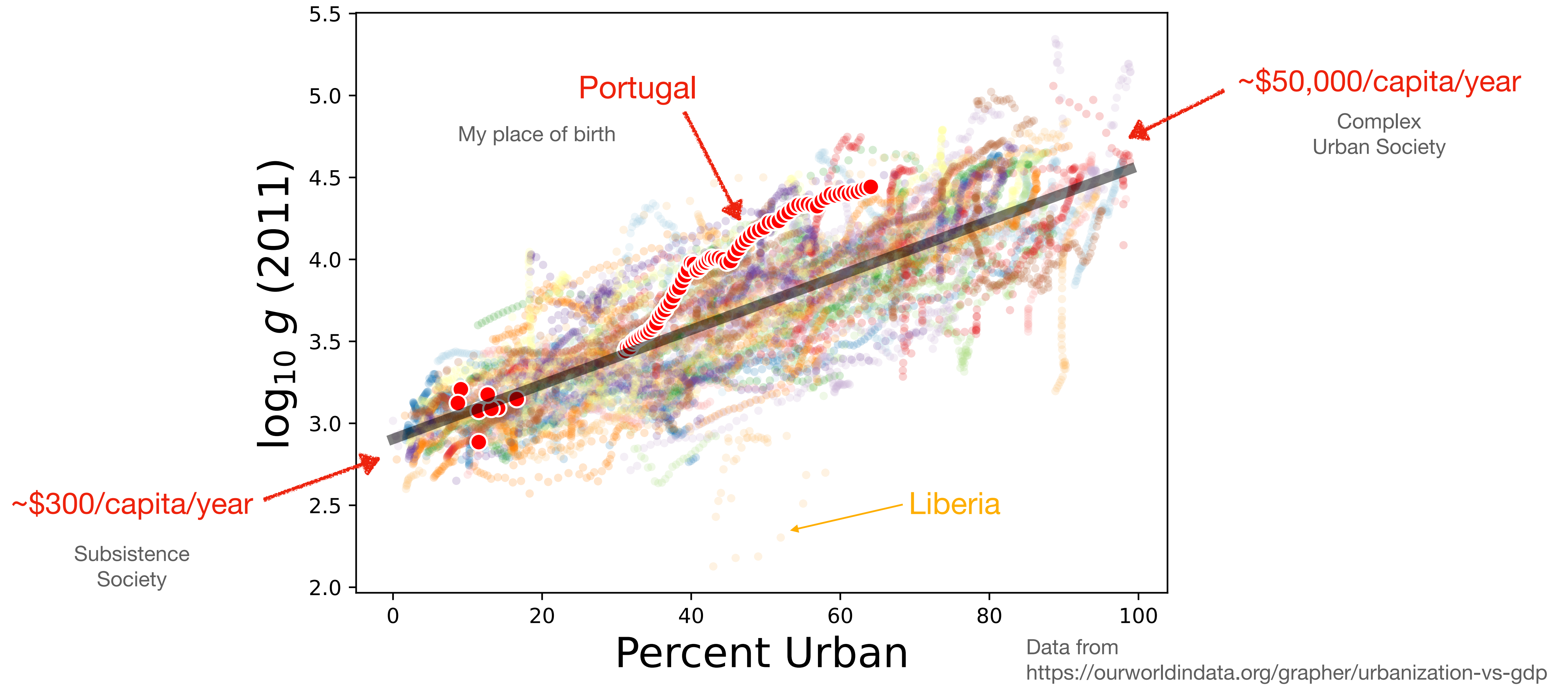
$$\frac{\Delta u}{\Delta t} = v_u$$

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

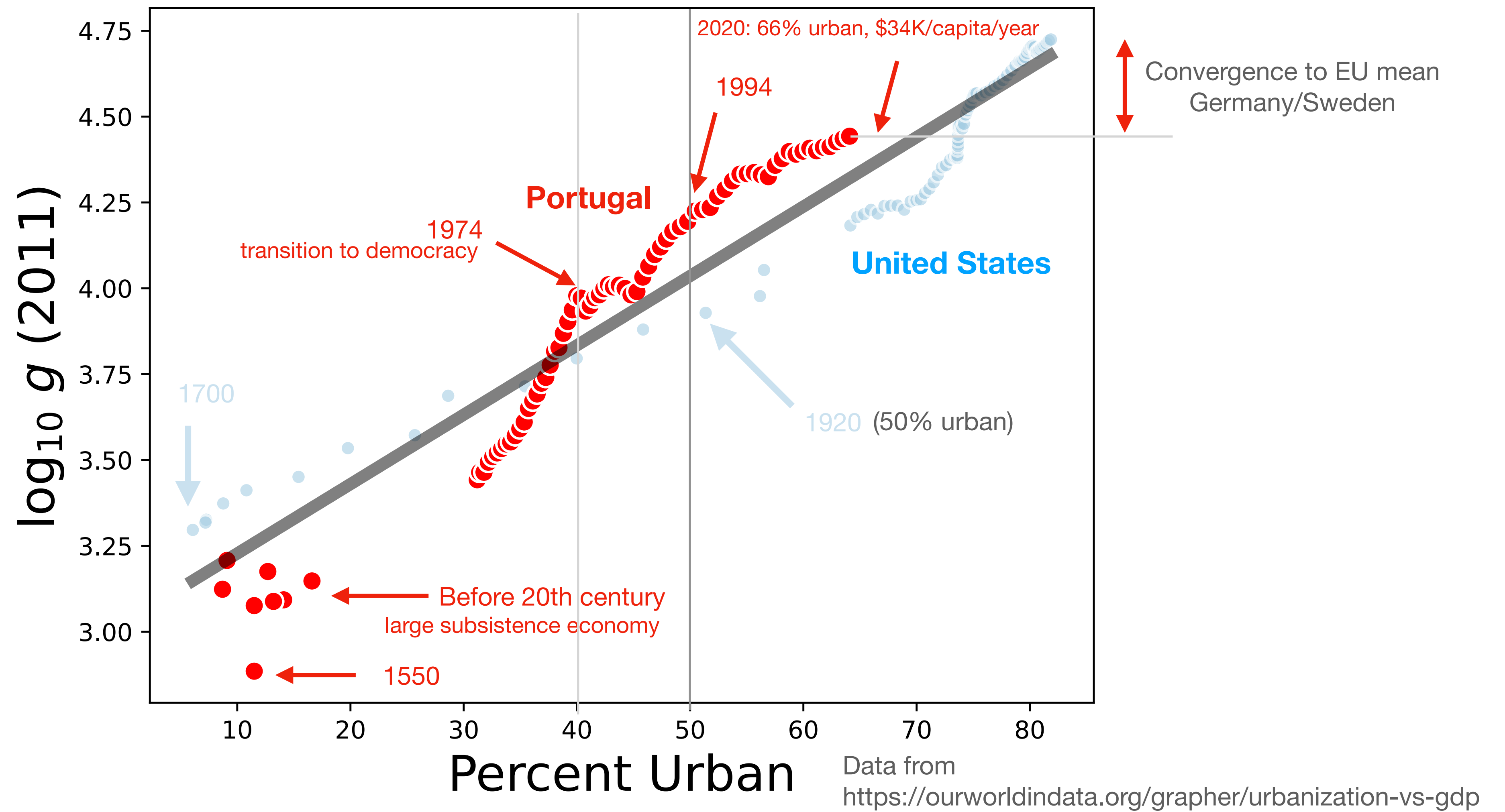
Most of the Effect is due to fast migration from rural environments to larger cities

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

The general connection between urbanization and development:



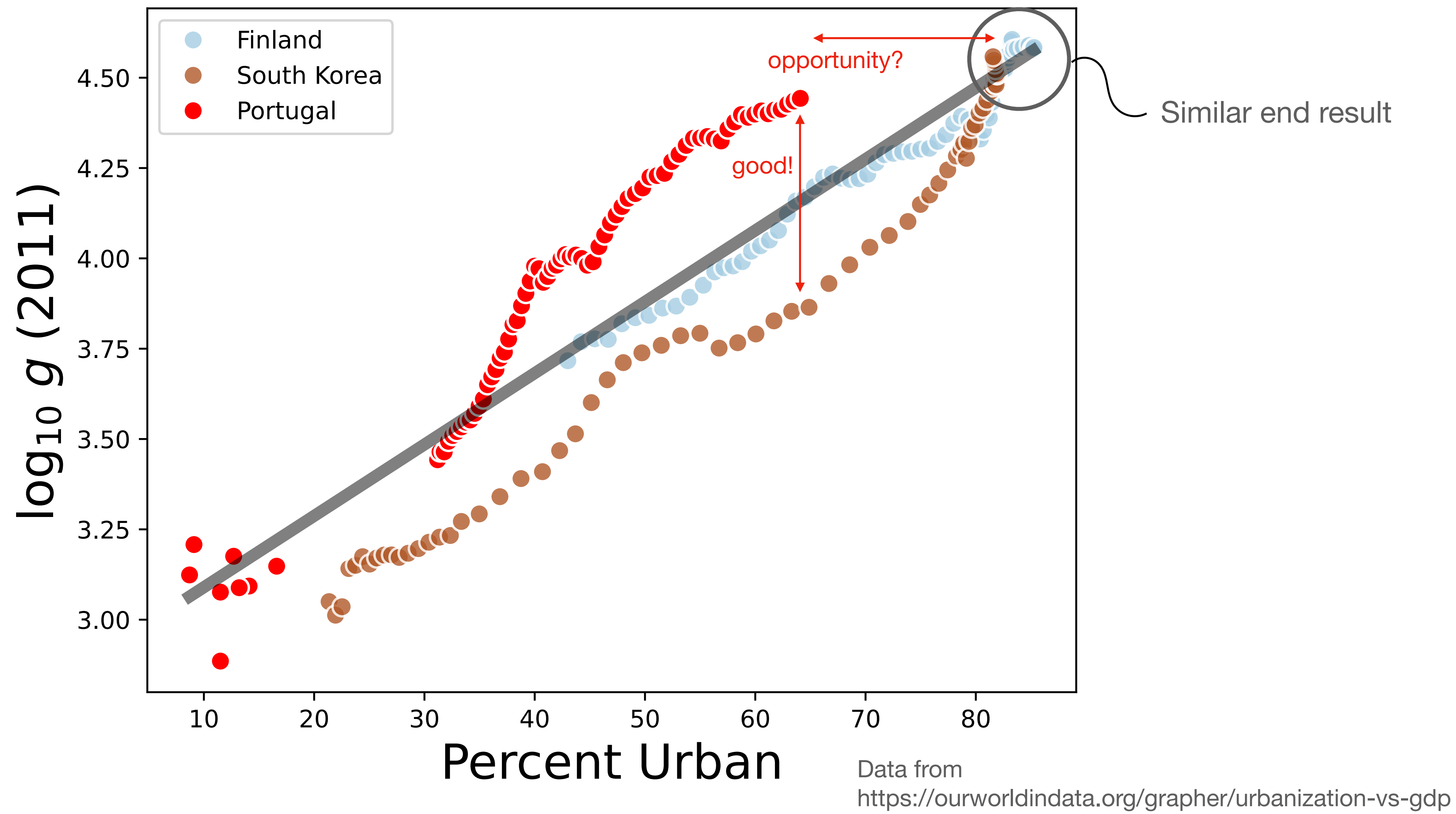
On average, every 1% rise in urbanization leads to a ~4% increase in real GDP/capita!

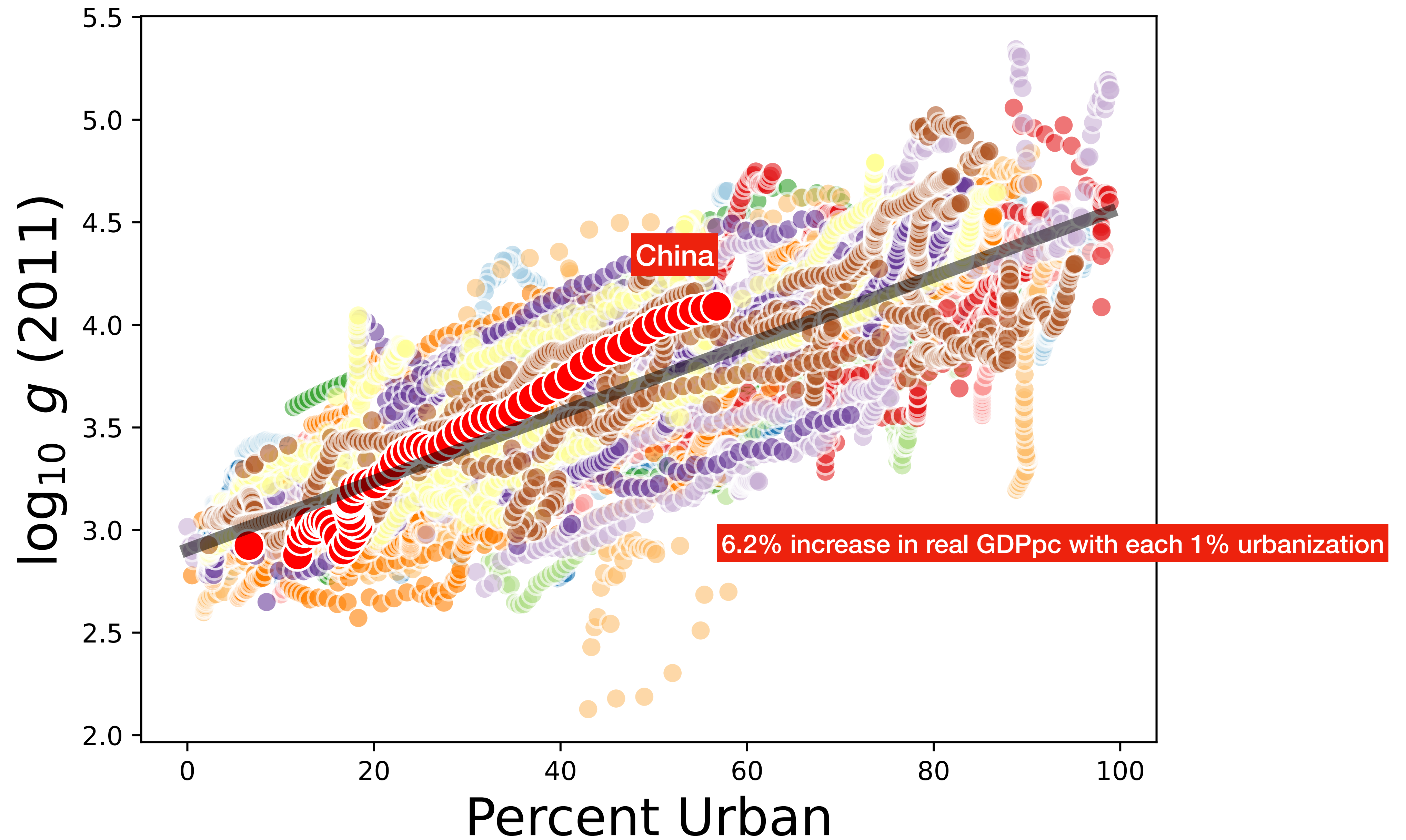


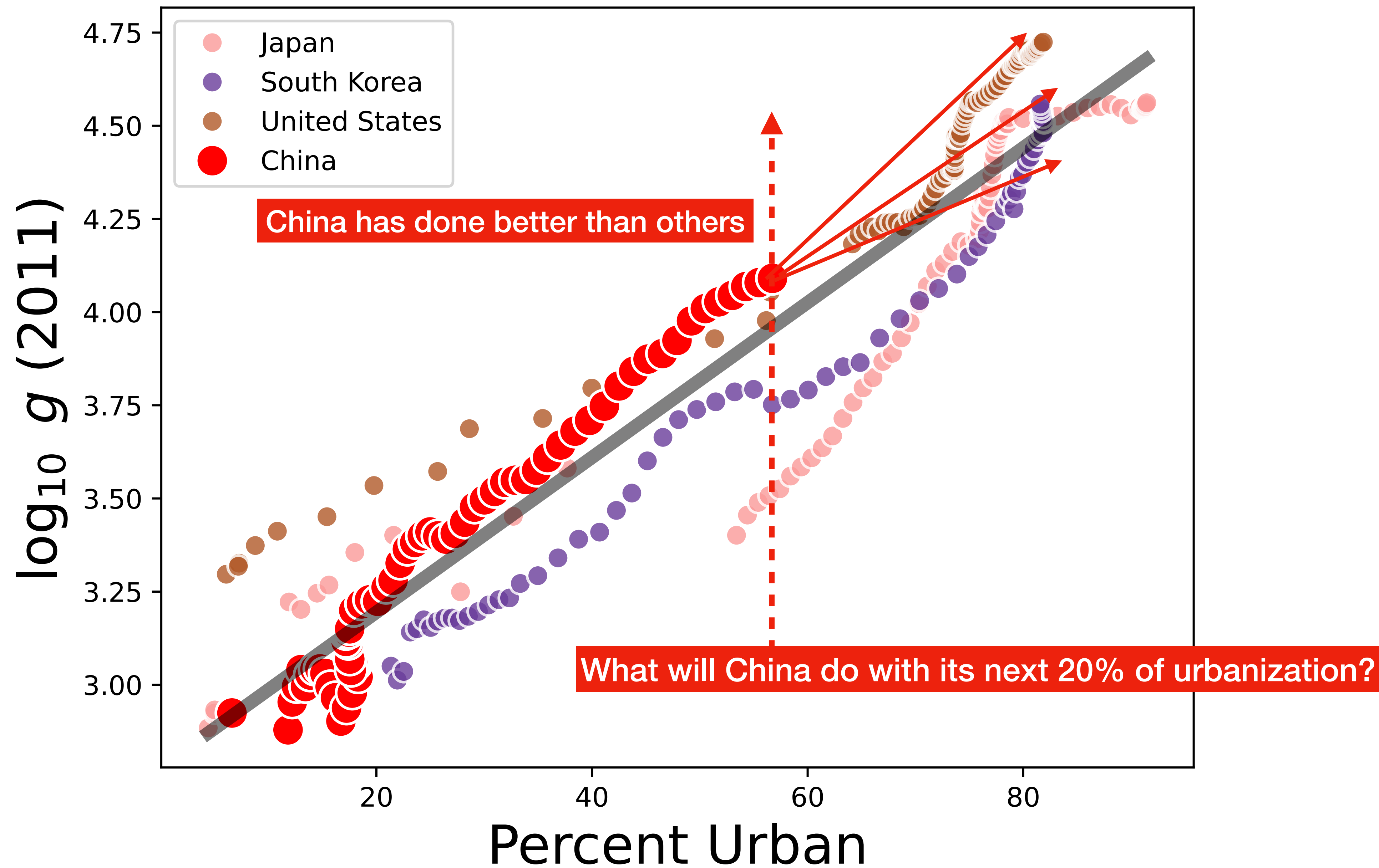
Portugal: every 1% rise in urbanization leads to a ~4.6% increase in real GDP/capita!

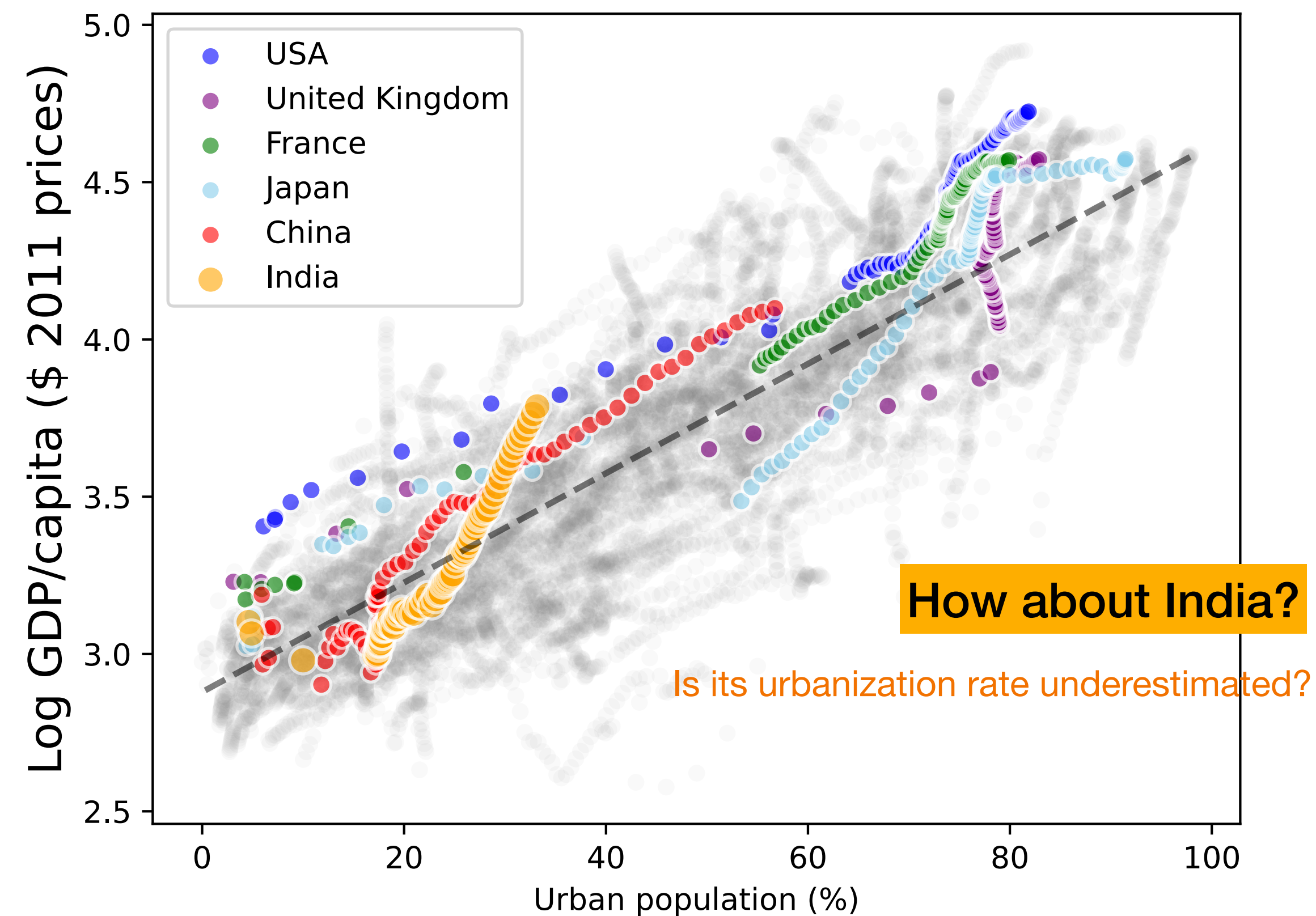
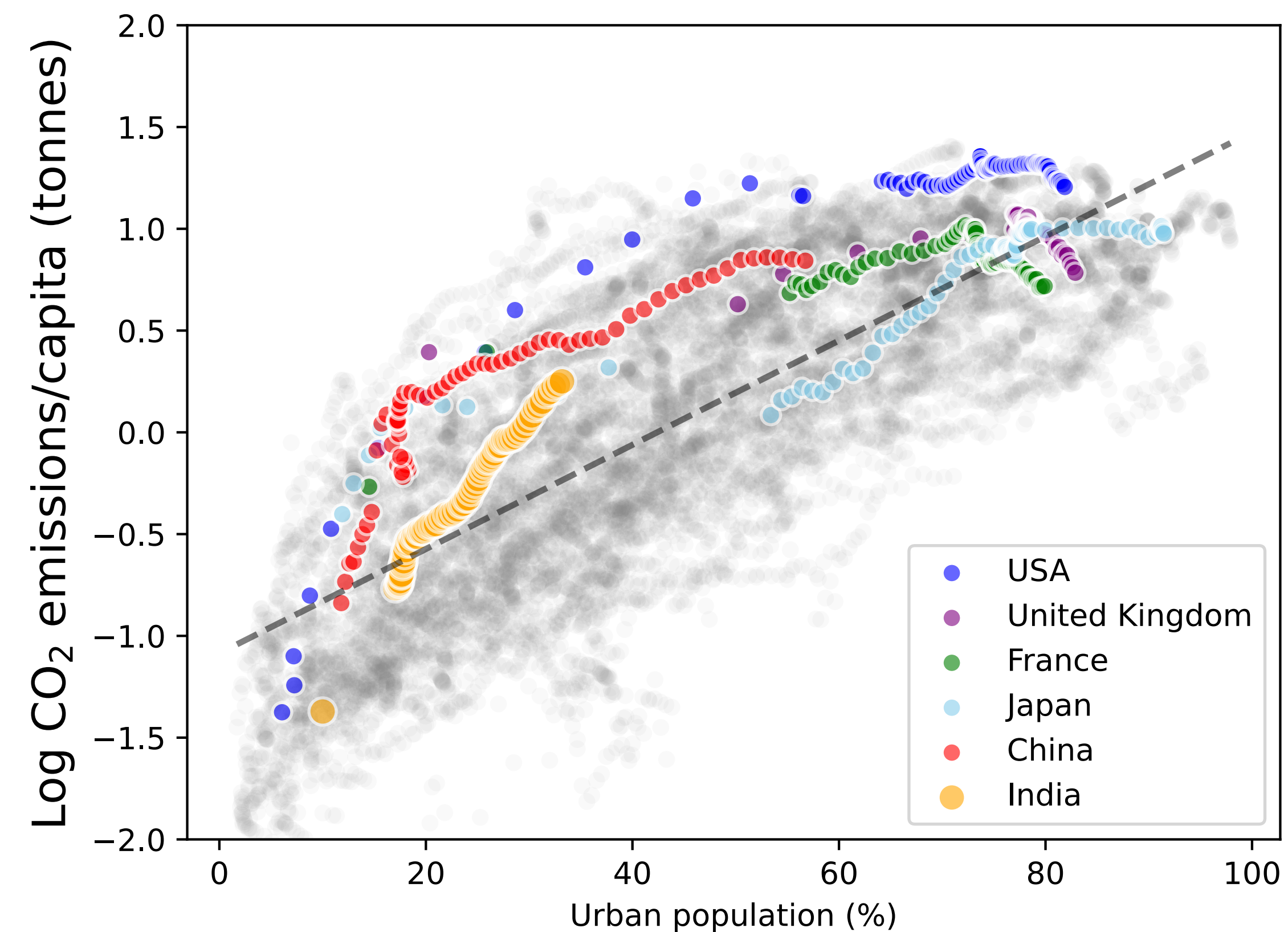
What can we do with 20% of urbanization still to go?

Two other successful “fast urbanizers”







A.**B.**

Growth rate, b	India	USA	China	All Nations
GDP/capita	7.65% (0.96)	3.83% (0.24)	5.77% (0.35)	4.00% (0.05)
Human Development Index	5.19 (0.14)	0.83 (0.08)	1.38 (0.08)	1.02 (0.03)
Years of Schooling	15.78% (2.01)	1.95% (0.14)	6.23% (4.68)	2.86% (0.14)
Life Expectancy	3.25 (0.11)	0.9 (0.07)	1.18 (0.23)	0.69 (0.01)
Child Mortality Rate	-11.24 (0.40)	-11.71 (0.91)	-6.44 (0.55)	-3.82 (0.06)
Death Rate Infectious Diseases	-13.95% (0.35)	-12.74% (1.38)	-5.65% (0.19)	-4.34% (0.13)
Energy use/capita	11.86% (0.36)	-0.60% (0.55)	5.60% (0.48)	5.63% (0.10)
CO ₂ /capita	14.04% (0.55)	0.06% (0.62)	6.73% (0.84)	5.89% (0.09)

Table 1. Growth rate b of various quantities with each 1 % increase in urbanization

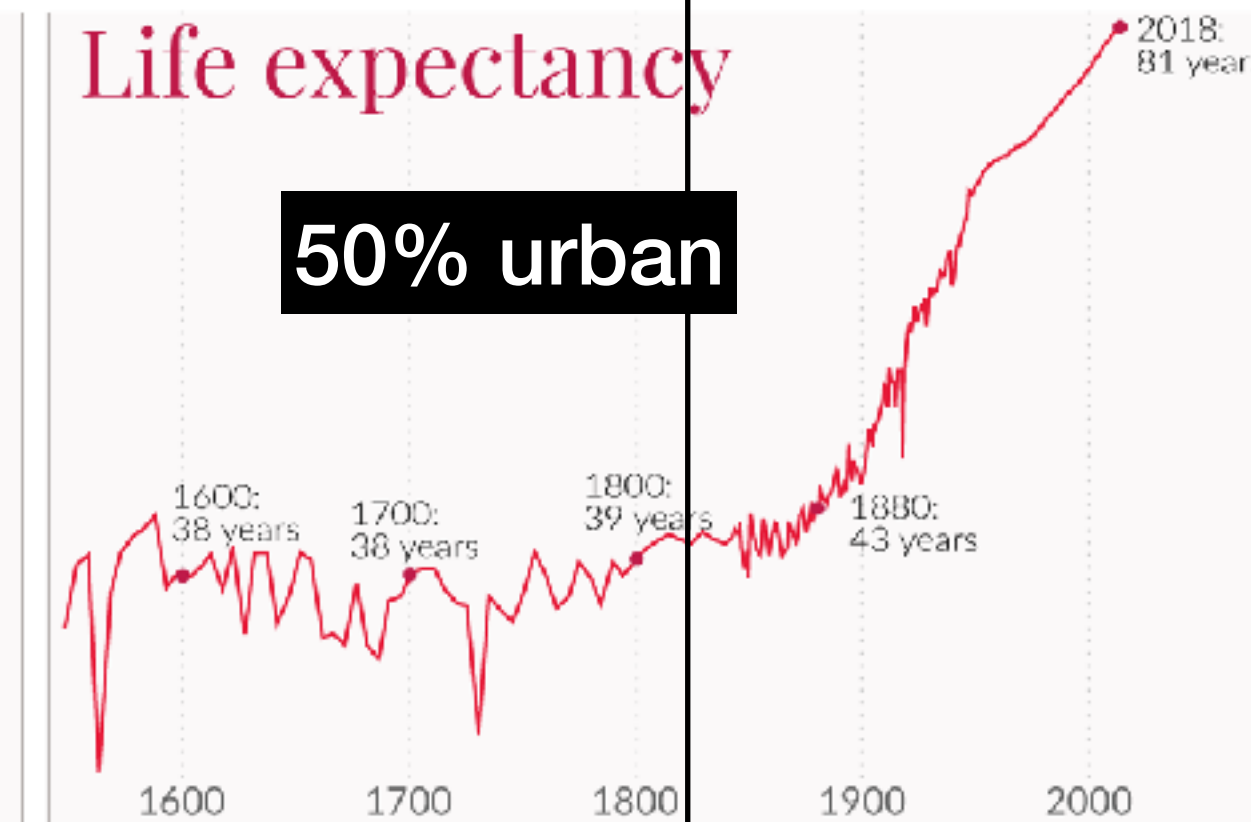
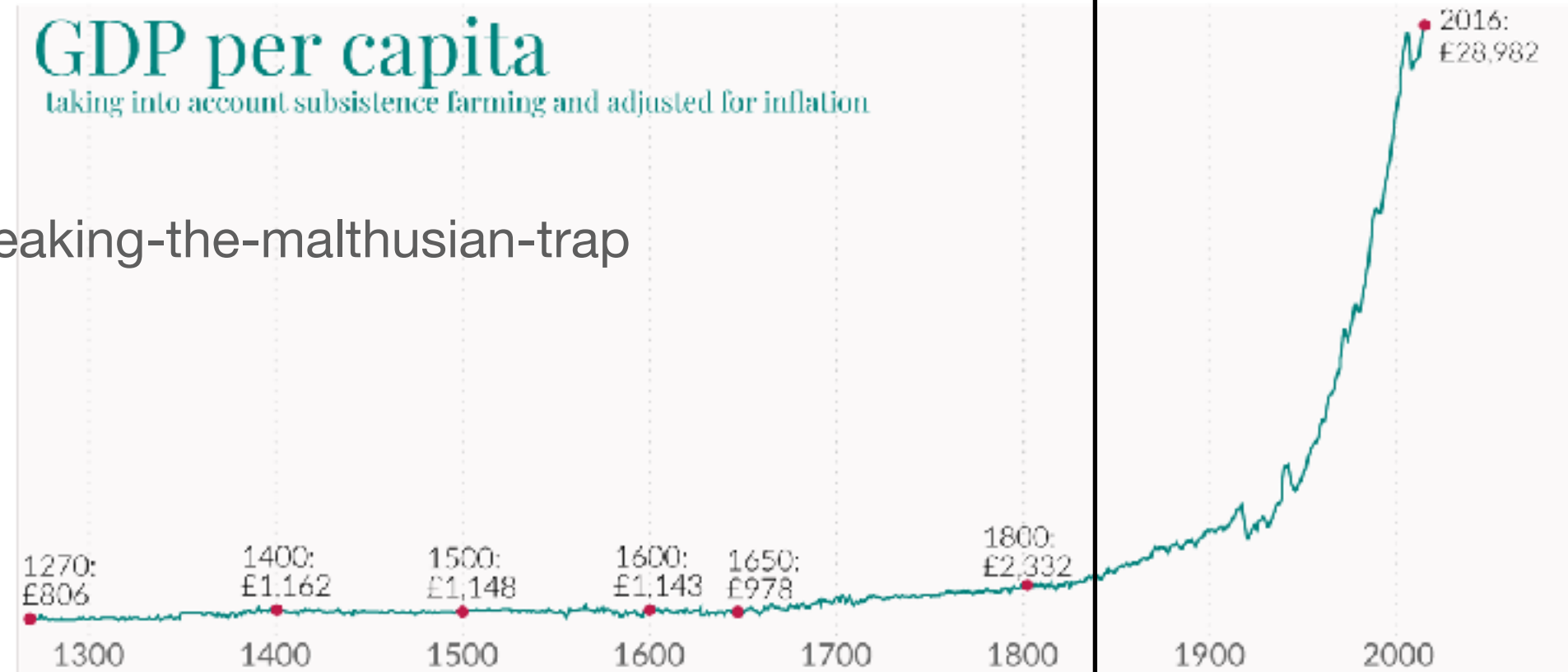
Urbanization begets its impact on economic growth per capita by
taking people from
low GDP situations (rural subsistence) to high GDP situations (large cities)
(structural change)

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

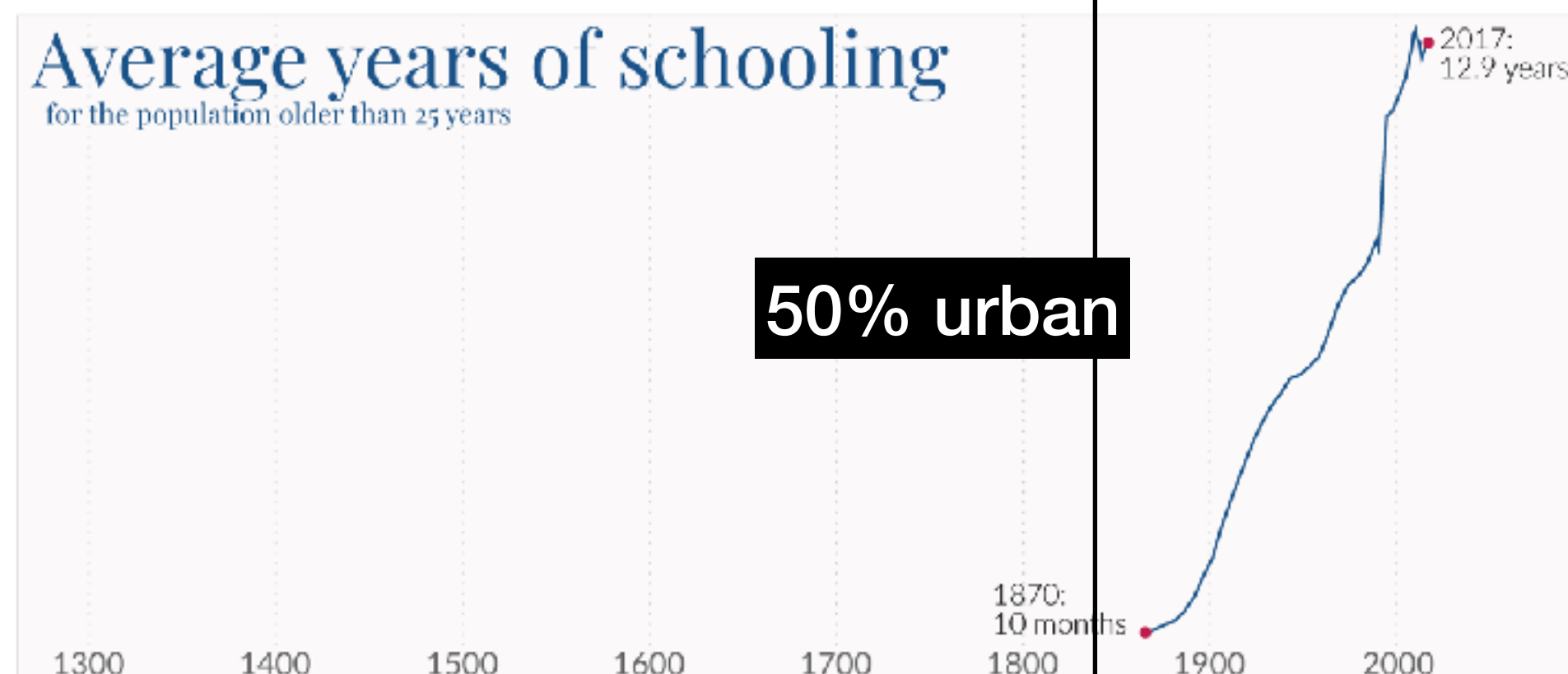
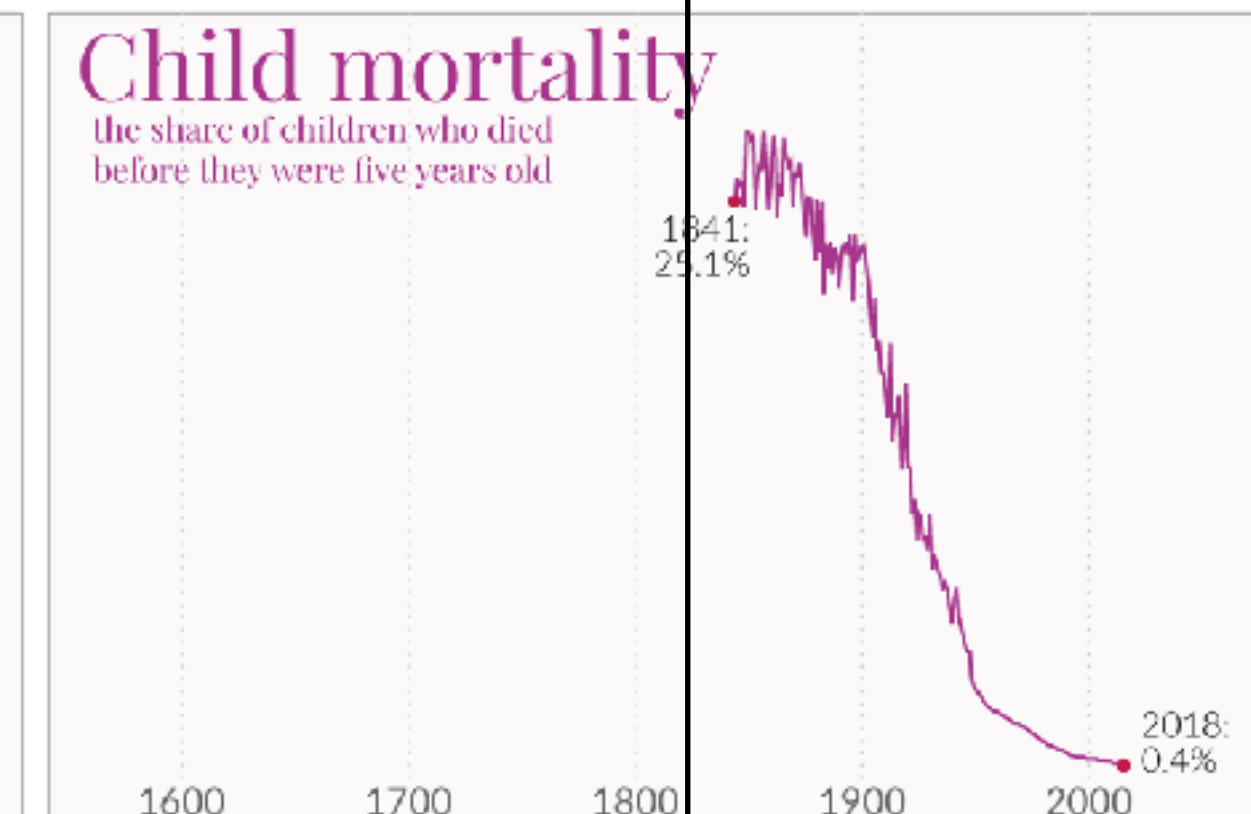
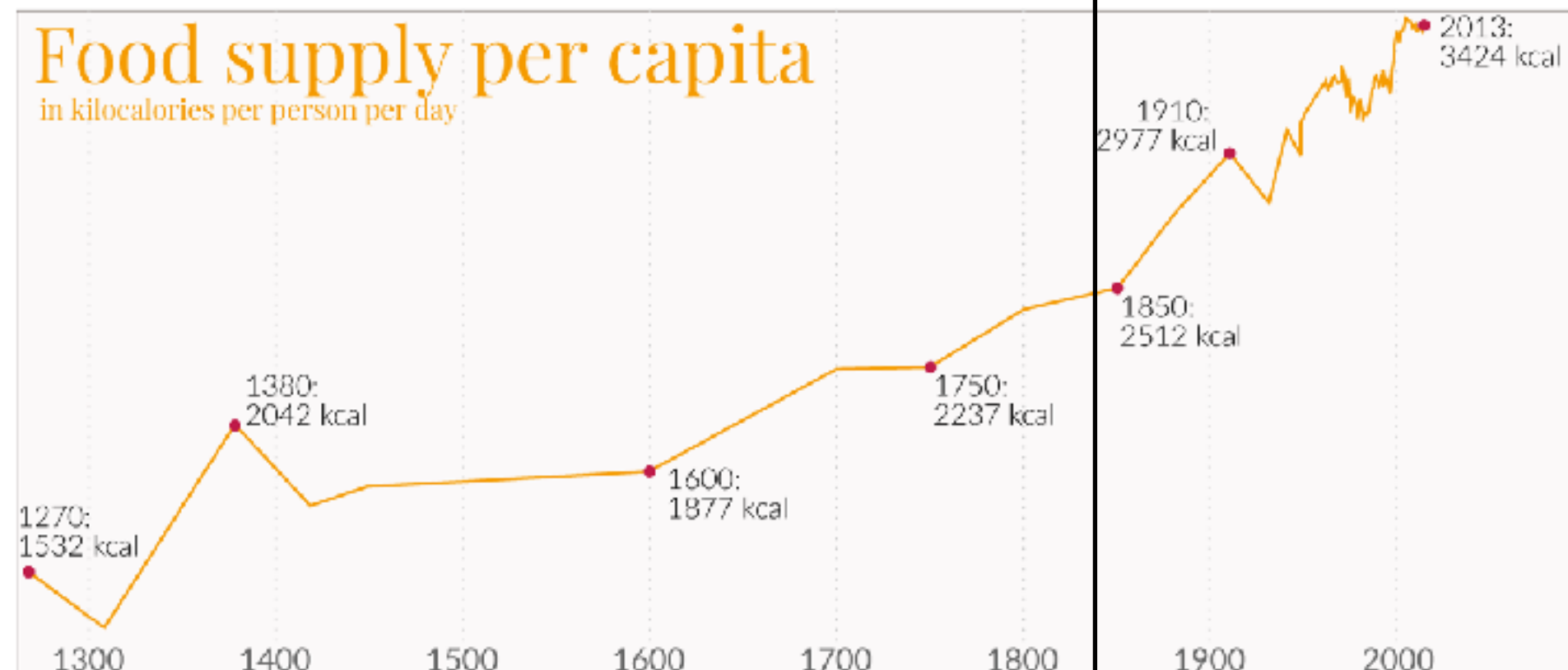
The history of living conditions in England

Our World
in Data

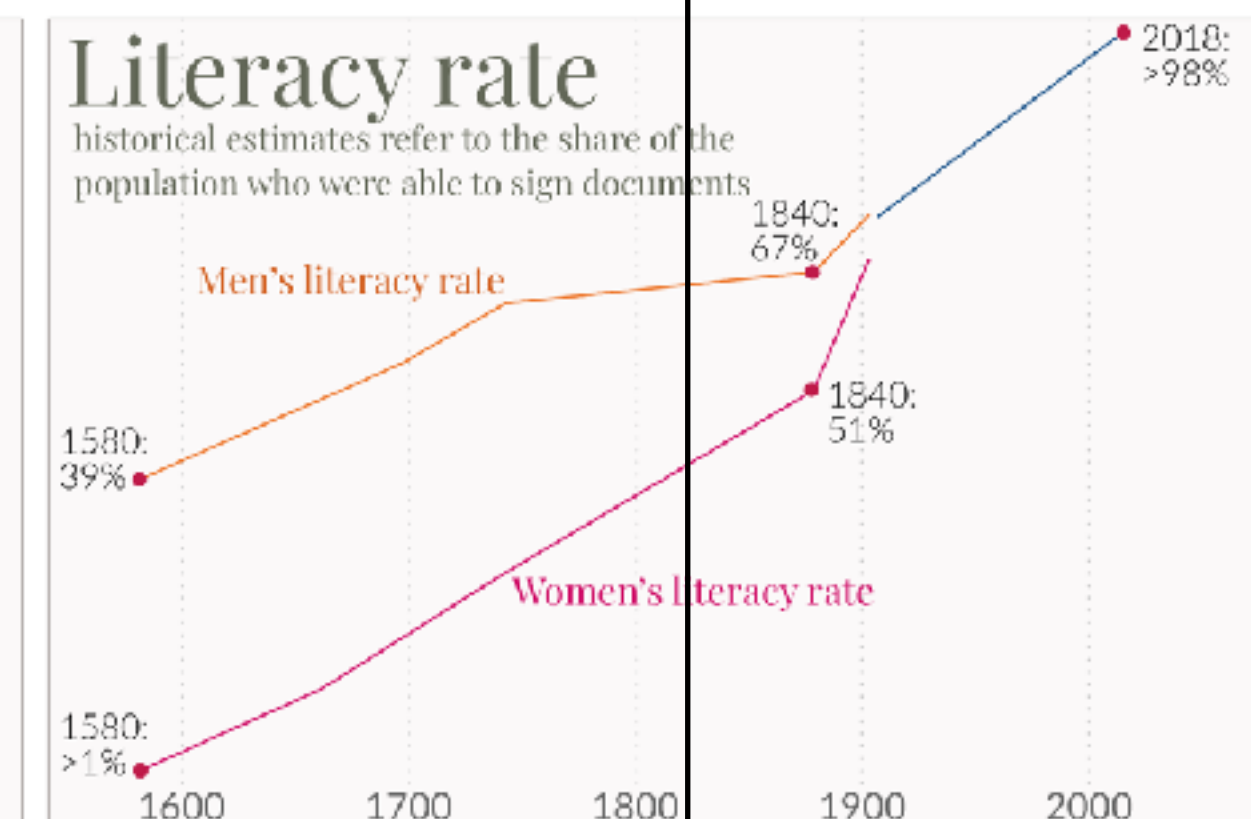
<https://ourworldindata.org/breaking-the-malthusian-trap>



50% urban



50% urban

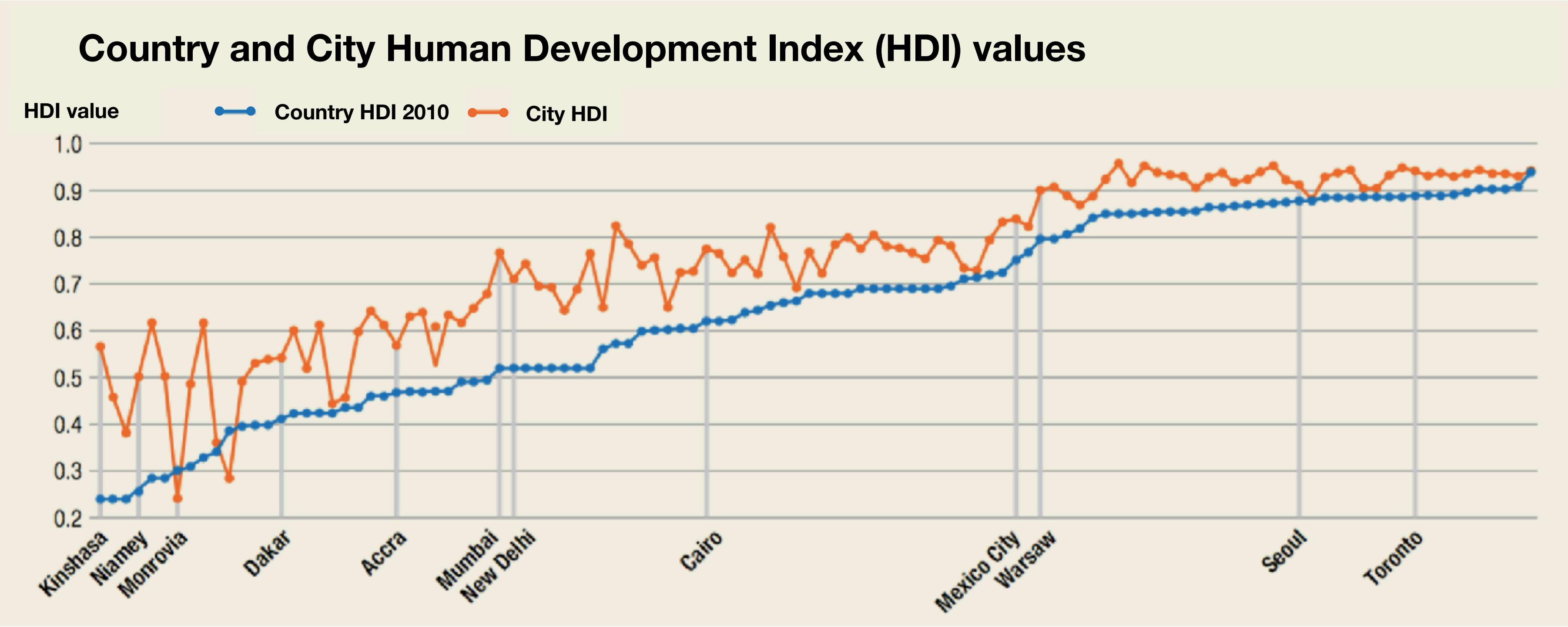


Data: Broadberry et al Life expectancy: Clio Infra and UN; Child mortality: Brian Mitchell and UN; Literacy: Schofield (1973), Houston (1982), Cressy (1980), Broadberry and O'Rourke (2010), and CIA; Food provision: Broadberry et al (2015) and UN; Lee and Lee (2016) and UNDP. All of the shown data relates 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)