

Econ 135: Day 9: 3.5. On the Eve of the Industrial Revolution



Review: Near-Stasis Before 1500

```
λ=1.59  
k=.0000871
```

```
P=[15]  
t=[-3000]  
tmax = 3960
```

```
for i in range(tmax):  
    P = P + [P[i]+k*(P[i]**λ)]  
    t = t + [t[i]+1]
```

Year	Population
-3000	15
-1000	49.853973019234566
0	170.1565460011882
200	255.10252243121988
400	434.6169944671038
500	614.1832095752687
600	948.5259583780045
700	1702.857028395262

There must be stepping-on-toes & low-hanging-fruit picked effects:

- $\frac{1}{P} \frac{dP}{dt} = kP^{\lambda-1}$

- Let's fit this to a population of 7 million in -6000, & 15 million in -3000...

- We then get...

- Even with SOT & LHF

We ought to have gotten a breakthrough to Commercial-Imperial Revolution growth rates by 500

Instead, we got the Late-Antiquity Pause

And a reversion to the ideas growth rates of the period from -3000 to -1000

Despite much greater human populations and much more powerful information technologies

Why no breakthrough before 1500 from any previous efflorescences? And why the 1500 breakthrough?

Certainly the Antonines of the Roman Empire Thought They Were Approaching the Limit of Attainable Human Felicity...

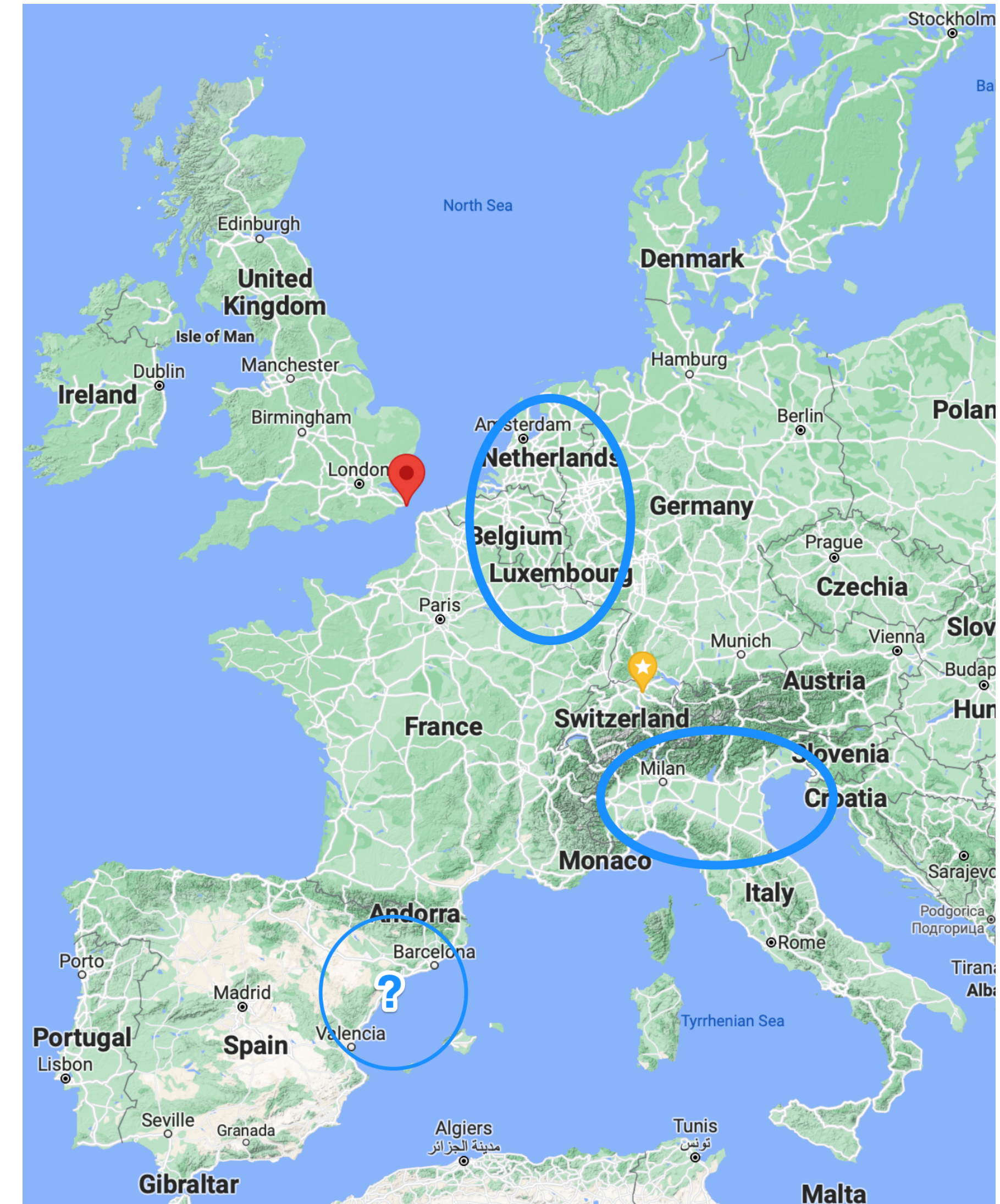
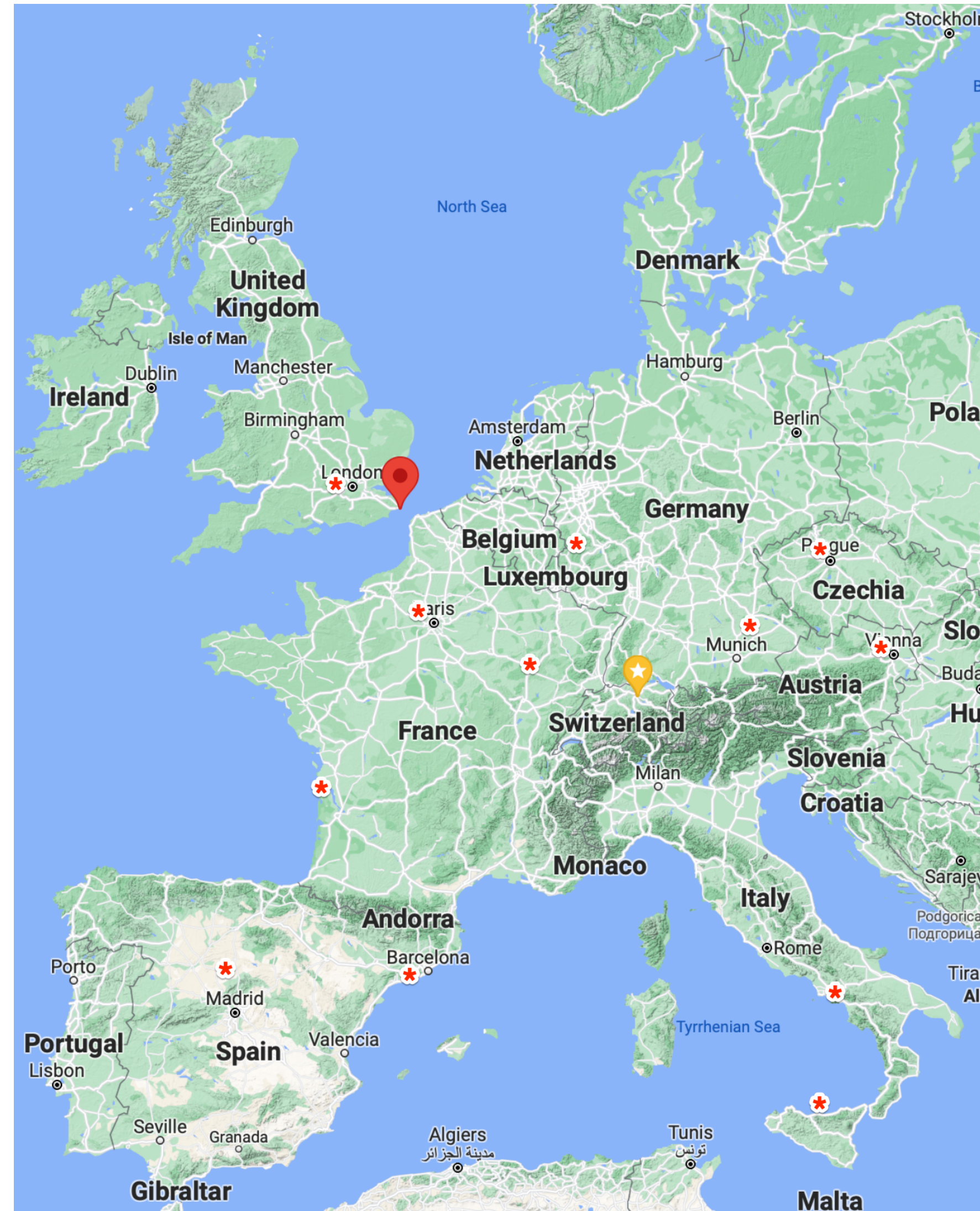
Aelius Aristides: *The Roman Oration*:

- “Whatever the seasons make grow and whatever countries and rivers and lakes and arts of Hellenes and non-Hellenes produce are brought from every land and sea, so that if one would look at all these things, he must needs behold them either by visiting the entire civilized world or by coming to this city. For whatever is grown and made among each people cannot fail to be here at all times and in abundance. And here the the merchant vessels come carrying these many products from all region in every season and even at every equinox, so that the city appears a kind of common emporium of the world.
- “Cargoes from India and, if you will, even from Arabia the Blest one can see in such numbers as to surmise that in those lands the trees will have been stripped bare and that the inhabitants of these lands, if they need anything, must come here and beg for a share of their own. Again one can see Babylonian garments and ornaments from the barbarian country beyond arriving in greater quantity and with more ease than if shippers from Naxos or from Cythnos, bearing something from those islands, had but to enter the port of Athens. Your farms are Egypt, Sicily and the civilized part of Africa.
- “Arrivals and departures by sea never cease, so that the wonder is not that the harbor has insufficient space for merchant vessels, but that even the sea has enough, if it really does.
- And just as Hesiod said about the ends of the Ocean, that there is a common channel where all waters have one source and destination, so there is a common channel to Rome and all meet here, trade, shipping, agriculture, metallurgy, all the arts and crafts that are or ever have been, all the things that are engendered or or grow from the earth. And whatever one does not see here neither did nor does exist. And so it is not easy to which is greater, the superiority of this city in respect to the cities that now are or the superiority of this city respect to the empires that ever were...”

Western Europe vis-à-vis “the Rest” in 1500

Nothing at all special:

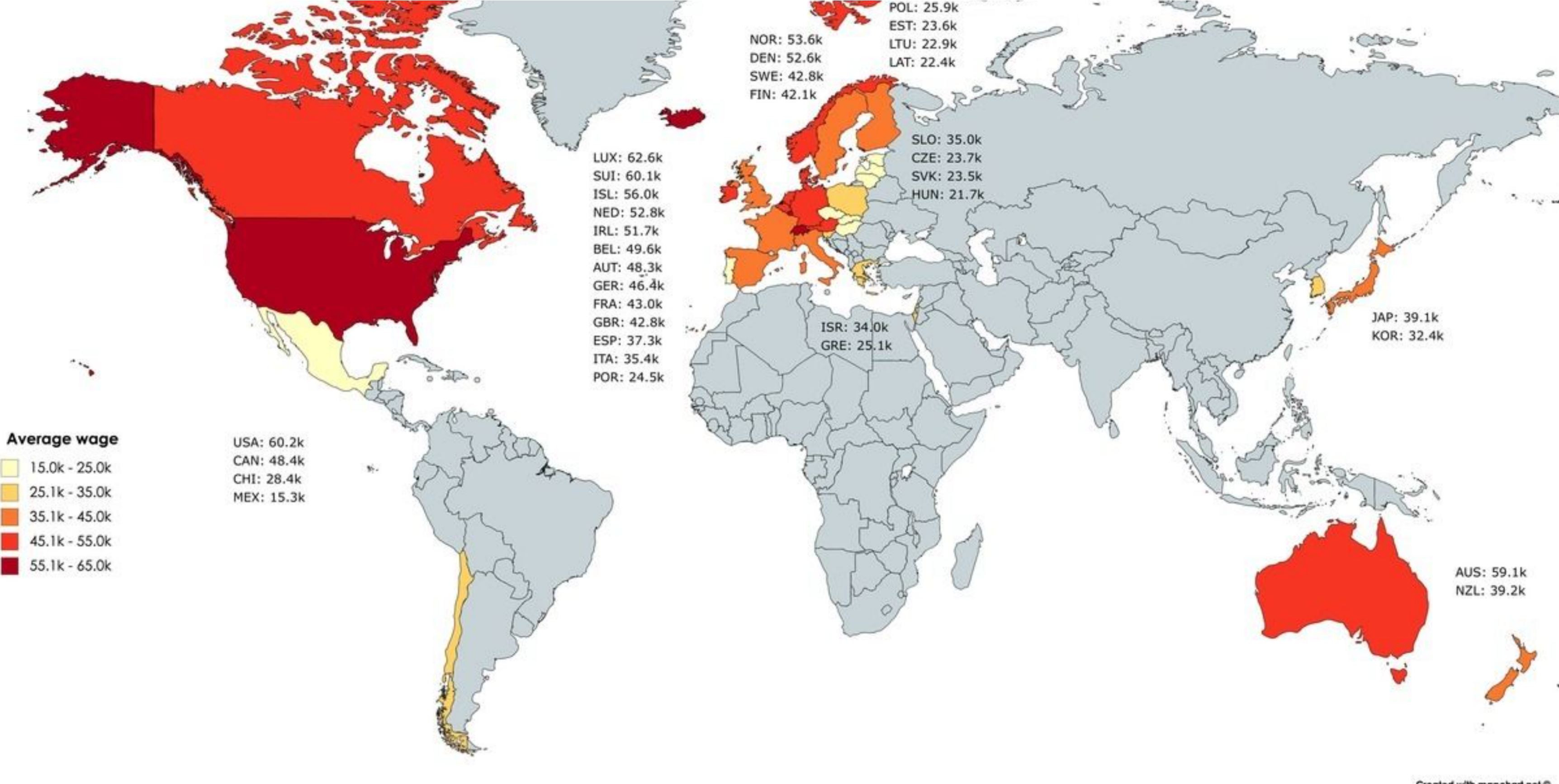
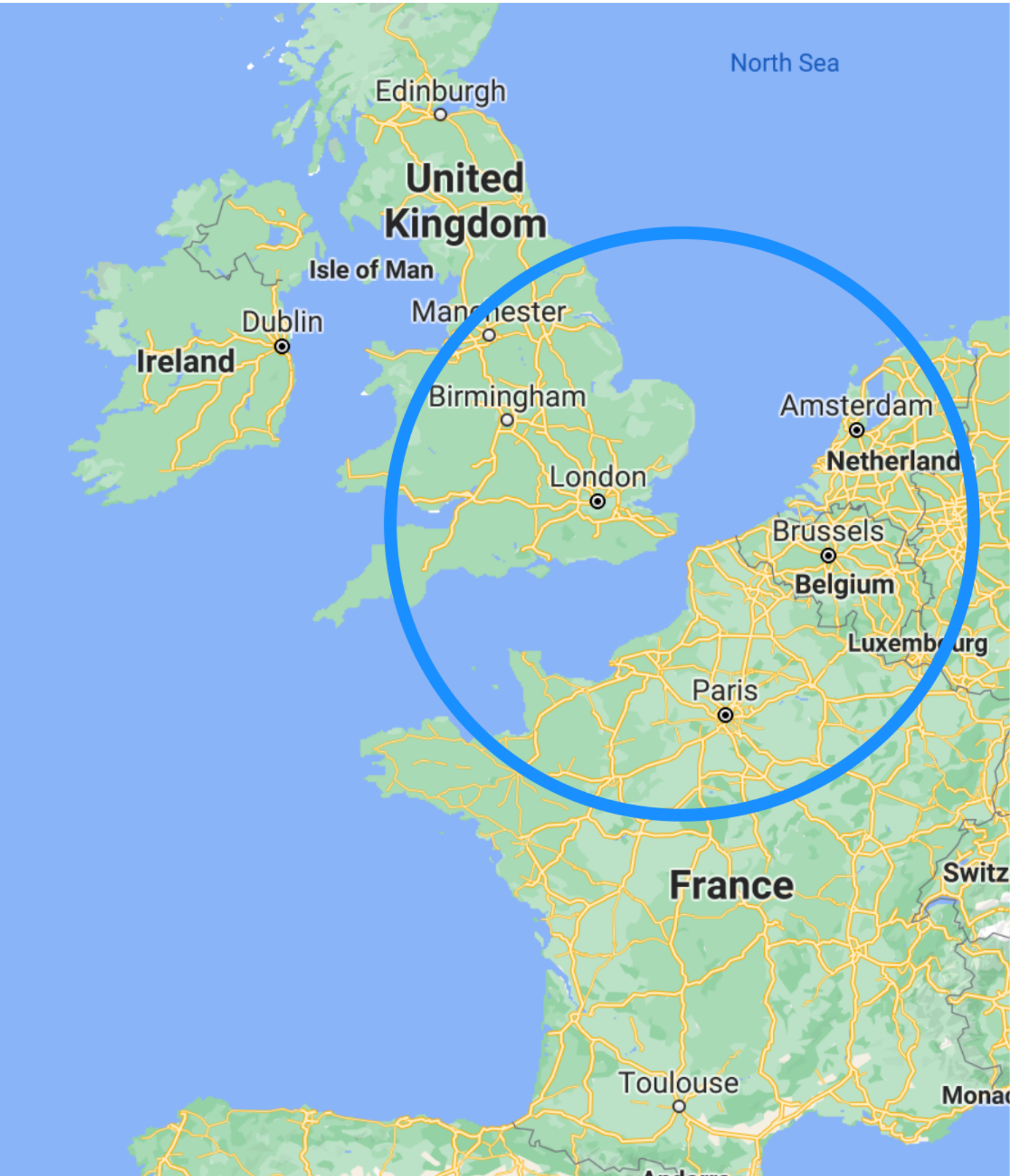
- 2 ½ economic core areas
- Evanescent, at best, kingdoms
 - Henry II Plantagenet → his son John I “Lackland”
 - Philippe IV “The Fair” Capet → Charles VI “The Fool” Valois
- Core areas sources of feudal and townly resistance to centralization and bureaucratization
- London, Paris, Bordeaux, Dijon, Barcelona, the high plains of Castile, Naples, Palermo, perhaps Vienna, Prague, Regensburg, and the Rhineland Palatinate as bases for rulers making a bid
- Military chaos holds back commerce and industry, save for gunpowder and metalworking.



Absolute & Relative Trajectories Inside & Outside the Dover Circle

Conquest, Settlement, Emulation...

- Plus resource engrossment: imperialism & neoimperialism
- 2.5% of the world's population in 800, 5% in 1500, 15% in 1870, 11% of the world's population today
- Leading edge vs. world as a whole: 1-1 in 1500, 1.1-1 in 1770, 2.1-1 in 1870, 4.5-1 today



Coal



The Africa-Caribbean-Europe Slave Trade



The British Empire & Its Commercial Society



Slave Trades & Slavery...

Nathan Nunn (2008): *The Long-Term Effects of Africa's Slave Trades* <<http://www.jstor.org/stable/pdfplus/25098896.pdf>>

- “Classical” Antiquity (-700 to -100): 30M?
- Africa-Atlantic Ocean: 17M?
- Africa-Indian Ocean (1 to 1900): 15M?
- Africa-Internal: ?????
- Black Sea: (1300-1700): 3M?
- Mediterranean (north-to-south) (800-1800): 2M?
- Scandinavian: (750-1100): 2M?

Nunn: Consequences of Rum, Guns, and Slaves

- From 8 to 6.5 in the natural log...
- $\exp(1.5) = 4.5$
- Do we need controls?
- Or, rather, what controls do we need?
- What else might be going on here

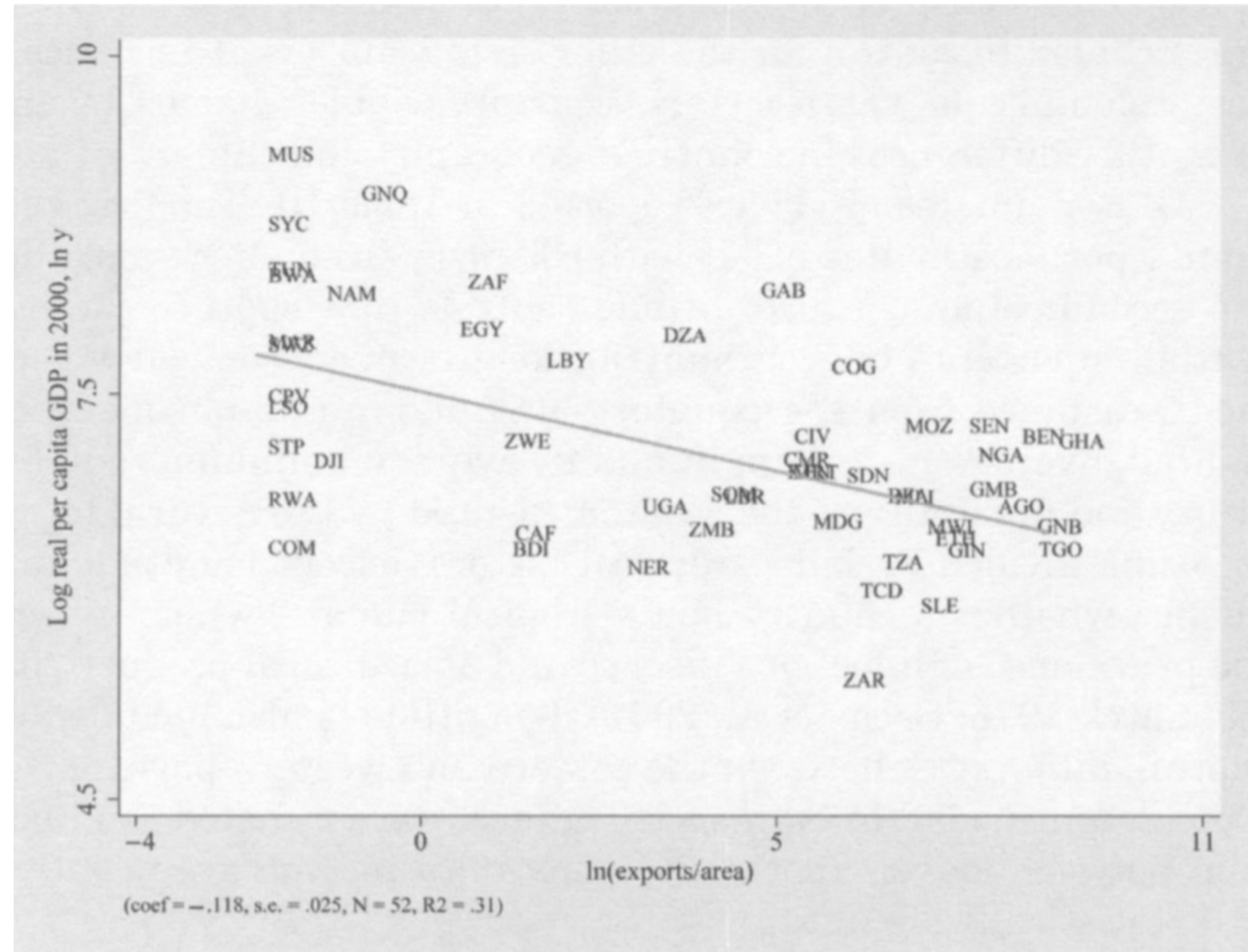


FIGURE III
Relationship between Log Slave Exports Normalized by Land Area, $\ln(\text{exports/area})$, and Log Real Per Capita GDP in 2000, $\ln y$

The Americas Under Spanish Rule



Flaws in Landes

Cannot Explain a Change by a Static Factor:

- Landes approvingly quotes Etienne Balasz:
 - “Chinese society.... No private initiative, no expression of public life that can escape official control... endless paper work and endless harassment. The ingenuity and inventiveness of the Chinese, which have given so much to mankind—silk, tea, porcelain, paper, printing, and more—would no doubt have enriched China further... had it not been for this stifling state control. It is the State that kills technological progress in China...”
- There is a problem here. How does Landes—how does Balasz—account for the existence of “silk, tea, porcelain, paper, printing, and more”, all technological progress the State manifestly did not kill?
- Landes does not provide any accounting. This is a serious weakness.

David Landes (2006): *Why Europe and the West? Why Not China?* <<https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.20.2.3>>:



Can the Argument Be Rescued?

Two Diverging Paths:

- On the one hand, Landes appeals to what he sees as largely unchanging features of China's culture, society, and government that seem to have been nearly constant since the accession of the Qing Dynasty to account for China's failure to industrialize before Europe.
- On the other hand, Landes does recognize that the bulk of the technological gaps as of 1500 or so see the Chinese economy as the more technologically advanced one.
- The question Landes thought he had to answer was “What is it about China that kept it poor?”
- But the question he needed to answer was “Why did China, which had been one of the world's leading economies in technological development up until 1500, stall out afterwards?”



Two Ways to Rescue the Argument

China Changed, or the Requirements of Technology Changed:

- The question he needed to answer was “Why did China, which had been one of the world’s leading economies in technological development up until 1500, stall out afterwards?”
- But you cannot answer a question about what caused a change by pointing to a cause that did not change.
 - Perhaps Landes could have repaired this weakness by arguing that the types of technological change arriving before 1500 were very different from the types that arrived after 1500, and that an economy and society well-positioned to grasp the first possessed features that made it unable to grasp the second.
 - Perhaps Landes could have repaired this weakness by pointing to the Song-Yuan-Ming-Qing succession trajectory
 - “Disembedded autonomy”—for the Yuan and the Qing, small élites seated on top of the volcano, and so change is very dangerous...
 - Ming puzzle...
- But he does not do either, and so leaves the weakness in his argument unrepaired.

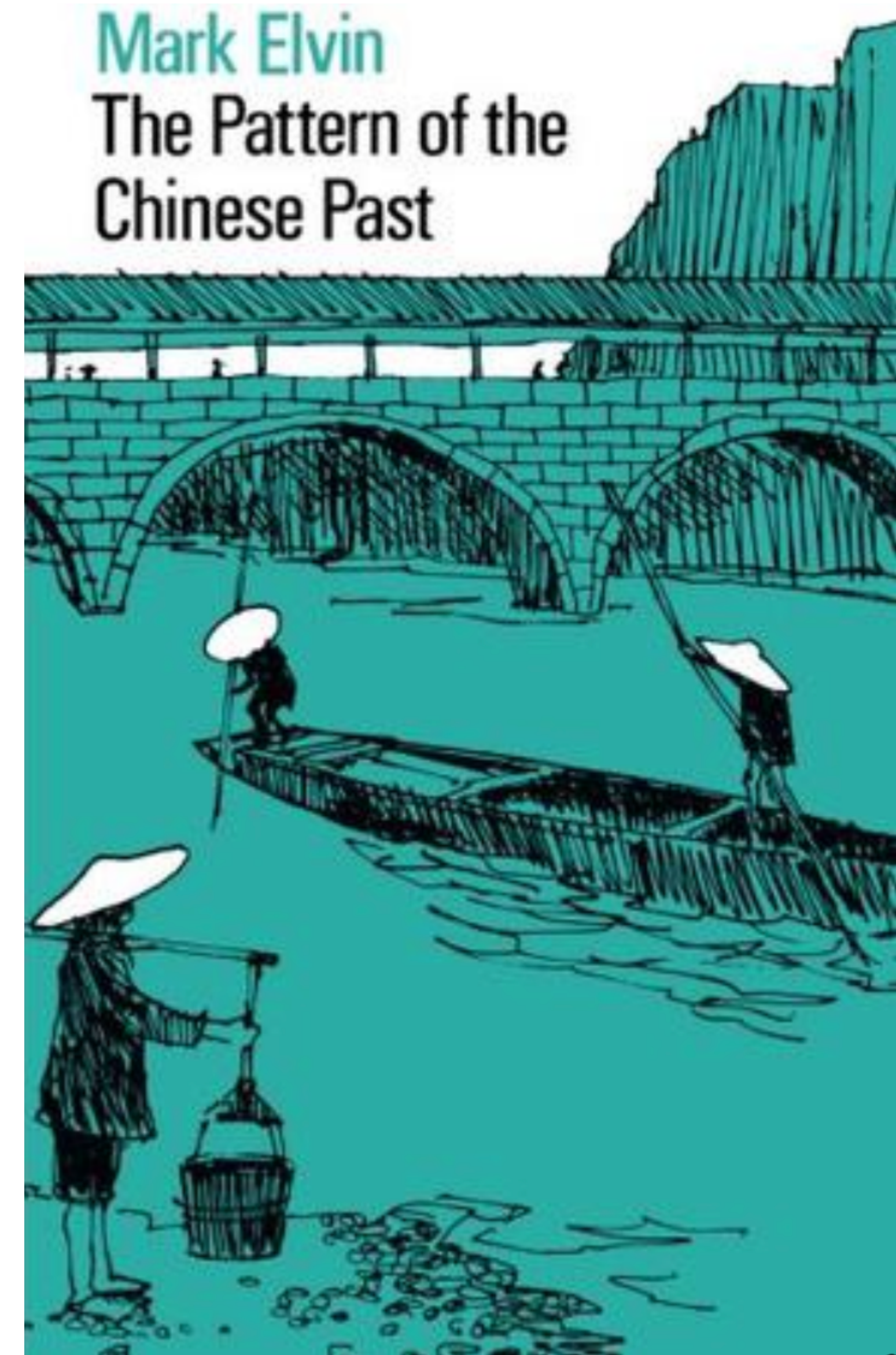


Elvin Does a Better Job...

“High-Level Equilibrium Trap”:

- Wang Shih-Mao’s description of the Kiangsi porcelain-making center of Ching-te-Chen:
 - “Tens of thousands of pestles shake the ground with their noise. The heavens are awake with the glare from the fires, so that one cannot sleep at night. The place has been called in jest ‘The Town of Year-Round Thunder and Lightning’ ...”
- Also in Kiangsi, water-driven hammers for husking rice:
 - “At important fords and in places where merchants gather... Over a hundred of the machines may be installed in the line of buildings to supply the grain boats which come and go selling rice...”
- “In Fukien, paddle wheels... are used to turn hammers for the manufacture of paper, so that ‘the sound of pounding was like the whirr of wings’ ...”

Mark Elvin (1973): *The Pattern of the Chinese Past: A Social & Economic Interpretation* (Palo Alto: Stanford) <<https://archive.org/details/patternofchines00elvi/mode/2up?view=theater>>



The Market Economy & Ingenuity Were There

Absence of Galileo-Newton? Could that have been important?

- Capital flowing to profit opportunities: the responsiveness of industry to the ebb and flow of market forces clear...
- Political hazards—but interpenetration of merchant and landlord-scholar elite: “1826 blockage of the Grand Canal... transport of rice by sea... 46 merchants... 26 of them... provincial graduates, Imperial Academy students, senior licentiates, or holders of purchased [scholar-administrator] rank...”
- Absence of durable semi-corporate forms for large-scale enterprise?
- A steam engine “should not have posed insuperable difficulties to people who had been building double-acting piston flamethrowers in the Song dynasty...”
- Shortages: fuel, textile fibers, metals...



Elvin's Conclusion

Malthusian forces simply too strong:

- “In late traditional China economic forces developed in such a way as to make profitable invention more and more difficult. With falling surplus and agriculture, and so falling per capita income and per capita demand, with the cheap ing labor but increasingly expensive resources in capital, with farming and transport technology so good that no simple improvements could be made, rational strategy for peasant in merchant a like tended in the direction not so much of a labor saving machinery as of economizing resources and fixed up. He nearly static market no bottle next that to creativity. When temporary shortages arose, mercantile versatility, based on cheap transport, was a faster intra-remedy than the contrivance of machines. This situation may be described as a ‘high-level equilibrium trap’...”

Qing vs. Meiji

Looking across the Sea of Japan: Meiji did it...

- Is there an alternative history—one in which late nineteenth-century China stood up economically, politically, and organizationally?
- Japan was perhaps the eighth industrial power in the world by 1929
- Narrow the viewscope to the Kaiping Coal Mine in northern China, and military-politician Li Hongzhang:
 - Saw that China needed industrial muscle—became the prime bureaucratic mover behind the coal mine, as well as other “self-strengthening efforts”
 - Commissioned a wealthy Hong Kong merchant, Tang Tingshu, to build the Kaiping mine.
 - Faced unusual: Vice President of the Board of Civil Offices, Chi Shihehang, declared that “mining methods angered the earth dragon . . . [and so] the late empress could not rest quietly in her grave.”
 - Blaming Li for any deaths or diseases that might strike the imperial family.
 - Very bravely—considering the large size of the imperial family and the high death rate of the time—Li Hongzhang chose modernity.

Memo: Why Has Pacific Rim Growth Been so Fast?

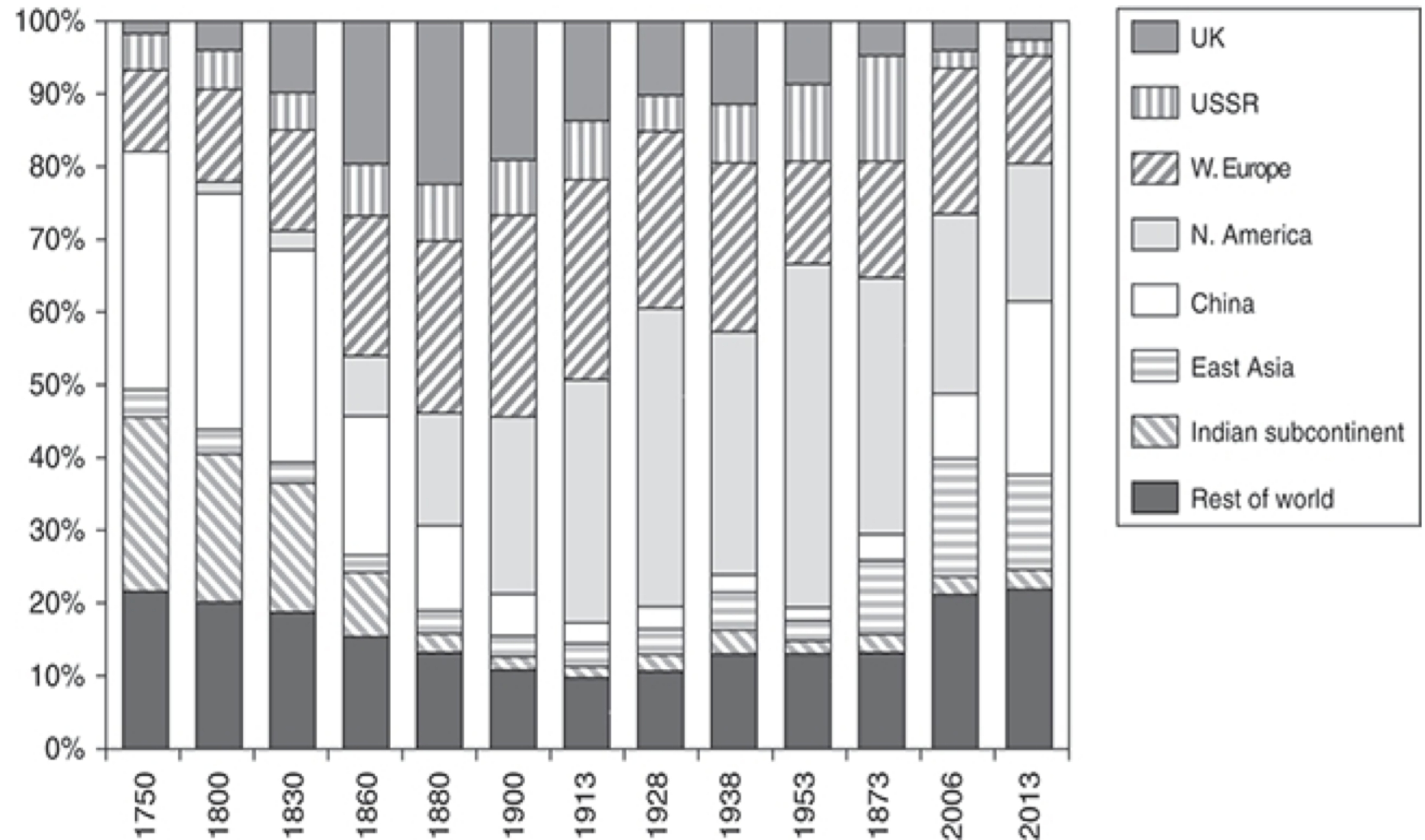
An absence of landlords; a presence of semi-honest bureaucracy:

- An agreement on common natural purpose
 - Previous land reform helps a lot...
- An agreed-on image of the future
 - It is not hard to see what is to be done, or how it is to be done, or that it will turn out to be profitable
- Resource mobilization
 - Successful bureaucratic organizational tradition helps a lot...
- Investment in things and people
 - Valuing education helps a lot...
- “Industrial Policy” concerns:
 - Communities of engineering practice
 - Selecting and supporting productive rather than unproductive firms
 - An undervalued exchange rate and global-north markets open to your exports may well be the best of all industrial policies
 - Use of foreign exchange to invest for the future rather than boost elite consumption in the present
- Amazing thing about post-1978 China is that it did this while suspended in mid-air—without the market-economy underpinnings already in place

Allen: Spread & Concentration of Industrialization

Robert Allen (2017): *The Industrial Revolution: A Very Short Introduction* <<https://delong.typepad.com/files/allen-industrial.pdf>>, chs. 3, 5-6:

- Western Europe: 12% in the 18th century to 28% in 1913
- North America: Less than 1% in the 18th century to 47% in 1953
- The Pacific Rim share dropped from 4 per cent to 2 per cent in the early 19th century, but then increased to 5 percent in the first half of the 20th century. By 2006, these countries were producing 17 per cent of the world's manufactures
- China in 1953 at 2% of manufacturing was at its all time low. 9 per cent in 2006. 25 per cent in 2013
- The Indian subcontinent: 2% of the world's manufactures in 1973 and only 3% in 2013



16. Percentage shares of world manufacturing output, 1750–2013.

Assessing Pre-Industrial Inequality: Farmers Cannot Run from Thugs

Branko Milanovic, Peter H. Lindert, & Jeffrey G. Williamson. 2011. "Pre-Industrial Inequality." *Economic Journal* 121 (March): 255-272. <<https://www-jstor-org.libproxy.berkeley.edu/stable/41057775>>

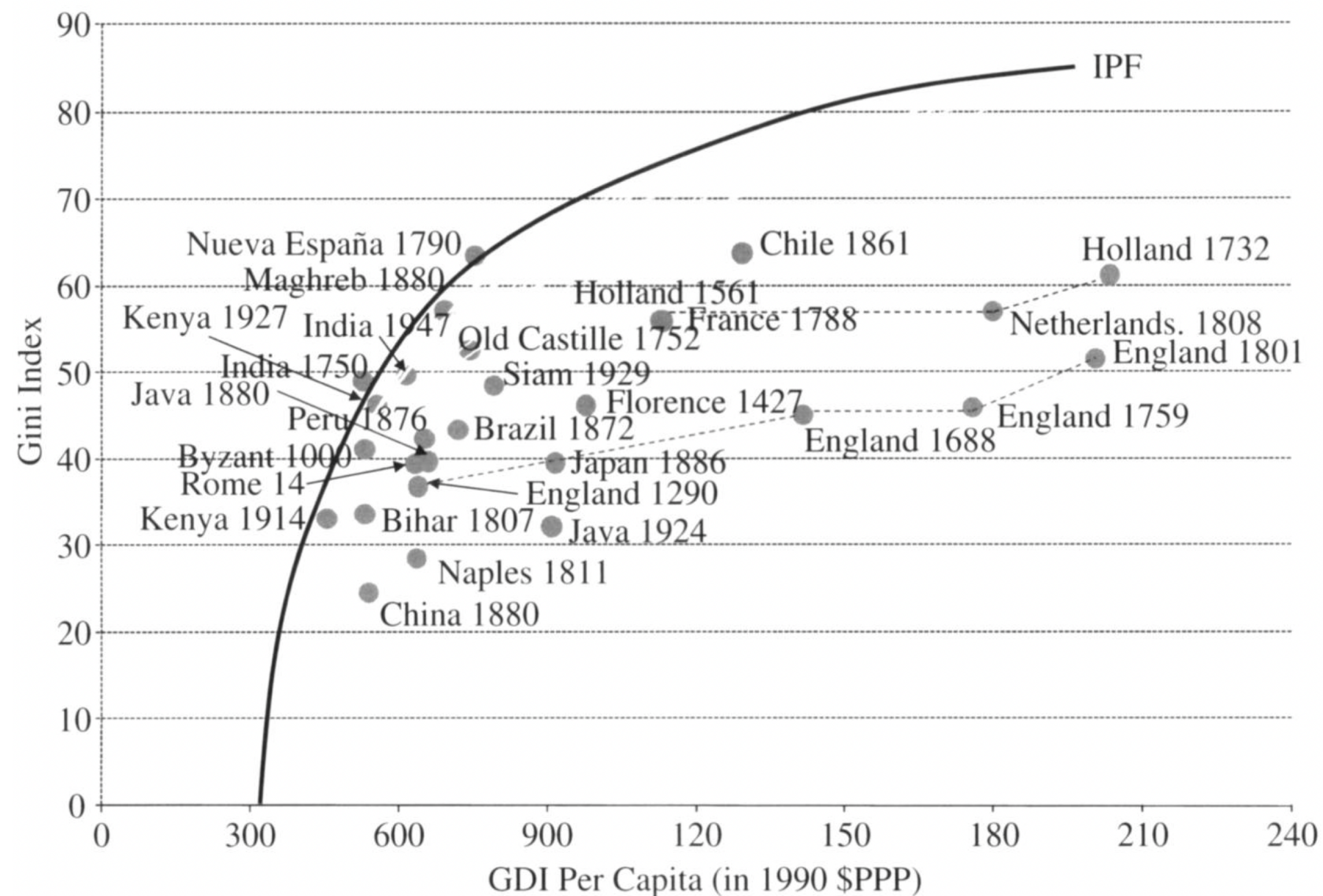


Fig. 2. *Pre-industrial Inequalities: Estimated Gini Coefficients, and the Inequality Possibility Frontiers*

Gender: Abigail Smith

Abigail Smith (20) married John Adams (30) in 1764:

- No formal schooling...
- She ran his Braintree-Boston operation...
- Not just the inside-the-household part—pretty much the whole thing while he was being a High Politician...
- Not present at husband's presidential inauguration: caring for her dying mother instead...
- At 74 in 1818: “Do not grieve, my friend, my dearest friend. I am ready to go. And John, it will not be long...”



Abigail Smith Adams: Eating for Two

Children:

- Abigail ("Nabby") 1765–1813
- John Quincy Adams 1767–1848
- Grace Susanna ("Suky") 1768–70
- Charles 1770–1800
- Thomas Boylston Adams 1772–1832
- Elizabeth (stillborn) 1777

- Likely a couple of miscarriages in there between 1772 and 1777...
- Likely wetnursed...

- Then they stopped, when she was 33...
- Eight pregnancies to have four survive beyond the age of ten...
 - This is low child mortality...
- Have a baby, lose a tooth...



Document: Abigail Smith Adams Letter to Her Husband John

<https://tinyurl.com/dl20180226a>: Letter to John Adams 31 Mar-5 Apr 1776...

Virginians: Are these slavemasters true friends of liberty?

- Braintree March 31, 1776: I wish you would ever write me a Letter half as long as I write you; and tell me if you may:
 - Where your Fleet are gone?
 - What sort of Defence Virginia can make against our common Enemy?
 - Whether it is so situated as to make an able Defence?
 - Are not the Gentry Lords and the common people vassals?
 - Are they not like the uncivilized Natives Brittain represents us to be?
- I hope their Riffel Men who have shewen themselves very savage and even Blood thirsty; are not a specimen of the Generality of the people.
- I [illegible] am willing to allow the Colony great merrit for having produced a Washington but they have been shamefully duped by a Dunmore.
- I have sometimes been ready to think that the passion for Liberty cannot be Eaquelly Strong in the Breasts of those who have been accustomed to deprive their fellow Creatures of theirs. Of this I am certain that it is not founded upon that generous and christian principal of doing to others as we would that others should do unto us.



Document: Abigail Smith Adams

Things to note about the letter as you read it:

1. Spelling...
2. Public concerns:
 - Suspicion of Virginia...
 - State of Boston after the occupation...
 - Power of the colonies to resist...
 - Soapmaking... saltpeter... gunpowder...
3. Private concerns:
 - Family security...
 - “Gorge the Eldest... Billy the youngest... Becky Peck... your brother’s youngest child lies bad with convulsion fits...”
 - Why don’t you write more, and at longer length?
4. Feminist concerns...



Managing the Boston Operation

<https://tinyurl.com/dl20180226a>: Letter to John Adams 31 Mar-5 Apr 1776...

- Do not you want to see Boston? I am fearfull of the small pox, or I should have been in before this time.
- I got Mr. Crane to go to our [Town] House [in Boston] and see what state it was in.
- I find it has been occupied by one of the Doctors of a Regiment, very dirty, but no other damage has been done to it.
- The few things which were left in it are all gone. Cranch has the key which he never deliverd up. I have wrote to him for it and am determined to get it cleand as soon as possible and shut it up.
- I look upon it a new acquisition of property, a property which one month ago I did not value at a single Shilling, and could with pleasure have seen it in flames.
- The Town in General is left in a better state than we expected, more oweing to a percipitate flight than any Regard to the inhabitants, tho some individuals discovered a sense of honour and justice and have left the rent of the Houses in which they were, for the owners and the furniture unhurt, or if damaged sufficent to make it good.
- Others have committed abominable Ravages. The Mansion House of your President is safe and the furniture unhurt whilst both the House and Furniture of the Solisiter General have fallen a prey to their own merciless party. Surely the very Fiends feel a Reverential awe for Virtue and patriotism, whilst they Detest the paricide and traitor.



Keeping Her Spirits Up

<https://tinyurl.com/dl20180226a>: Letter to John Adams 31 Mar-5 Apr 1776...

- I feel very differently at the approach of spring to what I did a month ago. We knew not then whether we could plant or sow with safety, whether when we had toiled we could reap the fruits of our own industry, whether we could rest in our own Cottages, or whether we should not be driven from the sea coasts to seek shelter in the wilderness, but now we feel as if we might sit under our own vine and eat the good of the land.
- I feel a *gaieti de Coar* to which before I was a stranger. I think the Sun looks brighter, the Birds sing more melodiously, and Nature puts on a more chearfull countenance. We feel a temporary peace, and the poor fugitives are returning to their deserted habitations.
- Tho we felicitate ourselves, we sympathize with those who are trembling least the Lot of Boston should be theirs. But they cannot be in similar circumstances unless pusillanimity and cowardise should take possession of them. They have time and warning given them to see the Evil and shun it.



“Remember the Ladies”

<https://tinyurl.com/dl20180226a>: Letter to John Adams 31 Mar-5 Apr 1776...

- I long to hear that you have declared an independency
- -- and by the way in the new Code of Laws which I suppose it will be necessary for you to make I desire you would Remember the Ladies, and be more generous and favourable to them than your ancestors.
- Do not put such unlimited power into the hands of the Husbands.
- Remember all Men would be tyrants if they could.
- If perticular care and attention is not paid to the Laidies we are determined to foment a Rebellion, and will not hold ourselves bound by any Laws in which we have no voice, or Representation.



“Your Sex Are Naturally Tyrannical”

<https://tinyurl.com/dl20180226a>: Letter to John Adams 31 Mar-5 Apr 1776...

- That your Sex are Naturally Tyrannical is a Truth so thoroughly established as to admit of no dispute,
- But such of you as wish to be happy willingly give up the harsh title of Master for the more tender and endearing one of Friend.
- Why then, not put it out of the power of the vicious and the Lawless to use us with cruelty and indignity with impunity?
- Men of Sense in all Ages abhor those customs which treat us only as the vassals of your Sex.
- Regard us then as Beings placed by providence under your protection and in imitation of the Supreme Being make use of that power only for our happiness.



A Week Later: Biomedical Concerns

<https://tinyurl.com/dl20180226a>: Letter to John Adams 31 Mar-5 Apr 1776...

- Not having an opportunity of sending this I shall add a few lines more; tho not with a heart so gay.
- I have been attending the sick chamber of our Neighbour Trot whose affliction I most sensibly feel but cannot discribe, striped of two lovely children in one week.
 - Gorge the El
 - dest died on wedensday and Billy the youngest on fryday, with the Canker fever, a terrible disorder so much like the throat distemper, that it differs but little from it.
- Betsy Cranch has been very bad, but upon the recovery. Becky Peck they do not expect will live out the day.
- Many grown persons are now sick with it, in this street. It rages much in other Towns.
- The Mumps too are very frequent. Isaac is now confined with it.
- Our own little flock are yet well. My Heart trembles with anxiety for them. God preserve them.
- I want to hear much oftener from you than I do. March 8 [John to Abigail, 08 March 1776] was the last date of any that I have yet had.



Experiments in Making Gunpowder

<https://tinyurl.com/dl20180226a>: Letter to John Adams 31 Mar-5 Apr 1776...

- -- You inquire of whether I am making Salt peter. I have not yet attempted it, but after Soap making believe I shall make the experiment. I find as much as I can do to manufacture cloathing for my family which would else be Naked.
- I know of but one person in this part of the Town who has made any, that is Mr. Tertias Bass as he is calld who has got very near an hundred weight which has been found to be very good. I have heard of some others in the other parishes. Mr. Reed of Weymouth has been applied to, to go to Andover to the mills which are now at work, and has gone.
- I have lately seen a small Manuscrip describing the proportions for the various sorts of powder, such as fit for cannon, small arms and pistols [illegible]. If it would be of any Service your way I will get it transcribed and send it to you..



Closing

<https://tinyurl.com/dl20180226a>: Letter to John Adams 31 Mar-5 Apr 1776...

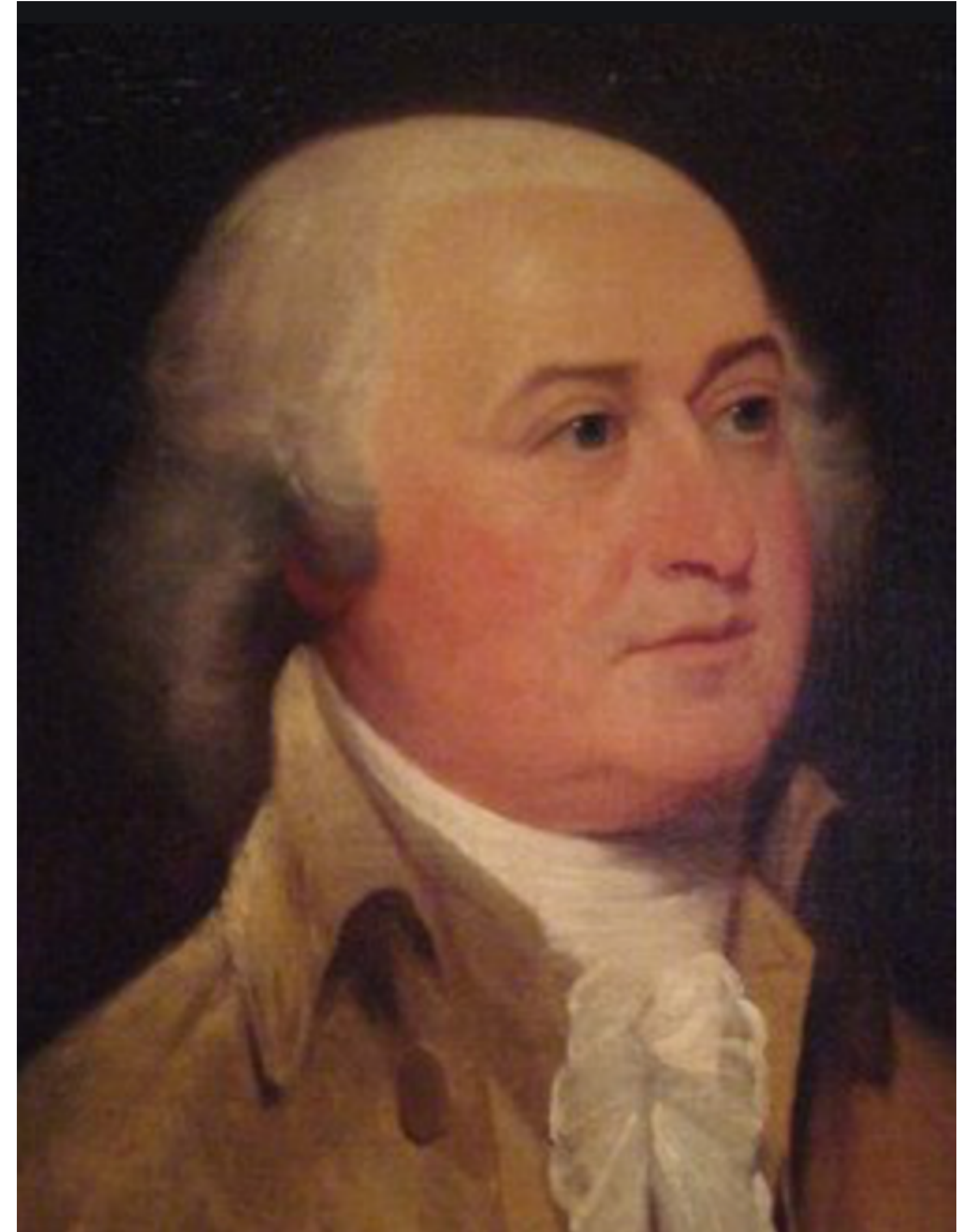
- -- Every one of your Friends send their Regards, and all the little ones.
- Your Brothers youngest child lies bad with convulsion fitts. Adieu.
- I need not say how much I am Your ever faithfull Friend...



John Adams's Reply to Abigail

As to your extraordinary code of laws, I cannot but laugh:

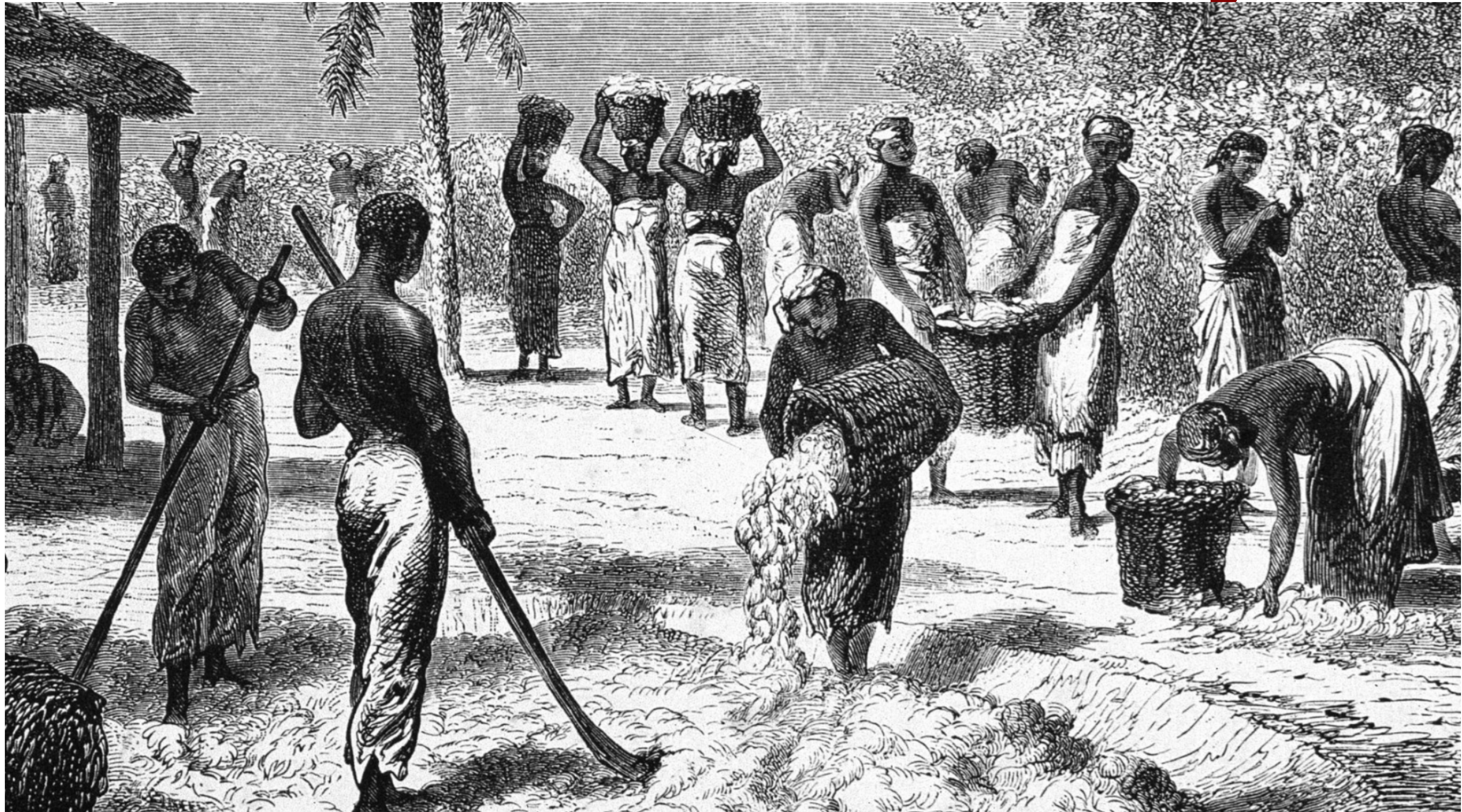
- We have been told that our struggle has loosened the bonds of government everywhere; that children and apprentices were disobedient; that schools and colleges were grown turbulent; that Indians slighted their guardians, and negroes grew insolent to their masters.
- But your letter was the first intimation that another tribe, more numerous and powerful than all the rest, were grown discontented.
- This is rather too coarse a compliment, but you are so saucy, I won't blot it out.
- Depend upon it, we know better than to repeal our masculine systems. Although they are in full force, you know they are little more than theory. We dare not exert our power in its full latitude. We are obliged to go fair and softly, and, in practice, you know we are the subjects.
- We have only the name of masters, and rather than give up this, which would completely subject us to the despotism of the petticoat, I hope General Washington and all our brave heroes would fight.



Abigail Smith Adams Had a Very Favored Place for an Agrarian-Age Woman...

- Other women had less favored places...
- **Abigail Adams to Thomas Jefferson**, 27 June 1787 <<https://founders.archives.gov/documents/Jefferson/01-11-02-0420>>:
 - "LONDON... I had the Honour of addressing you yesterday and informing you of the safe arrival of your daughter. She was but just come when I sent of my letter by the post, and the poor little Girl was very unhappy being wholly left to strangers. This however lasted only a few Hours, and Miss is as contented to day as she was miserable yesterday. She is indeed a fine child. I have taken her out to day and purchased her a few articles which she could not well do without and I hope they will meet your approbation.
 - "The Girl who is with her is quite a child, and Captain Ramsey is of opinion will be of so little Service that he had better carry her back with him. But of this you will be a judge. She seems fond of the child and appears good naturd..."
- "The Girl who is with her" is Sally Hemings, then 14. Rather than have Sally Hemings continue on to Paris for a reunion with her brother, Abigail Adams wants her sent back to Virginia...

Plantation Slavery



African Retardation & Slave Trade Legacy

In 1953 Africa was not “behind” the rest of the global south:

- Today it is—by far
- In 1950 1/7 of the world’s extreme poor were in Africa
- Today 3/5 of the world’s extreme poor are in Africa
- In the late colonial era Africa was doing good at exports: coffee, chocolate, palm oil, ground nuts, cotton
- In 1950 Zambia was more industrialized than and almost as rich as Portugal
- The same for Ghana



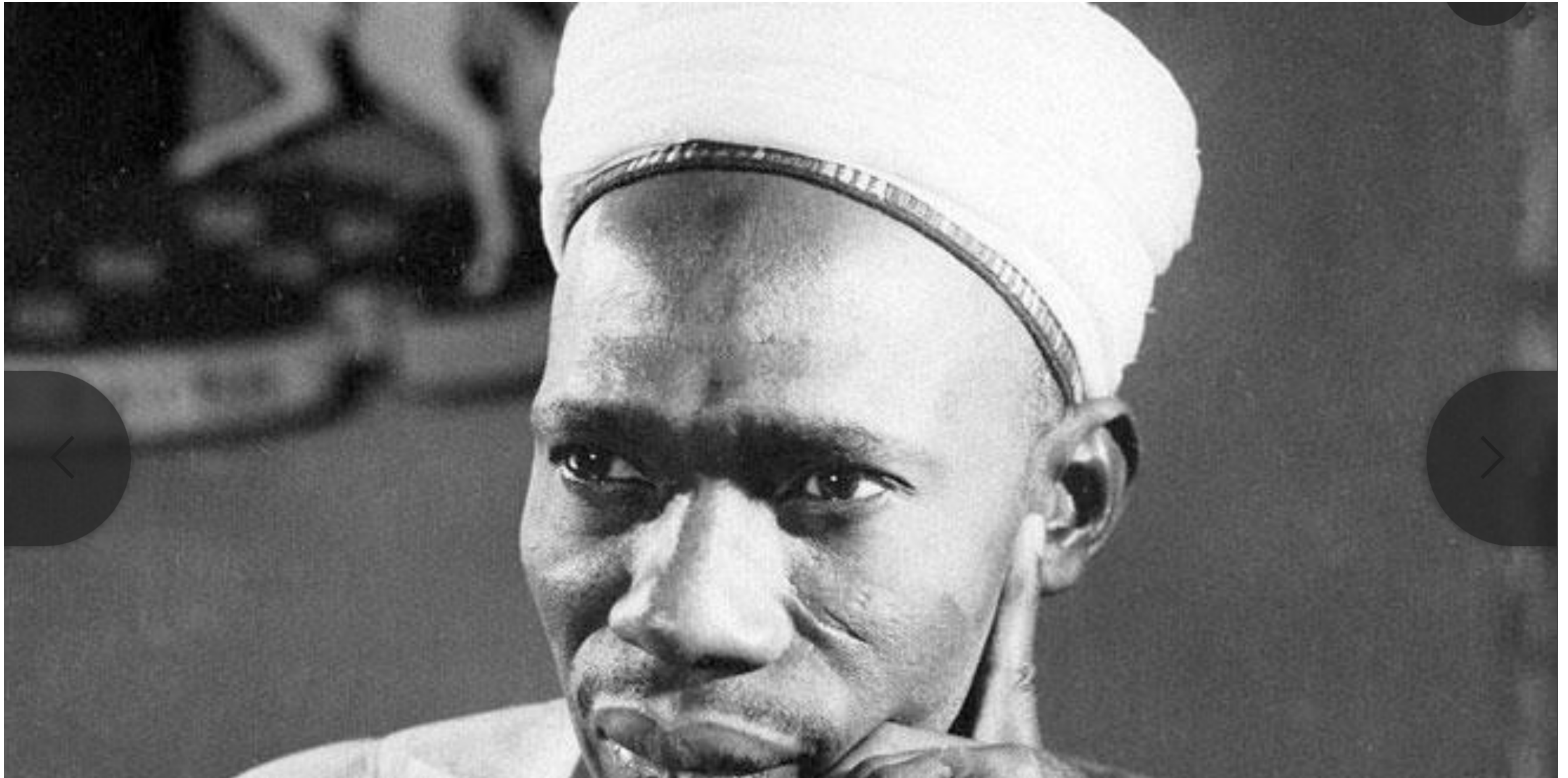
A Hypothesis

Why does African retardation vis-a-vis the rest of the global south start only with independence?

- Adam Smith: “it is not from the benevolence of the butcher or the baker that we expect our meat or bread, but from their self-interest”
- But is the self-interest of the butcher to sell you meat for money?
- Or is it the self-interest of the butcher to threaten you with his knife, take your money, tie you up, and sell you as a slave?
- Reciprocity and gift-exchange are powerful patterns of human interaction...
- But what if history leads you not to expect them?
- Not disastrous as long as colonial patterns of property and exchange dominate, but...



Abubakar Tafawa Balewa



Abysmal Growth After Autonomy & then Independence

North Africa grows along with the rest of the global south—an average of 2%/year or so:

- But south of the Sahara things are different
- Ethiopia, Ghana, Zambia grow at 0.3%/year
- Three very different countries: an industrial, a primary-product exporter, an independent non-colonized
- What could apply to Africa south of but not north of the Sahara?
- And what could apply to pretty much all of Africa south of Sahara?
- The answer: the slave trade—primarily the early-modern imperial-commercial age Atlantic slave trade
- But also Indian Ocean and trans-Saharan



The Industrial Revolution: Karl Marx (1867): The Key is “Capitalism”

—Market Economy Plus...

- Karl Marx (1867), "The Secret of Primitive Capital Accumulation," Capital, Vol. 1, Part VIII, Chapters 26-32 <http://tinyurl.com/dl20090112k>
- “We have seen how money is changed into capital; how through capital surplus-value is made, and from surplus-value more capital. But the accumulation of capital presupposes surplus-value; surplus-value presupposes capitalistic production; capitalistic production presupposes the pre-existence of considerable masses of capital and of labour power in the hands of producers of commodities. The whole movement, therefore, seems to turn in a vicious circle, out of which we can only get by supposing a primitive accumulation (previous accumulation of Adam Smith) preceding capitalistic accumulation; an accumulation not the result of the capitalistic mode of production, but its starting point...”
- “The immediate producer, the labourer, could only dispose of his own person after he had ceased to be attached to the soil... the slave, serf, or bondsman of another. To become a free seller of labour power... he must further have escaped from the regime of the guilds.... The historical movement which changes the producers into wage-workers... their emancipation from serfdom and from the fetters of the guilds... alone exists for our bourgeois historians...”
- “But... these new freedmen... [were also] robbed of all their own means of production, and of all the guarantees of existence afforded by the old feudal arrangements. And the history of this, their expropriation, is written in the annals of mankind in letters of blood and fire...”
- Workers *must* work for wages...
- Capitalists *must* invest and accumulate...

Adam Smith Had No Clue...

- We have market economies throughout Eurasia, at least—i.e., places where becoming a merchant drawing on sophisticated artisanal producers is a road to wealth, even if not *the* road...
- We have governments smart enough—or constrained enough—not to kill the goose that lays the golden eggs, at least not quickly...
- We have what looks like worldwide growth at a faster pace after 1500—one that calls for a demographic response...
 - Commercial Revolution sees shared global prosperity—but with Atlantic Europe grabbing the lion's share primarily via empire...
- Post-1770 in the North Atlantic we have growth that outruns any possible demographic response, and triggers the demographic transition...
- Why? And how?
 - Post-1870 we have a further acceleration to modern economic growth...

Longest-Run Global Economic Growth

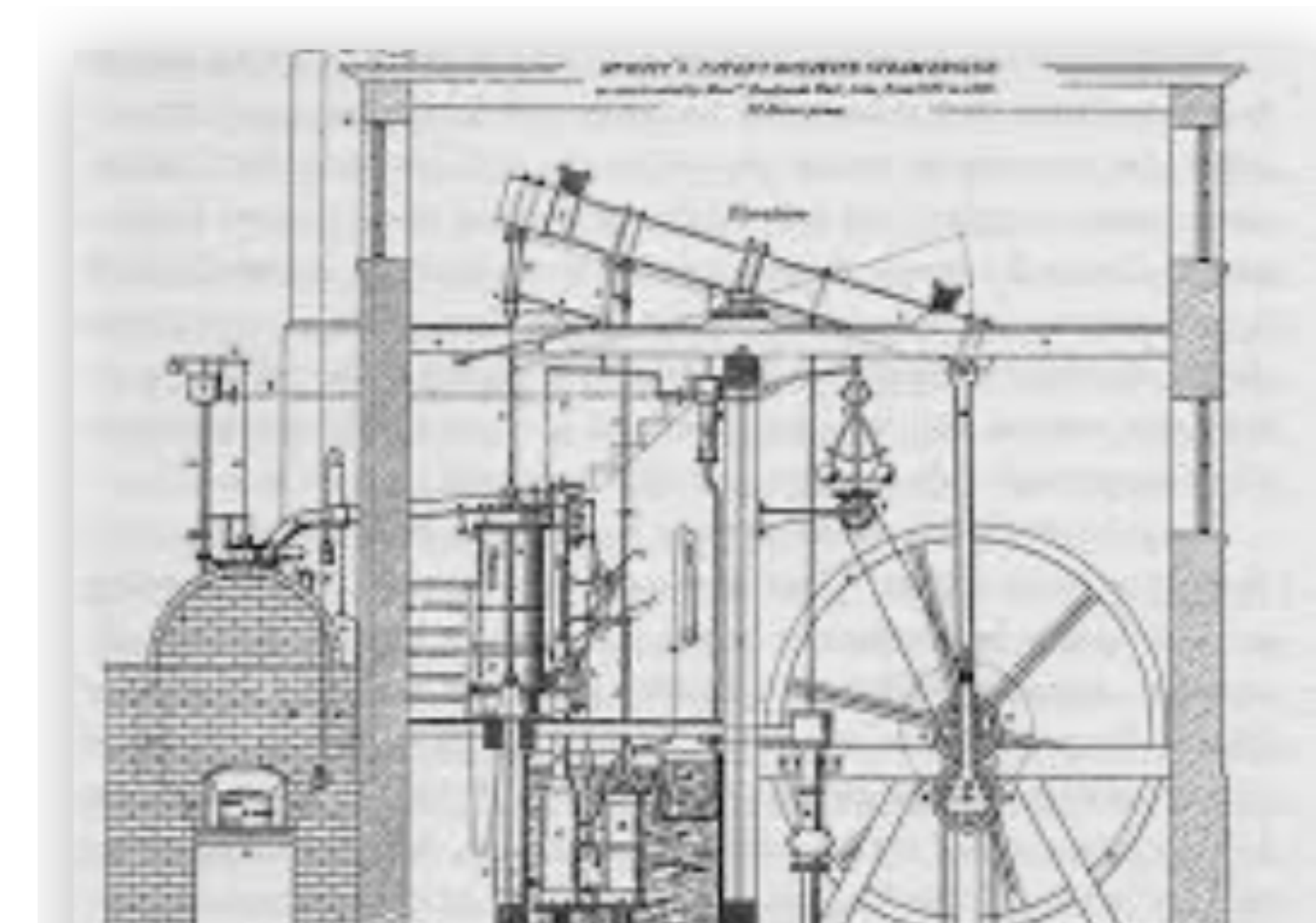
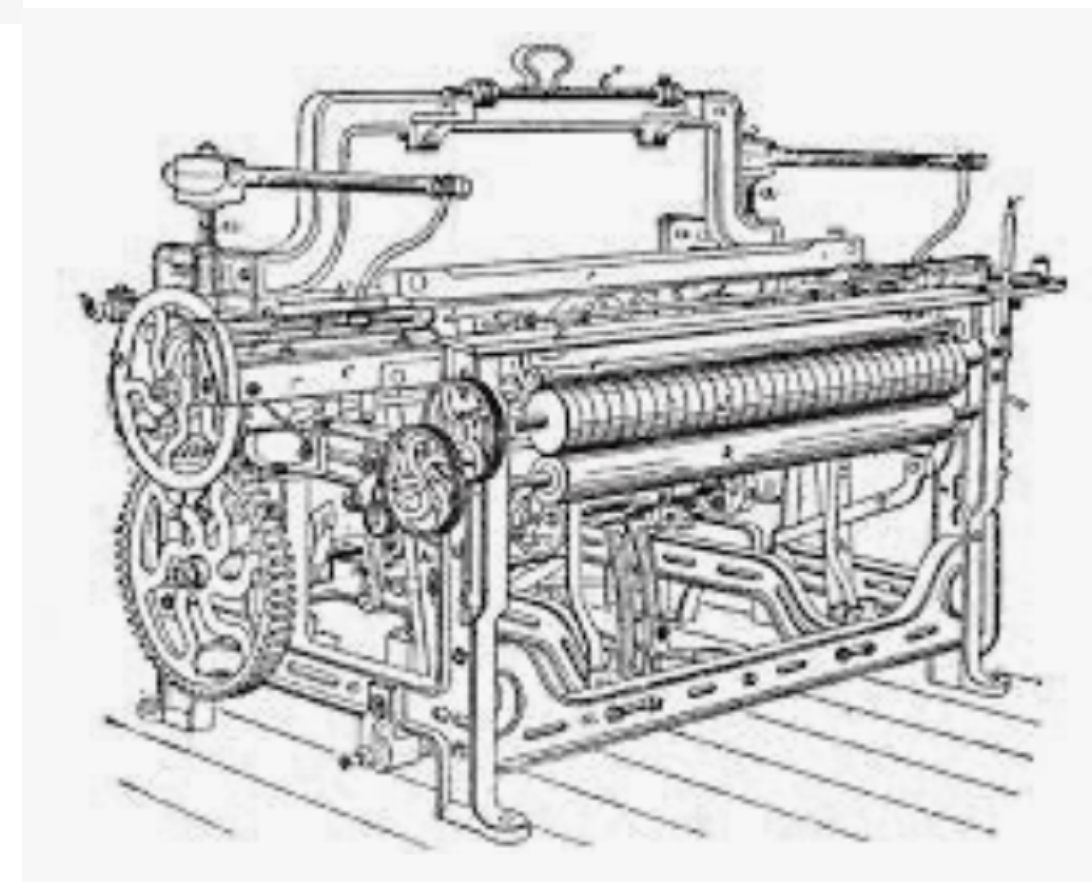
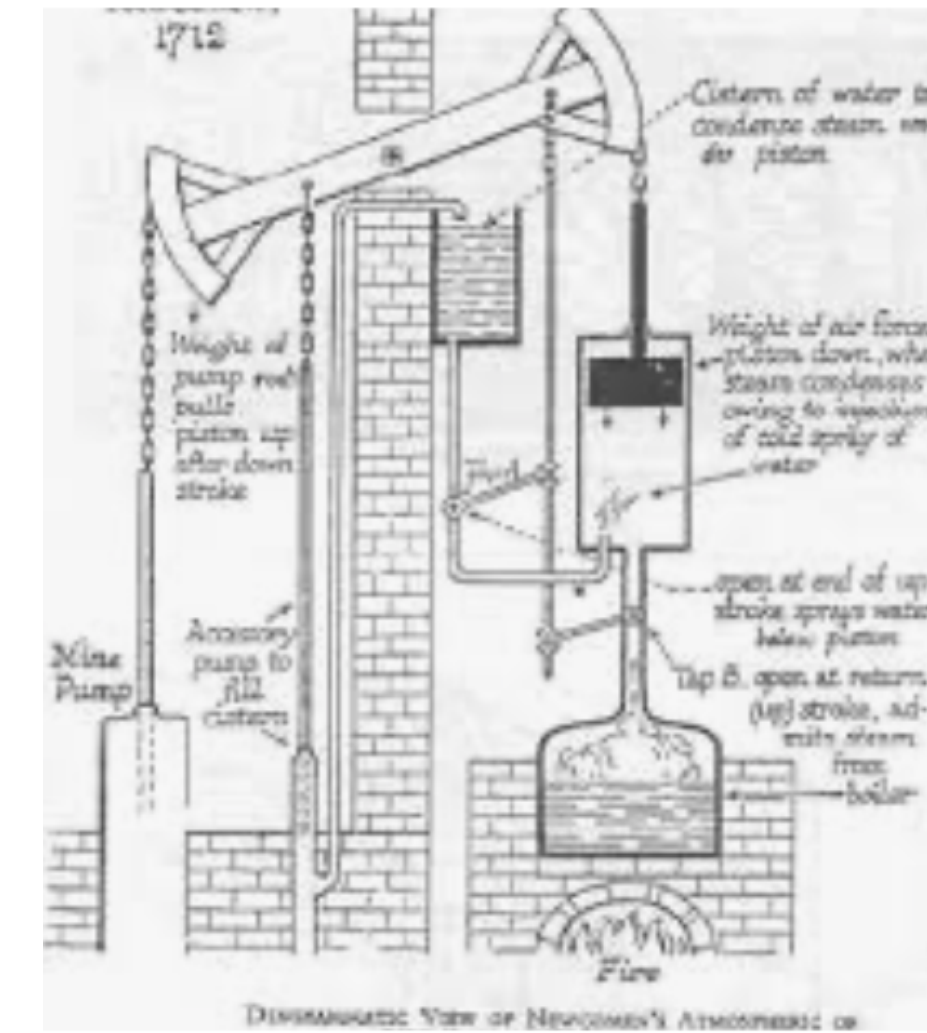
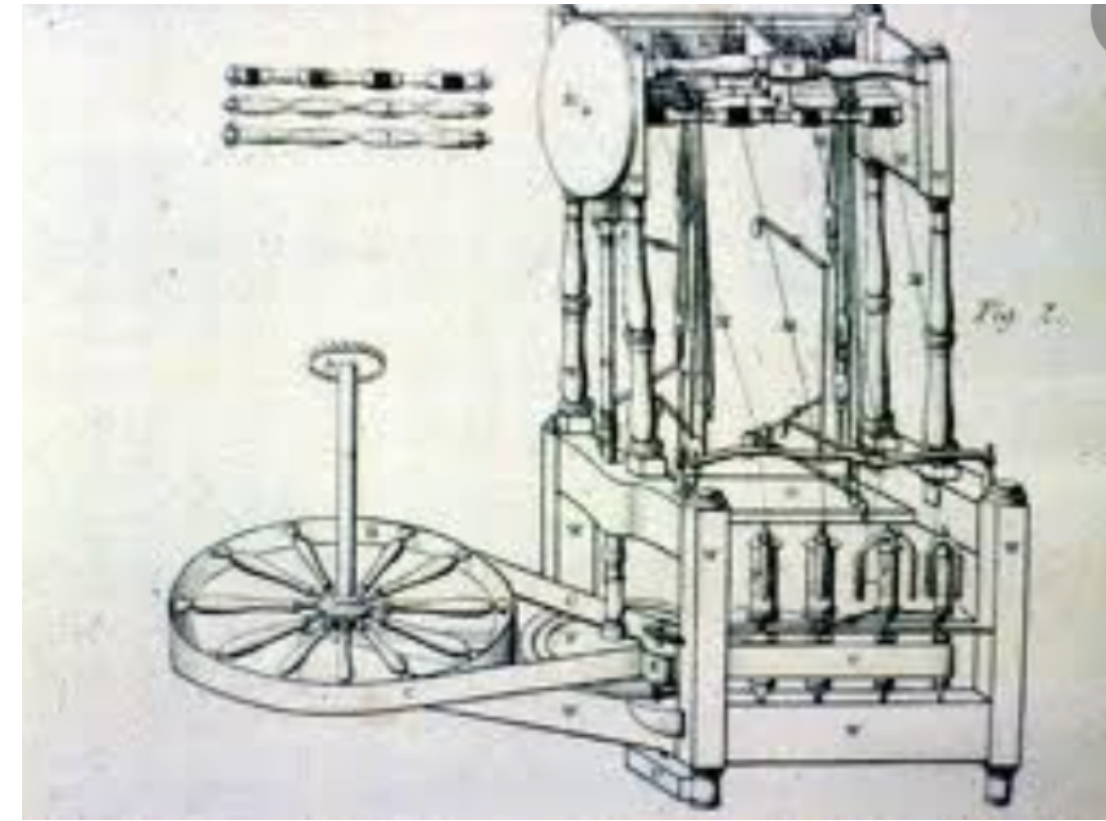
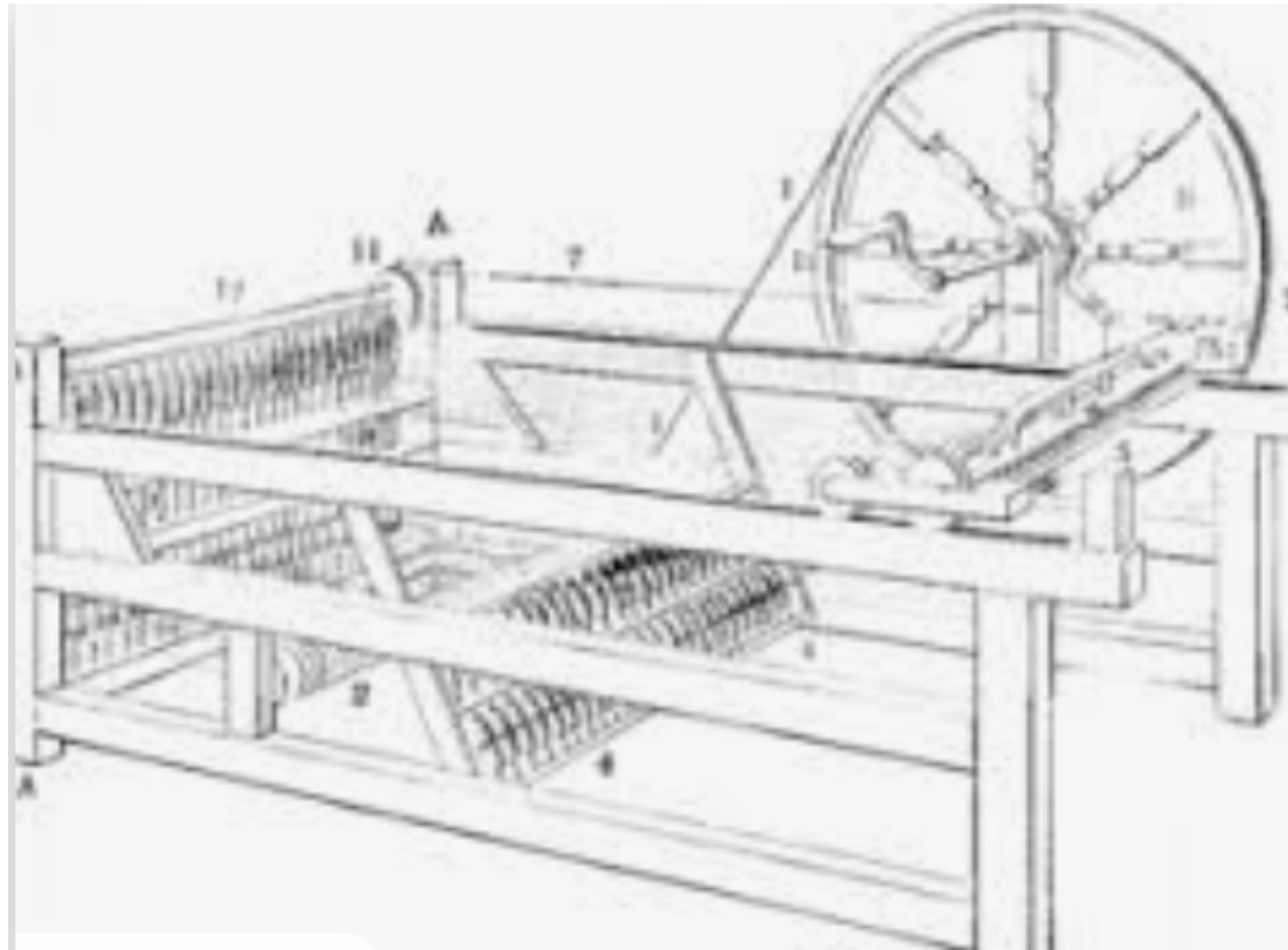
Date	Technological Ideas-Stock Growth Rate h	Technological Ideas Stock Level H (1870 = 1)	Average Annual Real Income per Capita y	Total Human Population P (millions)	Total Real World Income Y (billions)
-48000	0.002%	0.011	\$1,200	0.2	\$0.24
-8000	0.003%	0.036	\$1,200	2	\$2.4
-6000	0.009%	0.043	\$900	5	\$4.5
-3000	0.018%	0.074	\$900	15	\$14
-1000	0.030%	0.136	\$900	50	\$45
150	0.060%	0.272	\$900	200	\$180
800	0.014%	0.297	\$900	240	\$216
1500	0.052%	0.429	\$900	500	\$450
1770	0.149%	0.643	\$1,100	750	\$825
1870	0.442%	1.000	\$1,300	1300	\$1,690
2010	2.159%	20.557	\$11,600	6900	\$80,040

The Dover Circle

Date	Ideas-Stock Growth h	ideas Level H	Annual Real Income per Capita y	Population P (millions)	Total Real Income Y (billions)
-48000					
-8000	0.000%	0.0	\$1,200	0.1	\$0.12
-6000	0.003%	0.0	\$900	0.2	\$0.18
-3000	0.015%	0.1	\$900	0.5	\$0.45
-1000	0.035%	0.1	\$900	2	\$1.80
150	0.048%	0.2	\$900	6	\$5.40
800	0.022%	0.2	\$900	8	\$7.20
1500	0.096%	0.5	\$1,000	25	\$25.00
1770	0.200%	0.8	\$1,400	75	\$105.00
1870	0.914%	2.0	\$2,800	175	\$490.00
2010	2.514%	68.0	\$50,000	800	\$40,000.00

What Do These Look Like?

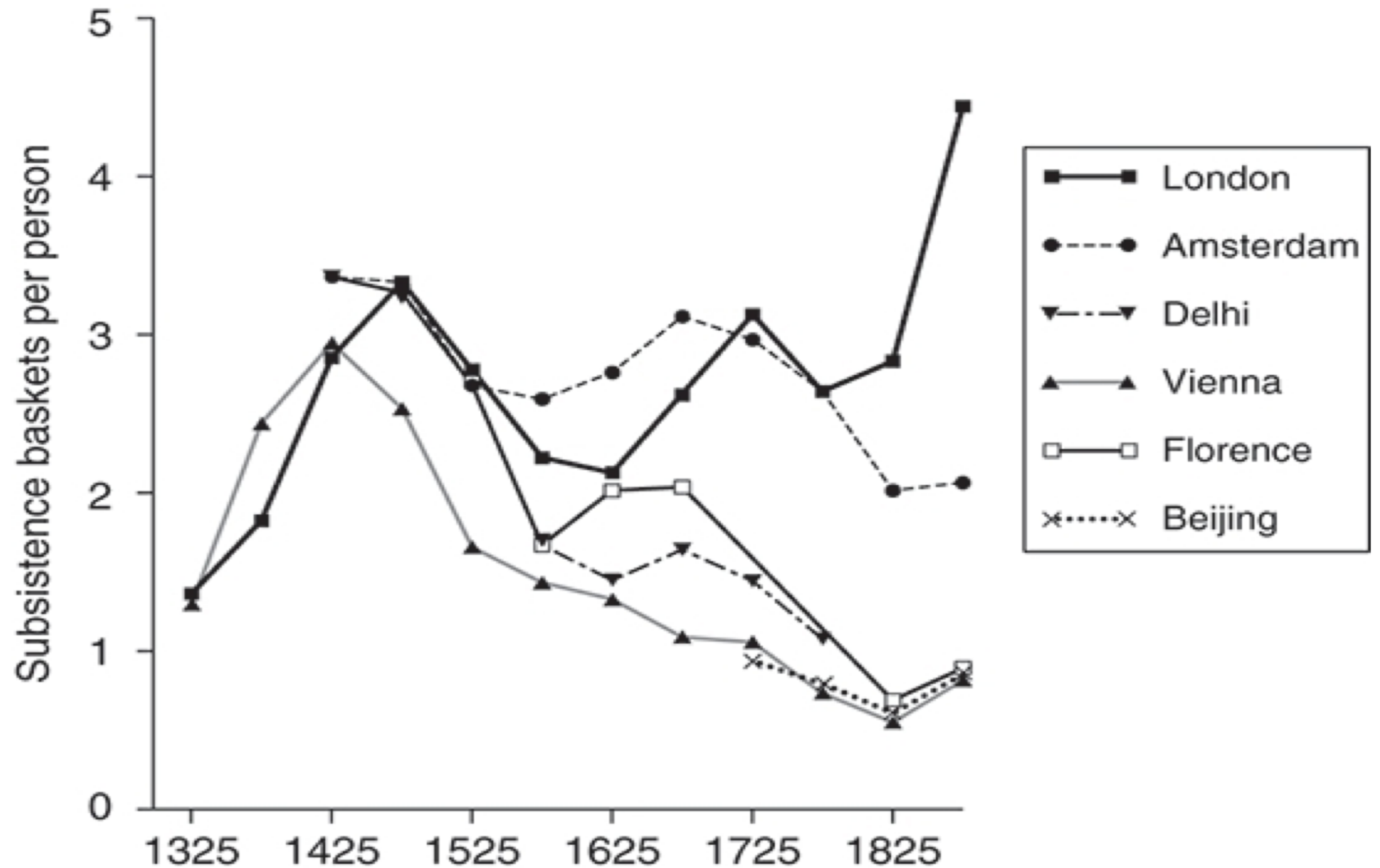
Spinning jenny, water frame, self-acting mule, Cartwright's power loom, Newcomen & Watt.



Background Factors

Allen (2017): “Institutions, practices, and culture that supported technological innovation and business investment, they were not sufficient on their own to explain the Industrial Revolution. Other parts of the world were equally blessed, but they did not have industrial revolutions...”:

- Specific triggers...
- Empire, commerce, and real wages...
- Cotton—a fiber that could be worked by machine...
- Factories...
- Coal...
- & steam engines...

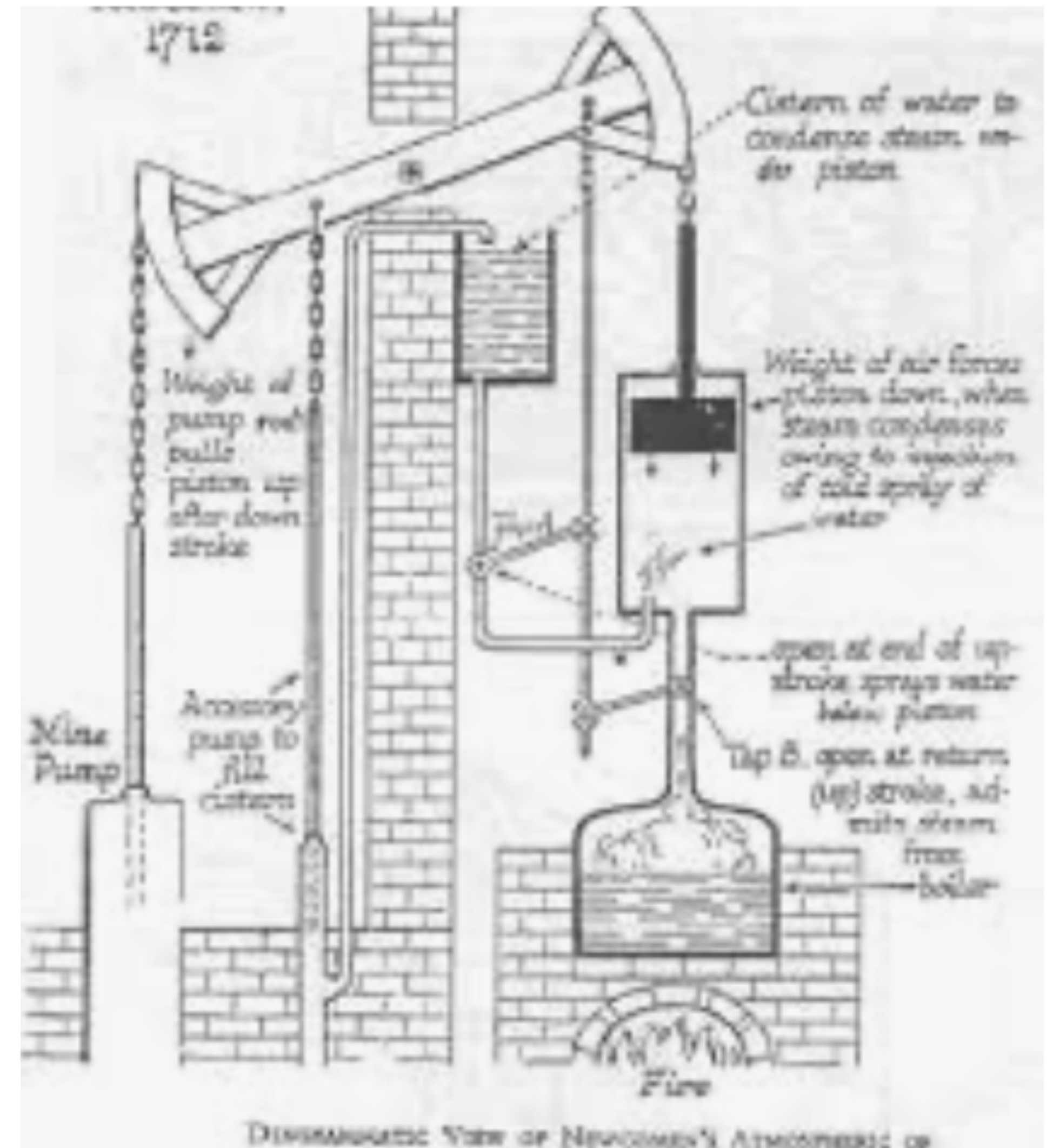


6. Wages relative to the cost of subsistence around the world.

Steam Engines

“The reason it was profitable to develop the Newcomen engine in Britain was because there were coal mines to be drained “:

- The science underlying the steam engine was pan-European
- The research and development (R&D) was carried out in Britain by an Englishman
- James Watt, FRS: The Industrial Enlightenment



English vs. Chinese Pottery Kilns

Energy prices mattered—a lot:

- England developed methods that differed fundamentally from those used in China. In both countries, technology evolved in the direction of reducing the use of expensive inputs while increasing the use of cheap ones...
- English-style kilns had a coal fire in the bottom. The heat rose, enveloped the pots, and then vented out of the furnace through a hole in the top...
- Chinese kilns used lots of capital to preserve energy. They consisted of a series of chambers rising up a hillside. A fire burned at the entrance to the lower chamber where the heat was drawn in to bake the pots. The heat was not vented out of a hole in the top in the English manner. Instead, it was forced down through a hole at floor level and entered the next chamber up the hill...



Quantitative Guesses

Date	Ideas Growth Rate h	Ideas Stock Level H	Real Income/ Capita y	Popula- tion P (millions)	Total Income Y (billions)		Population Growth Rate n	Labor Efficiency- Growth Rate g
-73000				0.01				
-68000		0.0082	\$1,200	0.1	\$0.12		0.046%	
-48000	0.002%	0.011	\$1,200	0.2	\$0.24		0.003%	0.000%
-30000	0.003%	0.018	\$1,200	0.5	\$1		0.005%	0.000%
-8000	0.005%	0.057	\$1,200	5	\$6		0.010%	0.000%
-6000	0.003%	0.061	\$900	10	\$9		0.035%	-0.014%
-4000	0.007%	0.070	\$900	13.23	\$12		0.014%	0.000%
-3000	0.007%	0.074	\$900	15	\$14		0.014%	0.000%
-1500	0.030%	0.117	\$900	37	\$33	Bronze-Literacy mode of production	0.060%	0.000%
-1000	0.030%	0.136	\$900	50	\$45		0.060%	0.000%
-400	0.060%	0.195	\$900	103	\$93	"Ancient" mode of domination ("Asiatic"?)	0.121%	0.000%
150	0.060%	0.272	\$900	200	\$180	High Antiquity	0.121%	0.000%
800	0.007%	0.285	\$900	220	\$198	Late-Antiquity Pause	0.015%	0.000%
1000	0.078%	0.333	\$900	300	\$270	Feudal mode of production	0.155%	0.000%
1500	0.062%	0.467	\$1,000	480	\$480	Commercial-Gunpowder-Empire mode of domination	0.094%	0.015%
1770	0.146%	0.694	\$1,100	875	\$963	Imperial-Commercial Revolution age ("bourgeois society")	0.222%	0.035%
1870	0.365%	1.000	\$1,300	1300	\$1,690	Steampower mode of production	0.396%	0.167%
1930	1.793%	3.000	\$3,000	2100	\$6,300	Second-Industrial-Revolution mode of production	0.799%	1.394%
1975	2.256%	9.000	\$6,000	4000	\$24,000	Mass-Production mode of production	1.432%	1.540%
2020	2.282%	27.000	\$12,000	7800	\$93,600	Global-Value-Chain mode of production	1.484%	1.540%
2077	1.939%	81.000	\$33,173	9311	\$308,857	Info-Biotech mode of production	0.311%	1.784%
2100	1.939%	127.381	\$50,000	10000	\$500,000	? Into the Future?	0.311%	1.784%
2200	2.000%	941.227	\$369.453	10000	\$3.694.528	?	0.000%	2.000%

Half of World Population Inside This Circle

