Geography, Environment, and Climate

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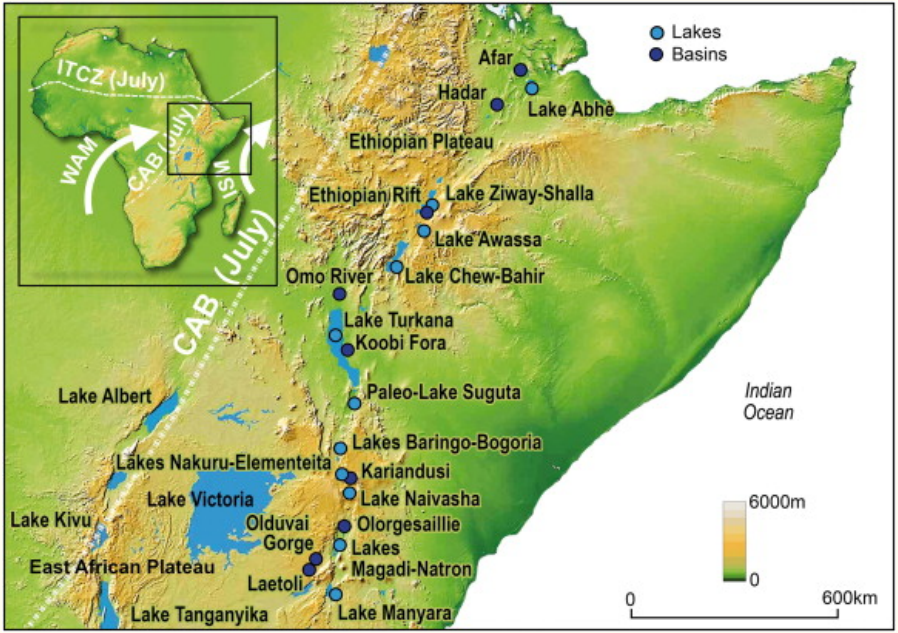
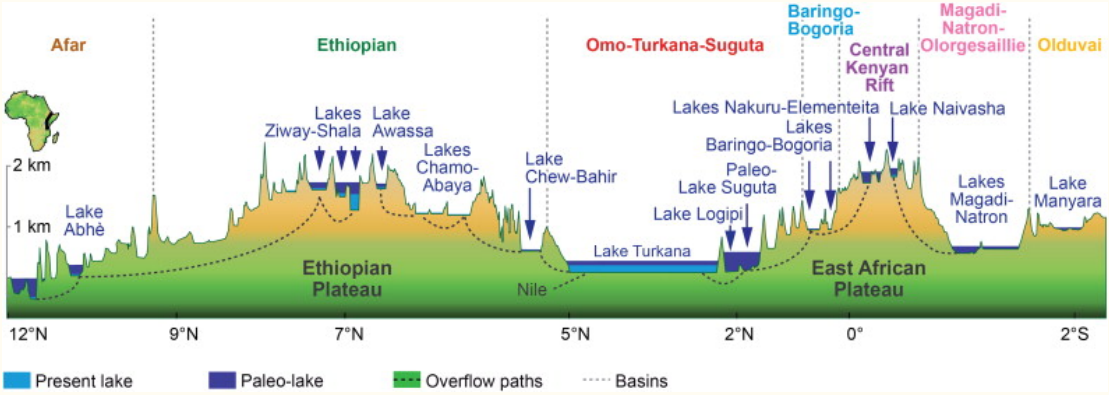
Geography, environment, and climate

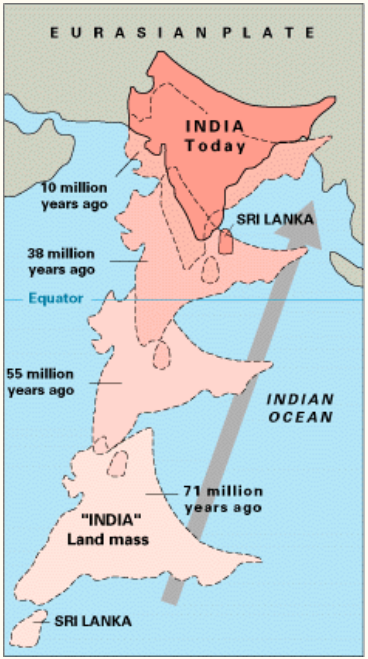
- 3 tightly connected aspects (GEC):
  1. (Physical) geography: structures and patterns of the natural space.
  2. (Biological) environment: all living species in a region.
  3. Climate: long-term patterns of weather.
- Separation among these three elements is artificial.
- For example, geography textbooks will include treatments of environment and climate.
- And, more in general, we are affected by events in our solar system (sun flares, meteorites,..) that are hard to fit in the elements above.
- But I find the breakdown useful to organize my presentation.

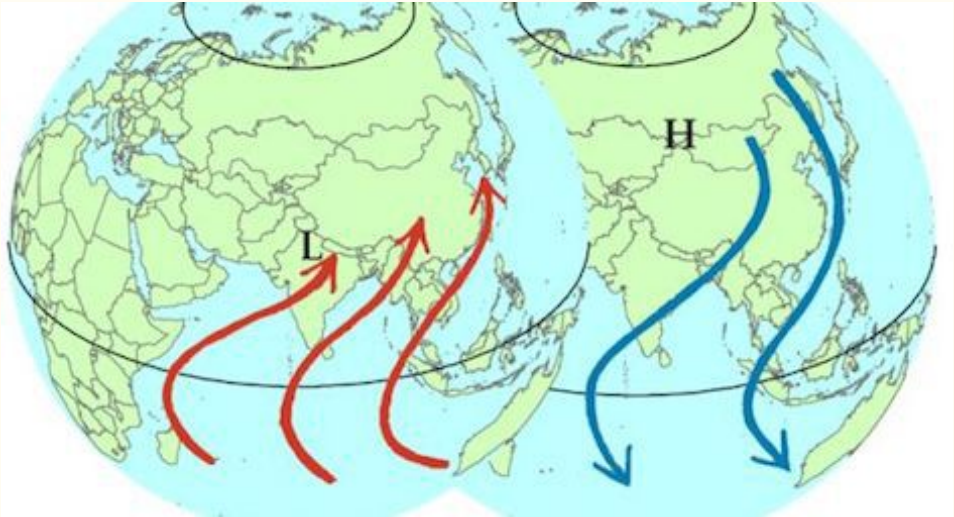
GEC and economic history I

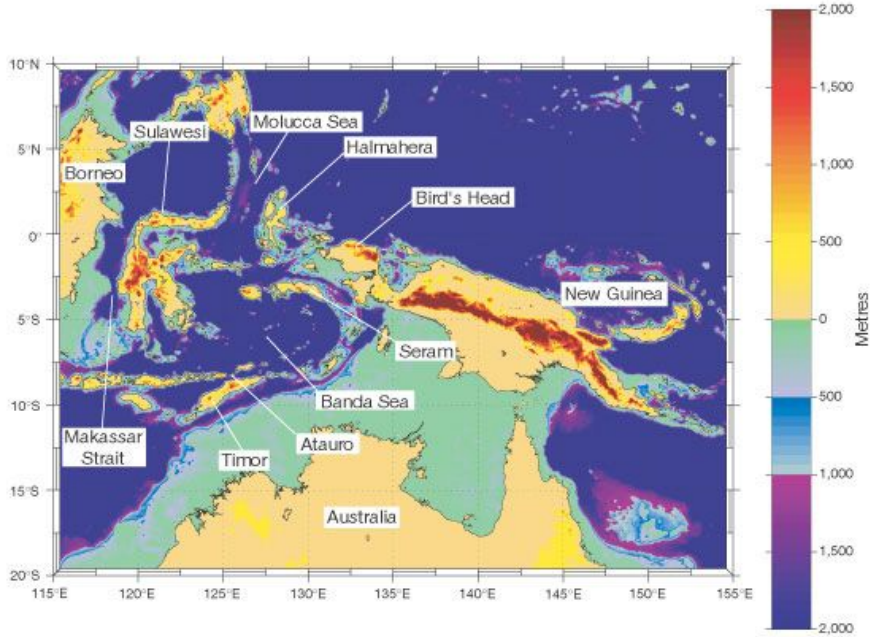
- We want to relate GEC with economic history and growth.
- How do GEC affect humans?
- At a very fundamental level, GEC determined our evolution as a species and, hence, all economic growth.
- Three correlated factors induced a deep evolutionary change:
  1. East African rift.
  2. Himalayas and the Tibetan plateau.
  3. Closing of the Indonesian seaway.


Lakes
Basins
ITCZ (July)
WAM
CAB (July)
ISM (July)
Afar
Hadar
Lake Abhe
Ethiopian Plateau
Ethiopian Rift
Lake Ziway-Shalla
Lake Awassa
Omo River
Lake Chew-Bahir
CAB
Lake Turkana
Koobi Fora
Lake Albert
Paleo-Lake Suguta
Indian Ocean
Lakes Baringo-Bogoria
Lakes Nakuru-Elementeita
Kariandusi
Lake Victoria
Lake Naivasha
Lake Kivu
Olduvai Gorge
Olorgesaillie Lakes
East African Plateau
Magadi-Natron
Laetoli
Lake Tanganyika
Lake Manyara
6000m
0
0
600km


Afar
Ethiopian
Omo-Turkana-Suguta
Baringo-Bogoria
Central Kenyan Rift
Magadi-Natron-Olorgesaillie
Olduvai
2 km
1 km
Lakes Ziway-Shala
Lake Awassa
Lakes Chamo-Abaya
Lake Chew-Bahir
Lakes Nakuru-Elementeita
Lake Naivasha
Lakes Baringo-Bogoria
Paleo-Lake Suguta
Lake Logipi
Lakes Magadi-Natron
Lake Manyara
Lake Abhè
Lake Turkana
Ethiopian Plateau
Nile
East African Plateau
12°N
9°N
7°N
5°N
2°N
0°
2°S
Present lake
Paleo-lake
Overflow paths
Basins


EURASIAN PLATE
INDIA
Today
10 million
years ago
SRI LANKA
38 million
years ago
Equator
55 million
years ago
INDIAN
OCEAN
71 million
years ago
"INDIA"
Land mass
SRI LANKA


L
H


Sulawesi
Molucca Sea
Halmahera
Borneo
Bird's Head
New Guinea
Seram
Banda Sea
Makassar Strait
Ataúro
Timor
Australia
10°N
5°N
0°
5°S
10°S
15°S
20°S
115°E
120°E
125°E
130°E
135°E
140°E
145°E
150°E
155°E
2,000
1,500
1,000
500
0
500
1,000
1,500
2,000
Metres

GEC and economic history II

- More recently, geology, terrain, temperature, rainfall, vegetation, and ecology shape how we organize our economic life: natural resources, transportation, and physical and biological hazards.
- GEC even affects our bodies through the high plasticity of our bones.
- And, indirectly, our brains:
  1. Farmers vs. hunter-gatherers.
  2. WEIRD (Western, educated, and from industrialized, rich, and democratic countries). Examples with:
     - 2.1 Ultimatum game.
     - 2.2 Discounting.
     - 2.3 Kinship relations.

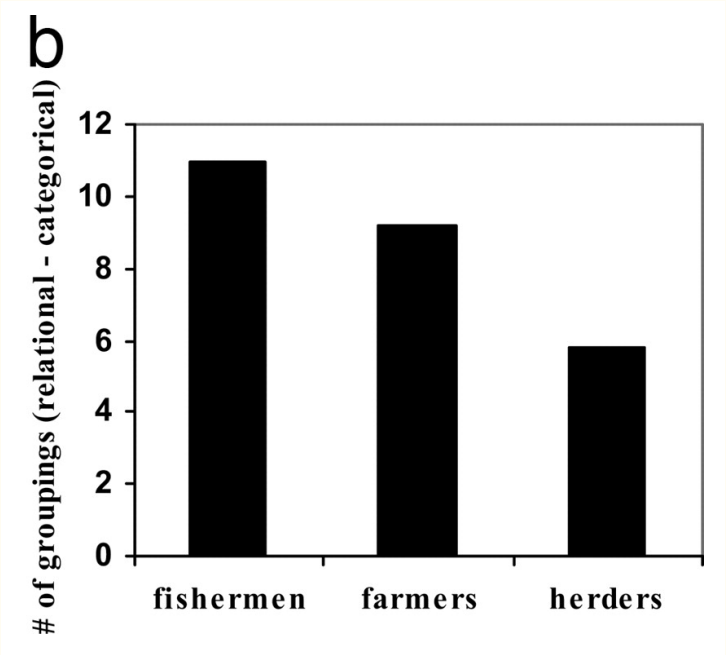

IBERIA NORTH

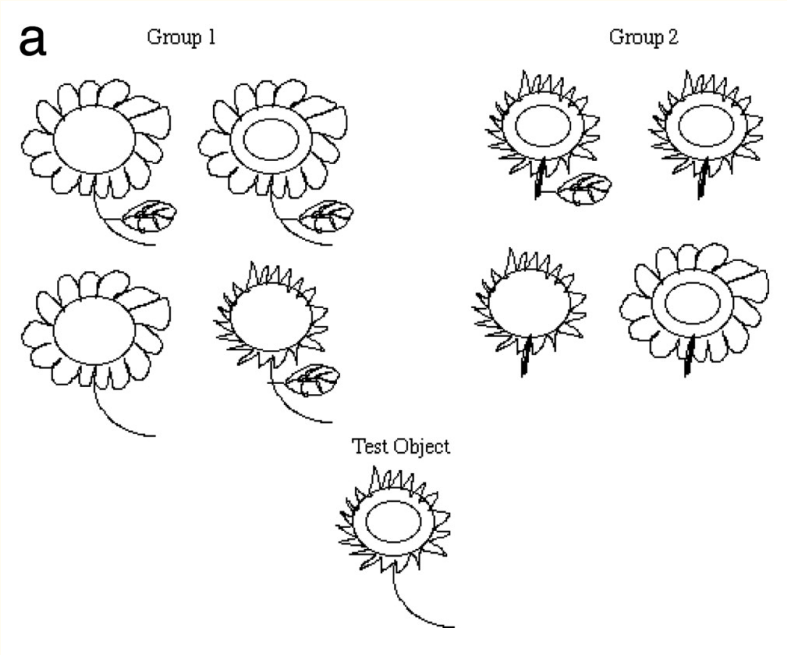
a

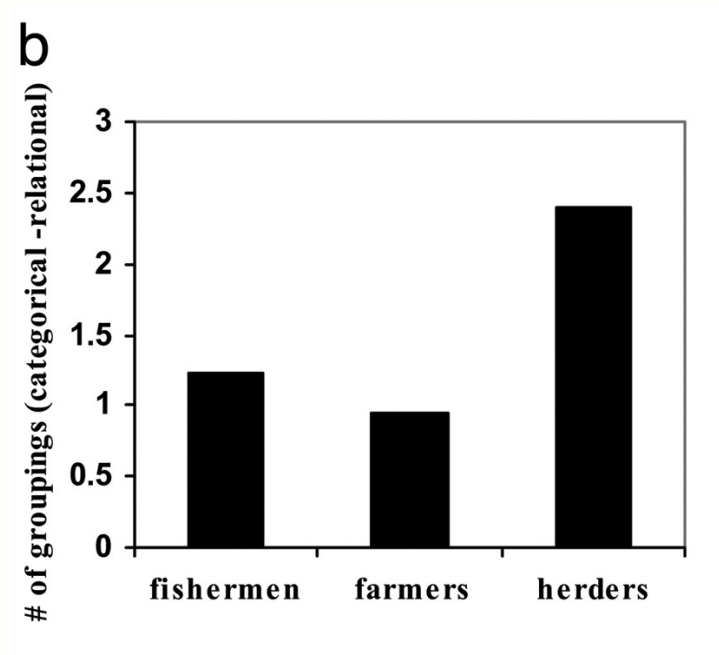
A

B

What goes with this? A or B


b
# of groupings (relational - categorical)
12
10
8
6
4
2
0
fishermen
farmers
herders


a
Group 1
Group 2
Test Object


b
# of groupings (categorical -relational)
3
2.5
2
1.5
1
0.5
0
fishermen
farmers
herders

GEC and economic history III

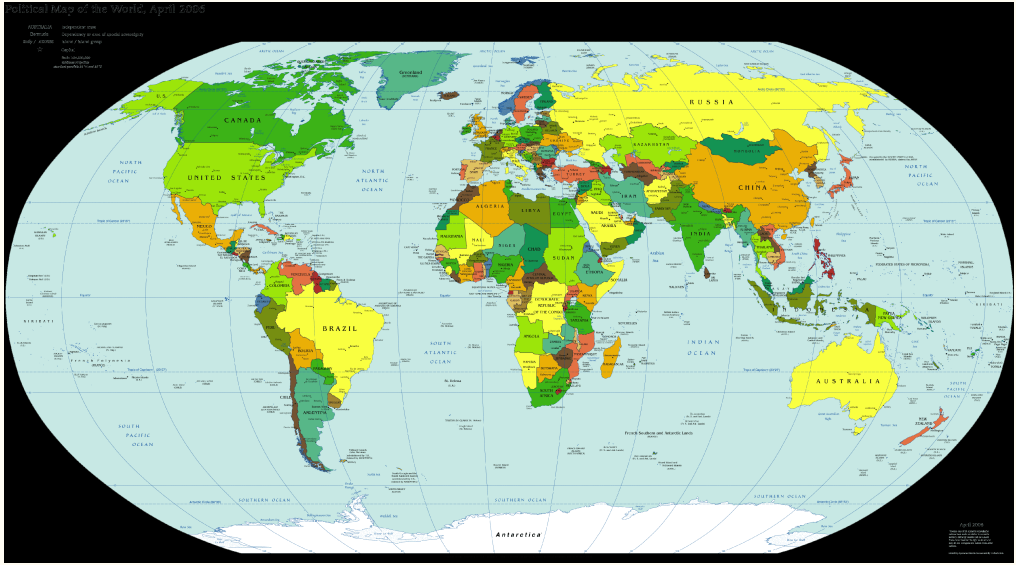
- More interestingly even, how do humans affect GEC?
- Many scientists like to talk about the "anthropocene" as a new geological epoch where the presence of humans is fundamentally changing the earth.
- A striking example: the scarcity of low-background steel for detecting radionuclides.

Three Gorges dam

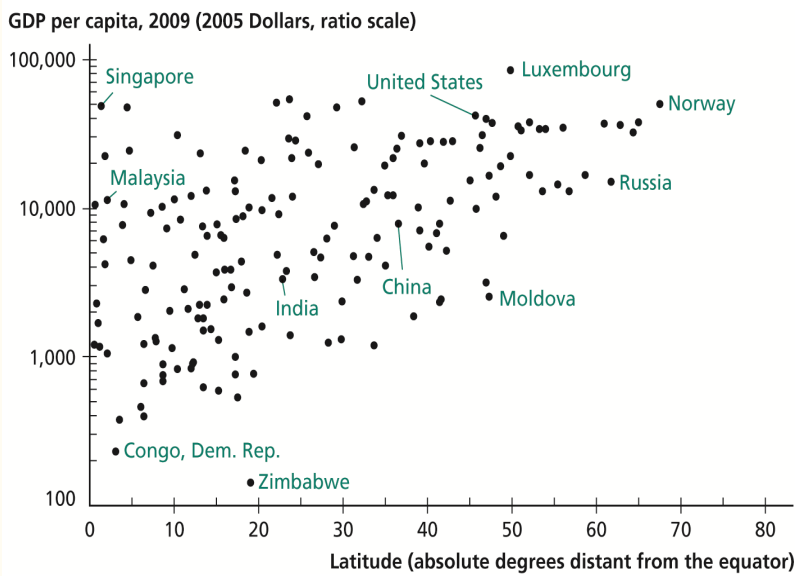
Our investigation

- Not your traditional geography or social studies class back in high school.
- Also, we will not postulate a deterministic relation between GEC and outcomes but a distribution of probabilities.
- Modern study in economics and history:
  1. New growth theory.
  2. Environmental history.
- Let's see some evidence. But remember: "Every map is a lie" (Attila Bátorfy).

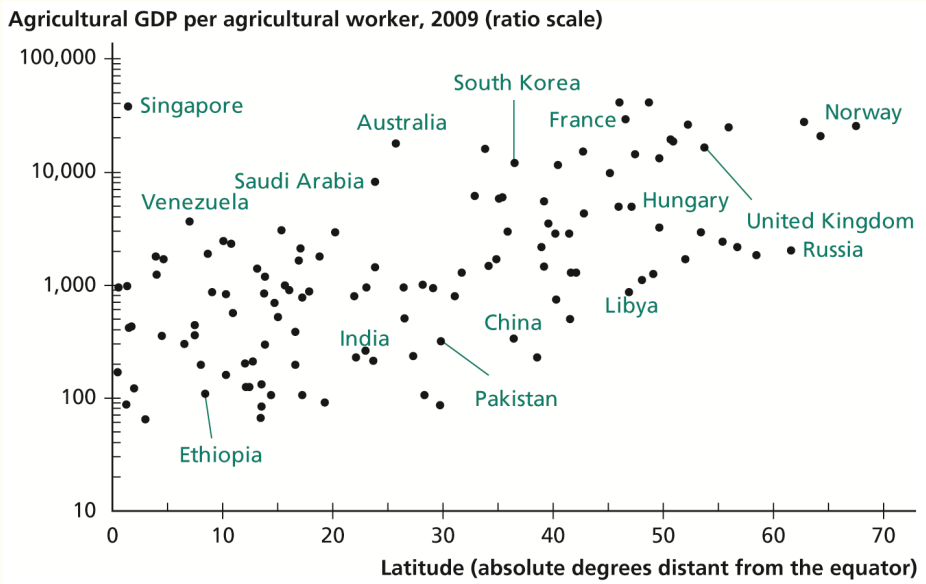
A world map


Political Map of the World, April 2005
RUSSIA
CANADA
UNITED STATES
CHINA
INDIA
BRAZIL
AUSTRALIA
Antarctica
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
SOUTHERN OCEAN

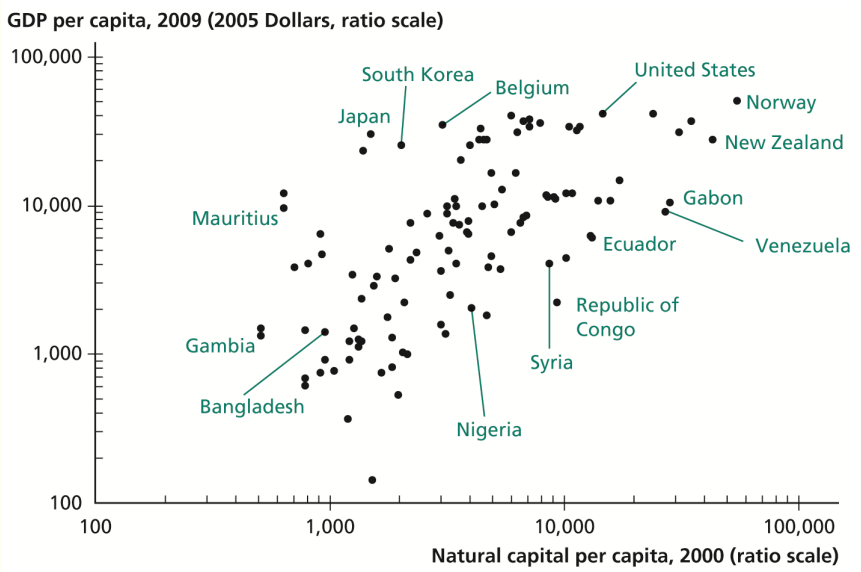
Latitude vs. income per capita



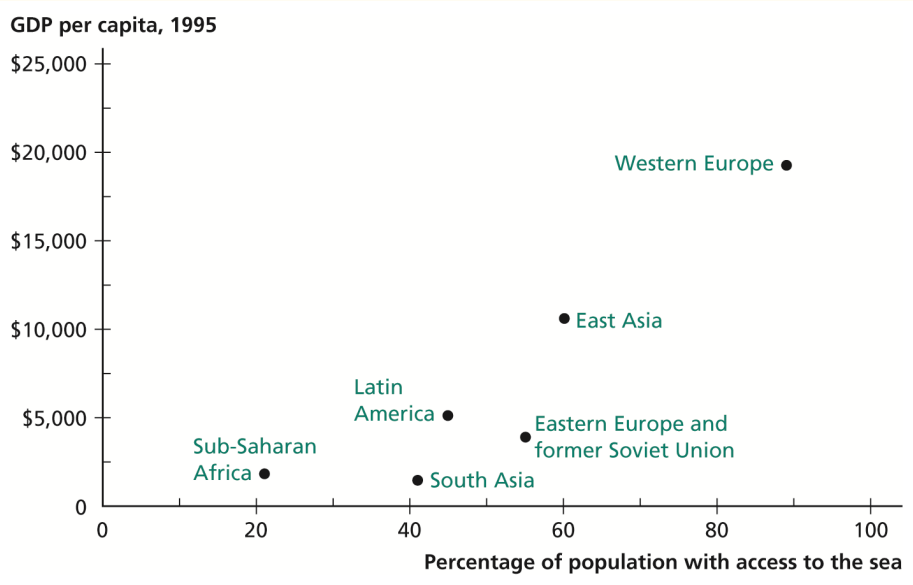
Latitude vs. agricultural GDP per worker



Natural capital vs. income per capita



Access to sea vs. income per capita



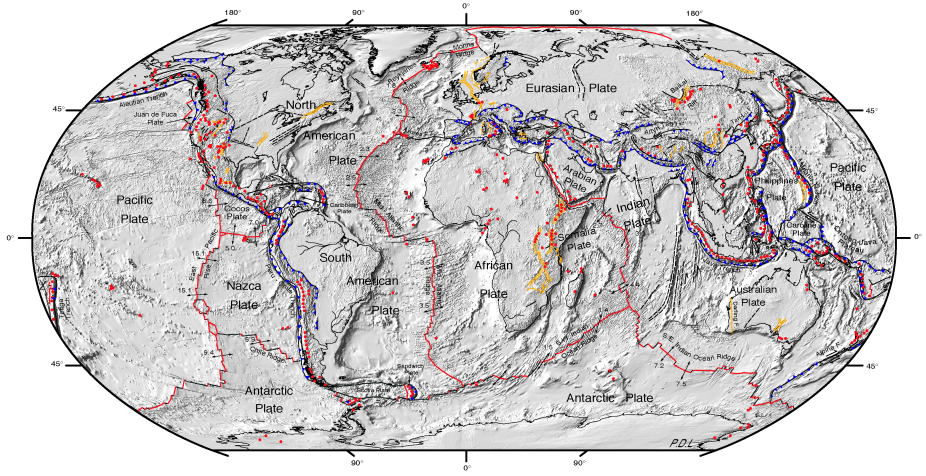
Geography

Geography

- Key role of plate tectonics in human history.
- Examples:
  1. Europe is 1/8th of the size of Africa, but the coastline is 50 percent longer.
  2. Plants of civilization: wheat, rice, and maize⇒Fernand Braudel, *Les Structures du quotidien: le possible et l'impossible* (1979).
  3. De Gaulle's memoirs: "Mr. Churchill and I agreed modestly in drawing from the events which had smashed the West this banal but definitive conclusion: when all is said and done, Great Britain is an island; France, the cape of a continent; the United States, another world."
- What are the consequences?

DIGITAL TECTONIC ACTIVITY MAP OF THE EARTH

Tectonism and Volcanism of the Last One Million Years



Actively-spreading ridges and transform faults

Total spreading rate, cm/year

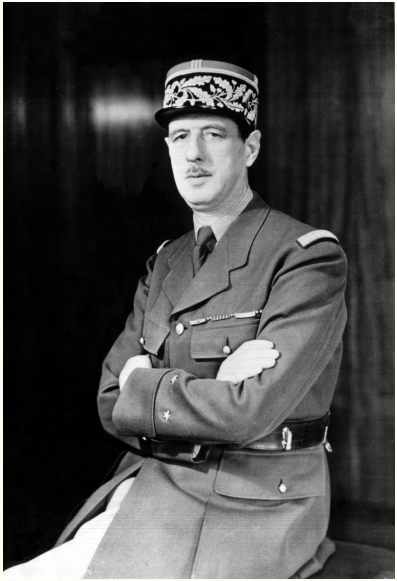
Major active fault or fault zone; dashed where nature, location, or activity uncertain

Normal fault or rift; hachures on downthrown side

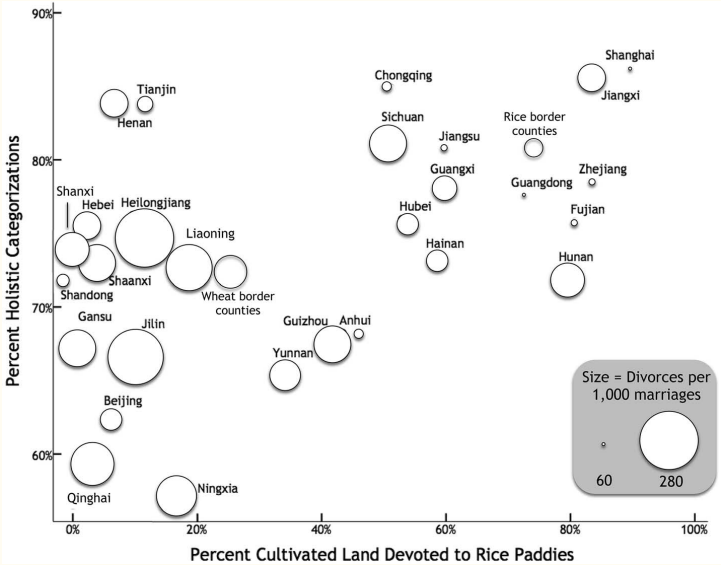
Reverse fault (overthrust, subduction zones); generalized; barbs on upthrown side

Volcanic centers active within the last one million years; generalized. Minor basaltic centers and seamounts omitted.

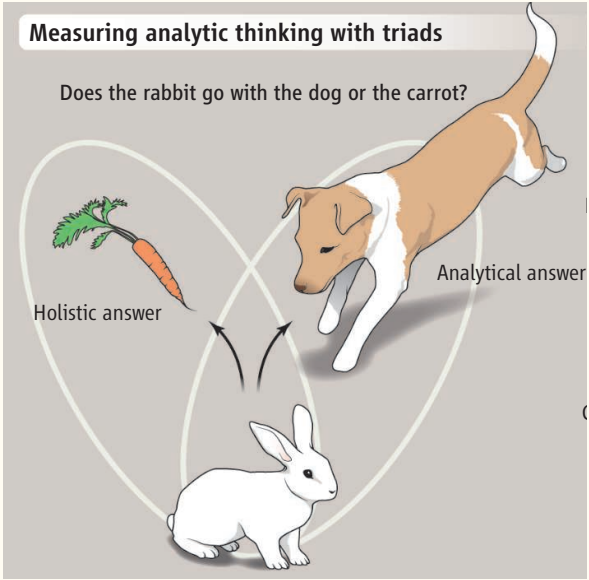
Le Général



Rice vs. wheat I



Rice vs. wheat II



Traditional geographical explanations

- Climate. Montesquieu, The Spirit of the Laws (1748) (he was a wine grower). A cold climate is good for growth; warm climates are bad: North Europe was a backwater region until the late middle ages. Comparison with Fertile Crescent and Nile valley.
- Low land river valleys in dry climates:
  1. Problems with Fertile Crescent: food production appears in hills. States and bureaucracy only follow agriculture for some time.
  2. Relation with "hydraulic-bureaucratic official-state," Karl Wittfogel, Oriental Despotism: A Comparative Study of Total Power (1957).
- Geographical determinism: Ellsworth Huntington (1876-1947).
- Geopolitics: Mackinder, Mahan, Kjellén, Haushofer.

The Geographical Pivot of History, Halford J. Mackinder

The Influence of Sea Power Upon History, 1660-1783, Alfred Thayer Mahan

Possibility I: Political division is good

Eric Jones, The European Miracle (2003)⇒ geography again, hypothesis 1.

- We already argued that China versus Europe.
- Why is political division good?
  1. Competition.
  2. Robustness.

Empirical evidence I: China

- Emperor Qiánlóng (1736-1799) ordered the compilation of the most famous works of the Chinese past: *Four Treasuries* (classics, history, philosophy, literary works).
- Enormous work: 36,000 manuscript volumes.
- To do so, private libraries were searched.
- Taking advantage of the opportunity, several types of books were destroyed:
  1. Books that implied resistance against the Manchu rule of China.
  2. Books on geography or travel that could give inside information on China's defenses.
  3. Books that exposed philosophical interpretations of the classics that were different from ones preferred by the scholars at the court.
- We know of over 2000 titles that were destroyed and that now are likely lost forever.
- This is not the only time in China's history: First Emperor's *Burning of the Books and Burying of the Intellectuals*.

Empirical evidence II: Florence

- Arrival of Arab numbers (actually Indian numbers) to Europe in the 13th century.
- Fantastic new technology.
- Florence opposed it. Arte del Cambio code in 1299 explicitly prohibited Arab numbers. Why?
- However, soon, Florence bankers were dominated by bankers in other cities.

Possibility II: China's endowments are bad

Kenneth Pomeranz,The Great Divergence: China, Europe, and the Making of the Modern World Economy⇒ geography again, hypothesis 2.

- Coal:
  1. Far away from production centers.
  2. Steam engine versus ventilations.
- Environmental limits.
- Pacific is bigger than Atlantic, and tides move in the opposite direction.

An empirical application

- How is the evolution of population growth and technological change since 1 Million BCE?
- Basic lesson so far: growth depends on technological progress.
- Intuition: more people probably must imply higher knowledge accumulation.
- Thus, growth and population may be closely linked.
- Empirical evidence.

A simple model I

- Production function: we produce output with land, labor, and technology:

$$Y = Ap^{\alpha} T^{1-\alpha}$$

- Malthusian assumption: we will reproduce (or die) until we reach income per capita y^* where:

$$p^* = \left(\frac{A}{y^*}\right)^{\frac{1}{1-\alpha}} T$$

- Technology progress depends on population size:

$$\dot{A} = gpA^{\phi}$$

where g and ϕ are parameters.

A simple model II

- Take time derivatives of p^* to get:

$$\frac{\dot{p}}{p} = \frac{1}{1-\alpha}\frac{\dot{A}}{A}$$

- Then:

$$\begin{aligned}\frac{\dot{p}}{p} &= \frac{g}{1-\alpha} p A^{\phi-1} \\ &= \frac{g}{1-\alpha} (y^*)^{\frac{1}{\alpha-1}} A^{\phi-1+\frac{1}{1-\alpha}} T\end{aligned}$$

- Therefore, bigger land surfaces should sustain more people $\Rightarrow$ more technology $\Rightarrow$ more people.
- Depending on the value of ϕ, we can have explosive growth, a balanced growth path, or a steady state.

Time series evidence

- A first look at the data.
- Regression:

$$\begin{aligned} n_t &= \underset{(0.0355)}{-0.0026} + \underset{(0.0258)}{0.524}\, L_t \\ R^2 &= 0.92,\ D.W = 1.10 \end{aligned}$$

- Robust to different data sets and specifications.

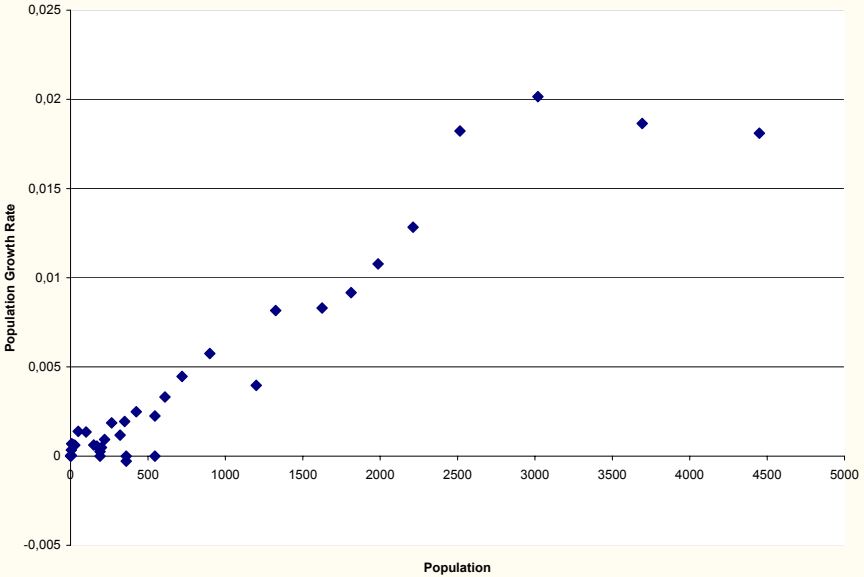
Cross-sectional evidence

- World population was separated from 10,000 BCE to circa 1500.
- Population and Population Density *circa* 1500:

	Land Area	Population	Pop/km^2
"Old World"	83.98	407	4.85
Americas	38.43	14	0.36
Australia	7.69	0.2	0.026
Tasmania	0.068	0.0012-0.005	0.018-0.074
Flinders Islands	0.0068	0.0	0.0

- England *versus* Europe and Japan *versus* Asia.

Population and population growth

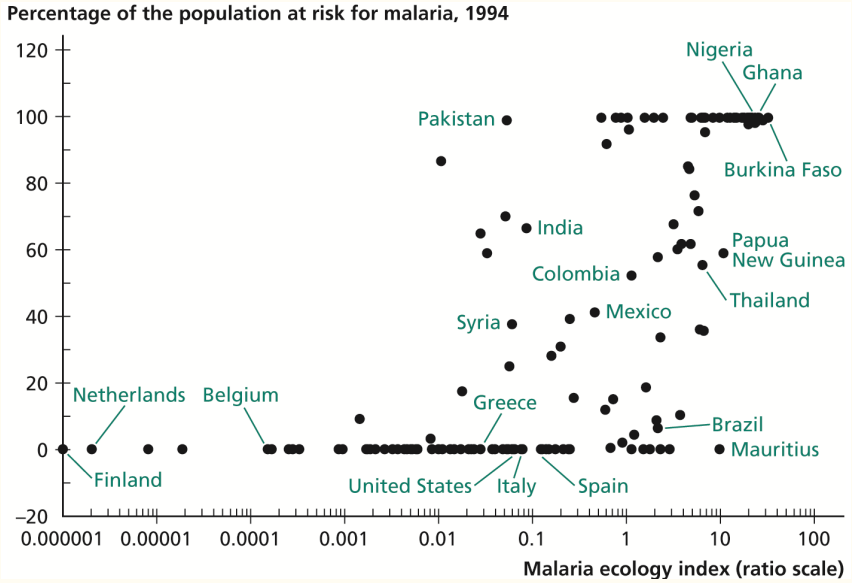


Environment

Microbes, viruses, and plagues

- Microbes, viruses, and plagues also play a crucial role in human history.
- Different patterns of economic, social, and political life.
- Co-evolution of diseases and plagues with humans.
- Tropical diseases are highly damaging and challenging to fight:
  1. Late Europeans colonization of Africa.
  2. New England vs. Virginia in American colonial times: winter kills all germs in the north but not in the south.
- Also, insects such as mosquitoes.

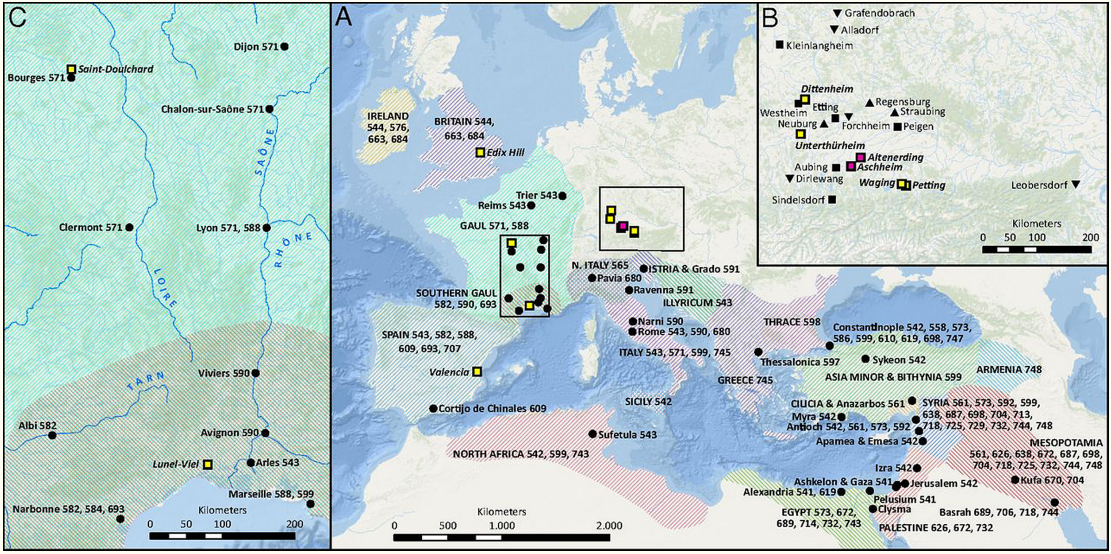
Malaria


Percentage of the population at risk for malaria, 1994
120
100
80
60
40
20
0
–20
Nigeria
Ghana
Pakistan
Burkina Faso
India
Papua
New Guinea
Colombia
Thailand
Mexico
Syria
Netherlands
Belgium
Greece
Brazil
Mauritius
Finland
United States
Italy
Spain
0.000001
0.00001
0.0001
0.001
0.01
0.1
1
10
100
Malaria ecology index (ratio scale)

Pandemics

1. The Plague of Athens (430 BCE): first document pandemic thanks to Thucydides.
2. Justinianic Plague, from 541 CE to 750 CE. Recent recovery of DNA from *Yersinia pestis*. Combined with the end of the Roman climatic optimum.
3. Black Death.
4. Arrivals of Europeans to the Americas.
5. Spanish Flu (1918).
6. HIV/AIDS.
7. COVID-19.

Justinianic Plague

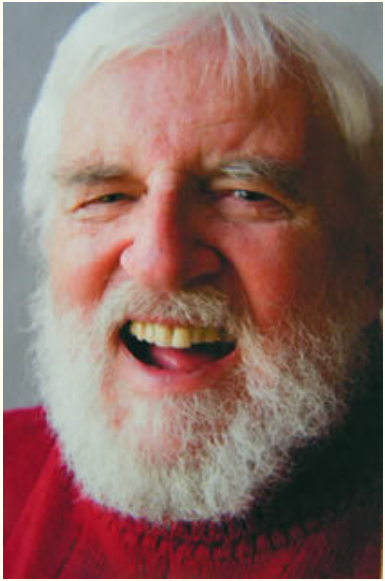


Changing the environment: the Columbian Exchange

- Environment can be modified: the Columbian Exchange.
- Transfers of plants, animals, and microbes among the Americas, Europe, Asia, and Africa.
- Also, within the Americas (e.g., mate).
- Some of it was voluntary, some involuntary.

  Alfred Crosby, The Columbian Exchange and Ecological Imperialism.
- Breaks hundreds of thousands of years of separate evolutionary changes.

Alfred W. Crosby



Euroasia to America

1. Cereals: wheat, rice, barley, rye, millet, oat.
2. Fruits: banana, watermelon, coconut, mango, apple, pear, apricot, peach, plum, cherry, citrus, olive.
3. Vegetables: turnip, radish, soybean, garlic, eggplant, artichoke, asparagus, beet, cabbage, cucumber, carrot, pea.
4. Work animals: Horse, camel, water buffalo.
5. Farm animals: cow, pig, chicken, goat, sheep, goose.
6. Bee.
7. Coffee, tea, and sugar (white gold, Canada versus Guadeloupe in 1763).
8. Microbes: bubonic plague, chickenpox, cholera, influenza, leprosy, malaria, measles, scarlet fever, smallpox, typhoid, typhus, yellow fever.

An “American” breakfast

Sugar

America to Euroasia

1. Maize (first for livestock feeding, later human consumption).
2. Other staples: sweet potatoes, potatoes, manioc (remember Malthusian model?).
3. Vegetables: tomatoes, chili pepper, bell pepper, bean, squash.
4. Peanut, sunflower, cashew, pecan.
5. Fruits: blueberry, huckleberry, pineapple, pumpkin, avocado.
6. Vanilla.
7. Rubber.
8. Animals: turkey, llama, guinea pig.
9. Tobacco and cocoa.
10. Syphilis.

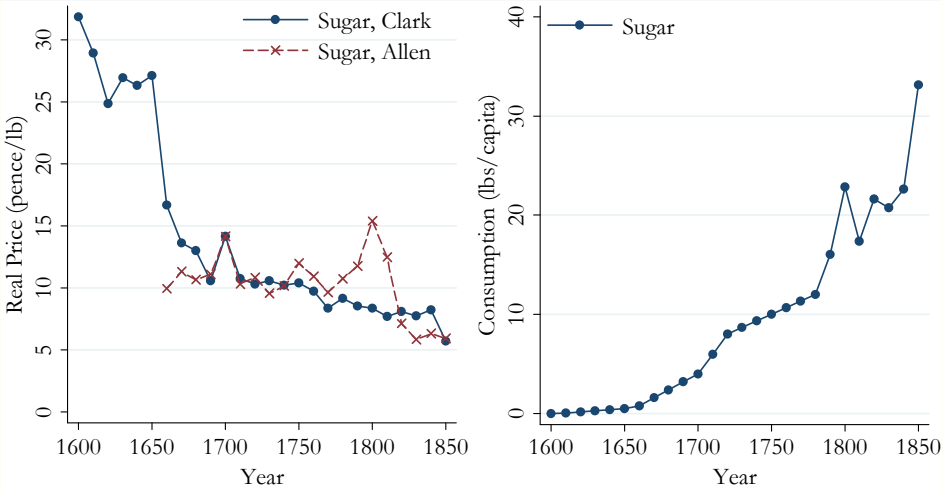
Byrd plantation

Consumption colonial luxuries in Europe, lbs. per head/year

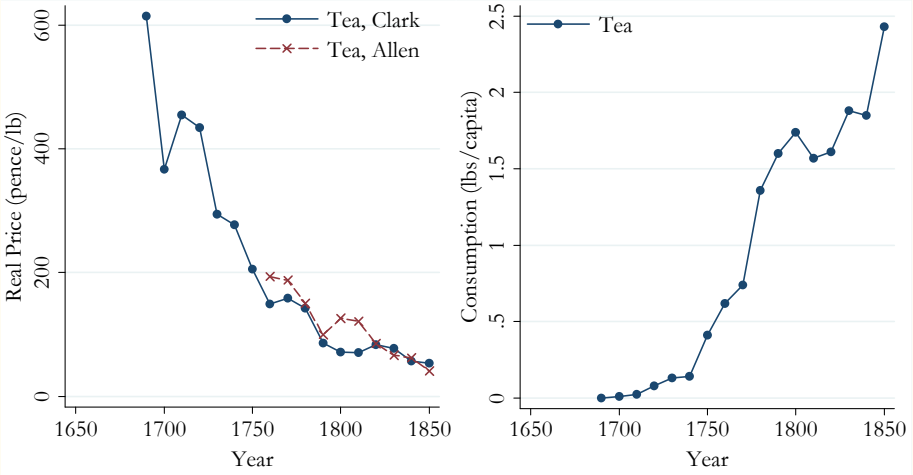
	Sugar		Coffee		Tea	
England	1670s	2.2	1699-1701	0.1	1722	0.6
	1700-9	5.7	1749-51	0.1	1750-9	1.1
	1750-9	11.0	1801	0.1	1804-6	1.7
	1770-9	23.1	1841	0.5	1844-6	1.8
Belgium	1800	3.6	1790	0.1	1720-9	0.1
	1850-4	6.6	1850-4	8.8	1850-4	0.02
France	1730-4	1.0	1781-9	0.5		
	1788-90	2.1	1815-24	0.5	1825-34	0.1
	1830	4.4	1825-35	0.6	1835-44	0.1
Austria	1780	0.3	1780	0.1		
	1800	0.9	1800	0.1		
	1830	2.2				

Source: adapted from DeVries (2008)

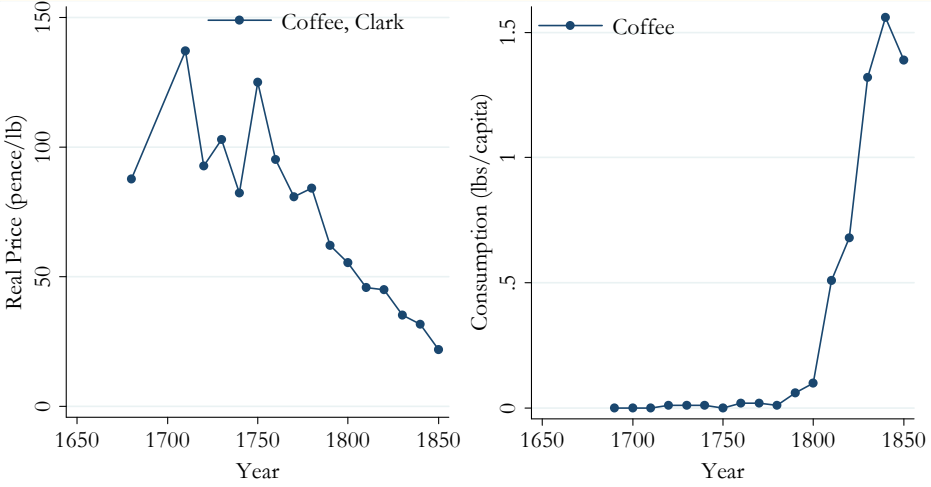
Sugar prices and consumption per capita in England, 1600-1850



Tea prices and consumption per capita in England, 1600-1850



Coffee prices and consumption per capita in England, 1600-1850



Welfare gains from sugar, tea, and coffee in England, 1600-1850

New Good	Year Range	EV	CV	ν	ρ	θ	R^2
Panel A. Results with ρ calibrated at 0.9395							
Sugar	1600–1850	8.0%	7.6%	0.0993	0.9395	0.9435	0.8517
Tea	1690–1850	7.9%	7.3%	0.0572	0.9395	0.9590	0.7718
Coffee	1690–1850	1.5%	1.5%	0.1255	0.9395	0.9875	0.8508
Welfare Gain		17.3%	16.4%				
Panel B. Results with $0<\rho \leq 2$							
Sugar	1600–1850	6.4%	6.2%	0.0590	0.7216	0.9268	0.8596
Tea	1690–1850	13.6%	11.3%	0.1550	1.4894	0.9711	0.8066
Coffee	1690–1850	2.9%	3.0%	0.3857	2	0.9991	0.8871
Welfare Gain		22.9%	20.40%				

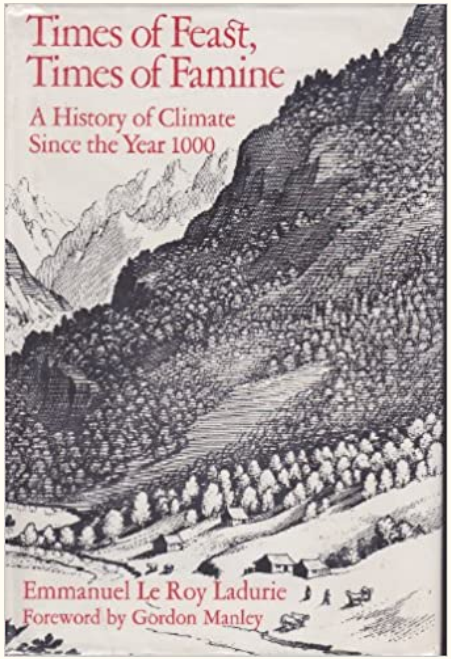
Impact of new goods on welfare

Good	Welfare Gain	Year	Source
Modern Goods			
Apple Cinnamon Cheerios	0.002%	1992	Hausman (1996)
Personal computers	3.5–4%	2004	Kopecky & Greenwood (2009)
Minivans	0.03%	1988	Petrin (2002)
Satellite TV	0.04–0.06%	2001	Goolsbee & Petrin (2004)
Internet	2-3*%	2005	Goolsbee & Klenow (2006)
Mobile phones	0.46–0.9%	1996	Hausman (1999)
Colonial Luxuries			
Sugar	7.58–8.03%	1600–1850	this study
Tea	7.28–7.85%	1690–1850	this study
Coffee	1.45–1.54%	1690–1850	this study

Climate

Climate in history

- Three basic observations:
  1. Climate changes across different areas.
  2. Climate changes over time.
  3. Widespread consensus that part of this change is due to human agency (particularly during the last century).
- Enormous development in the study of climate in history since Emmanuel Le Roy Ladurie's pathbreaking work.


Times of Feast,
Times of Famine
A History of Climate
Since the Year 1000
Emmanuel Le Roy Ladurie
Foreword by Gordon Manley

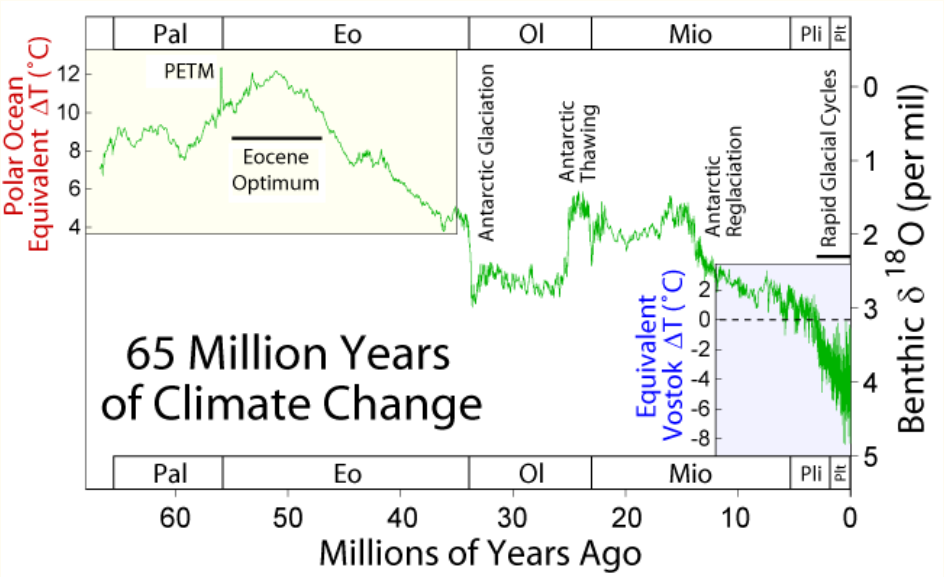
Natural archives

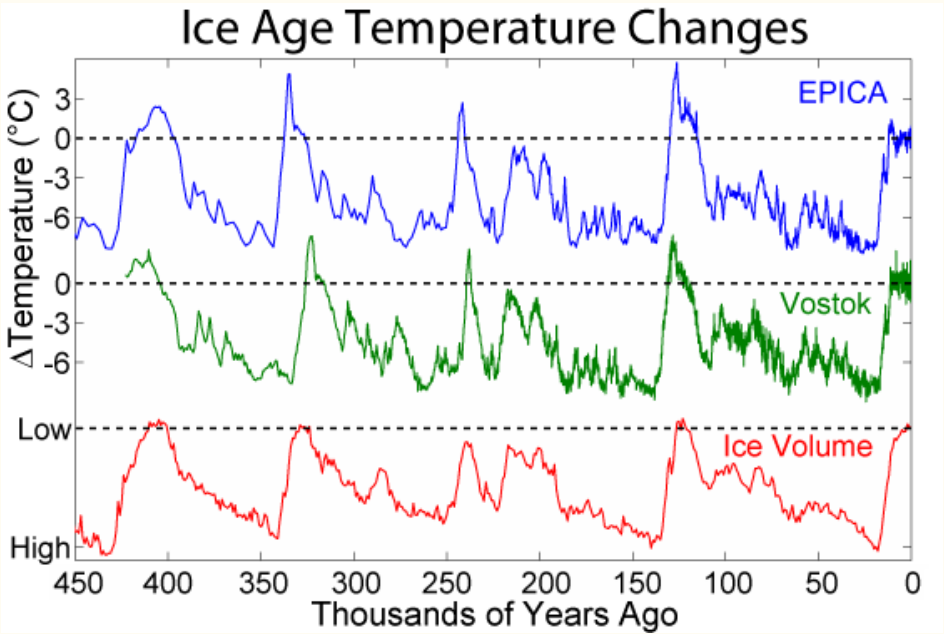
- First reliable thermometer is invented in 1714 by Daniel Gabriel Fahrenheit using mercury.
- Information sources:

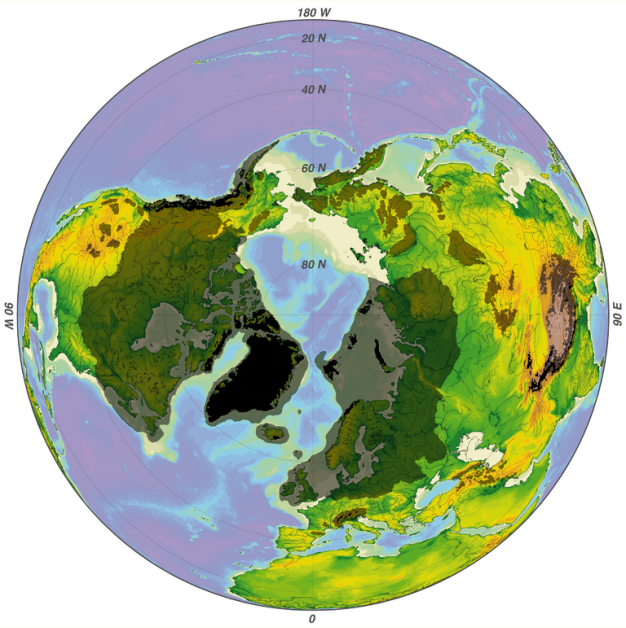
1. Ice cores.
2. Tree rings.
3. Cave deposits and speleothems.
4. Ocean sediments.
5. Lake varves.
6. Written accounts: ship logs, letters, diaries, manorial accounts ...
7. Art: winter landspaces.
8. Skeletal remains: femur length, infections, degenerative joint disease, dental disease, iron/vitamin deficiencies, trauma, and specific diseases such as TB, rickets, and leprosy.

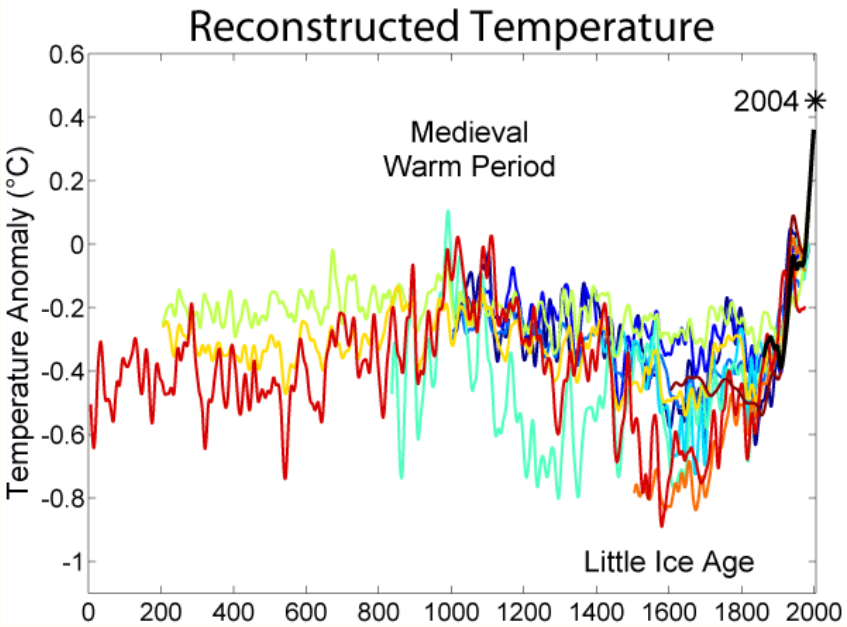
Climate Zone	Description	Representative Cities	Percentage of World Landmass	Percentage of World Population	GDP per Capita Relative to World Average
Af	Tropical Rain Forest	Jakarta, Indonesia Manaus, Brazil	4.0	4.4	0.64
Am	Tropical Rain Forest with Seasonal Monsoon	Manila, Philippines Cochin, India Belém, Brazil	0.8	2.4	0.41
Aw	Tropical Savannah	Dhaka, Bangladesh Kinshasa, Congo Havana, Cuba	10.8	17.5	0.38
Cw	Subtropical: MildHumid with Dry Winter	Hanoi, Vietnam Kanpur, India Lilongwe, Malawi	4.3	16.0	0.44
Cf	Mild Humid Climate with No Dry Season	New York, USA Paris, France Shanghai, China Sydney, Australia	7.7	19.5	2.24
Cs	Mediterranean Climate: Mild, Humid with Dry Summer	San Francisco, USA Rome, Italy Santiago, Chile	2.2	4.3	2.10
Df	Snowy-Forest Climate with No Dry Season	Chicago, USA Moscow, Russia	23.0	5.8	1.90
Dw	Snowy-Forest Climate with Dry Winter	Seoul, South Korea Vladivostok, Russia	6.2	5.3	0.64
BS	Semi-arid Steppe	San Diego, USA Odessa, Ukraine	12.3	11.8	0.55
BW	Desert: Annual Precipitation Less than 15 in. (38 cm)	Cairo, Egypt Karachi, Pakistan	17.3	6.2	0.58
H	Highlands	Mexico City, Mexico	7.3	6.8	0.78
E	Ice Climates: Average Temperature in Warmest Month Less Than 50°F (10°C)	Nuuk, Greenland	4.0	<0.1	—

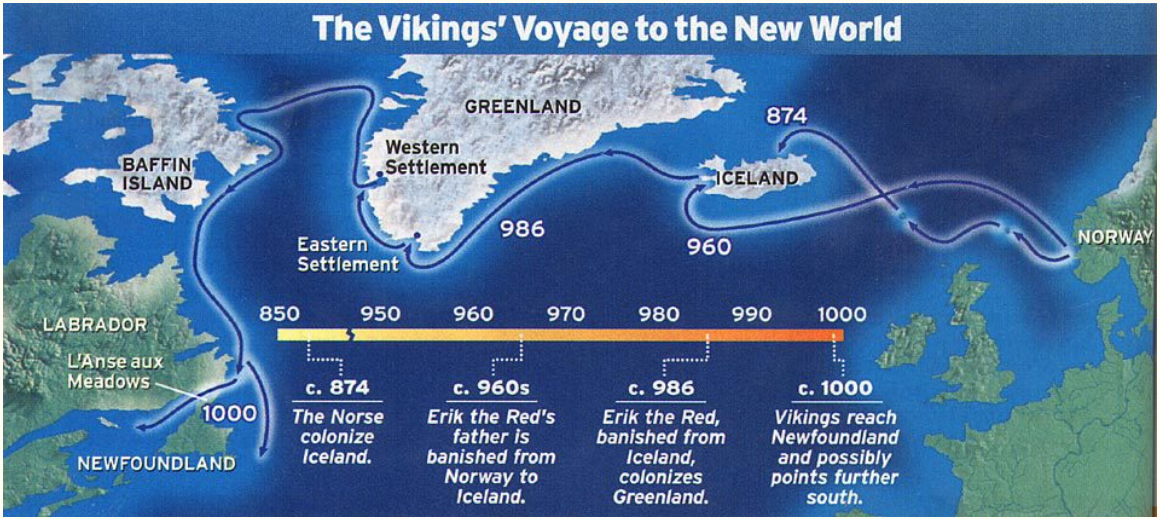
Source: Data on landmass, population, and GDP per capita are from Mellinger, Sachs, and Gallup (1999).


Pal
Eo
Ol
Mio
Pli
Plt
PETM
Eocene Optimum
Antarctic Glaciation
Antarctic Thawing
Antarctic Reglaciation
Rapid Glacial Cycles
Polar Ocean Equivalent ΔT (°C)
Equivalent Vostok ΔT (°C)
Benthic δ18O (per mil)
65 Million Years of Climate Change
Millions of Years Ago


Ice Age Temperature Changes
ΔTemperature (°C)
3
0
-3
-6
EPICA
0
-3
-6
Vostok
Low
High
Ice Volume
450
400
350
300
250
200
150
100
50
0
Thousands of Years Ago


180 W
20 N
40 N
60 N
80 N
90 W
90 E
0


Reconstructed Temperature
Temperature Anomaly (°C)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2004
Medieval
Warm Period
Little Ice Age


The Vikings' Voyage to the New World
GREENLAND
874
Western Settlement
BAFFIN ISLAND
ICELAND
986
960
Eastern Settlement
NORWAY
LABRADOR
L'Anse aux Meadows
1000
NEWFOUNDLAND
850
950
960
970
980
990
1000
c. 874
The Norse colonize Iceland.
c. 960s
Erik the Red's father is banished from Norway to Iceland.
c. 986
Erik the Red, banished from Iceland, colonizes Greenland.
c. 1000
Vikings reach Newfoundland and possibly points further south.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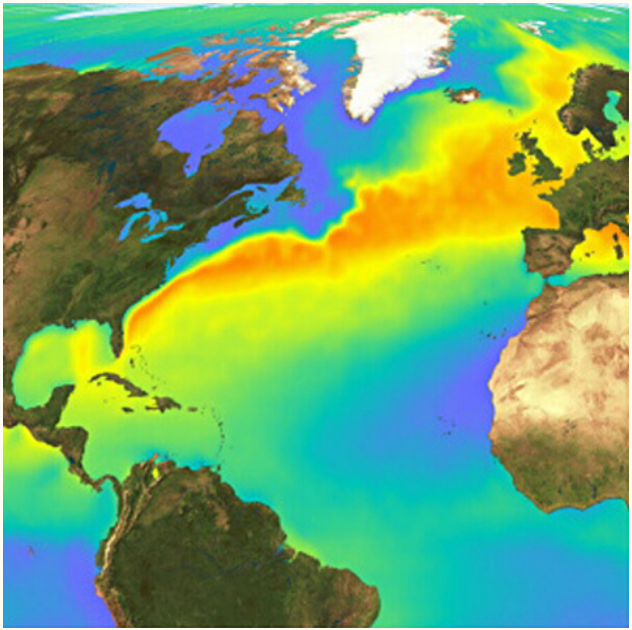
Climate in Europe

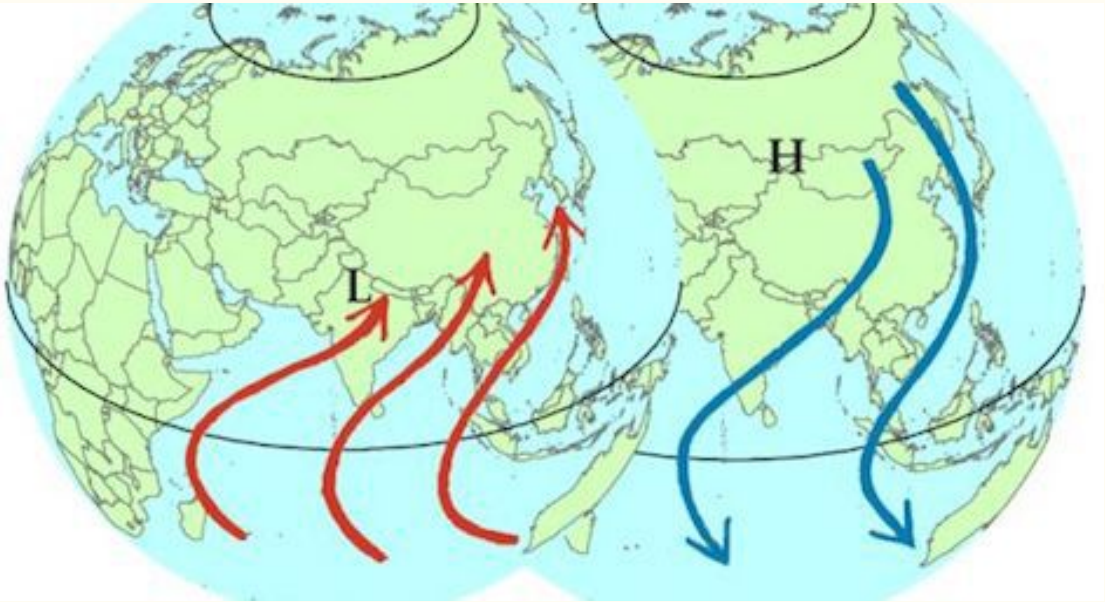
- Winters cold enough to wipe out germs, but not too cold. High humidity. Constant rain.
- Dry summers.
- Gulf Stream: the presence of Brazil forces the hot water up in the ocean, and Greenland's waters stop it in the north.
- However:
  1. Too many forests (Grimm Brothers), difficult to cultivate until iron ax.
  2. Hard soils, not enough rain in summer: fallow.
  3. Need animals for plowing and manure.
- Consequences: a diet rich in wheat and animal protein (meat and dairy products).
- Mediterranean sea.



Mediterranean winds

Climate in Asia

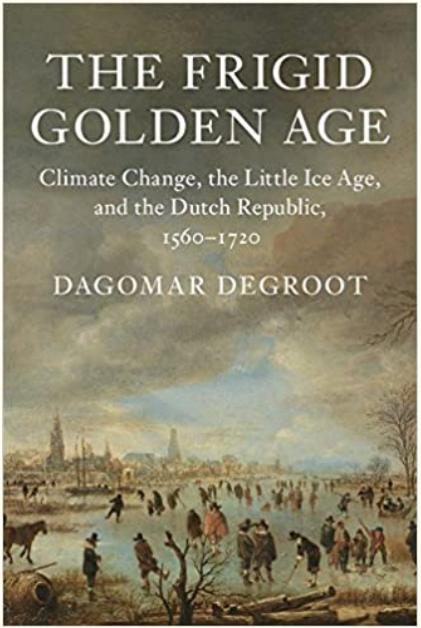
- Interior $\Rightarrow$ grasslands that supported Nomads.
- Exterior $\Rightarrow$ monsoon:
  1. Much less need to fallow.
  2. Possible to cultivate rice in large parts of Asia.
- Consequences:
  1. Much higher density.
  2. Fewer cows, more pigs and chicken.
  3. Constant struggle between nomads and settled peoples.
     Lev Nikolaevich Gumilev, Searches for an Imaginary Kingdom: The Legend of the Kingdom of Prester John.
  4. Seasonal patterns of trade. Example: Portuguese in Goa.


H
L


GOA fortissima Indiæ urbs in Christianorum potestatem anno Salutis 1509 deuenit

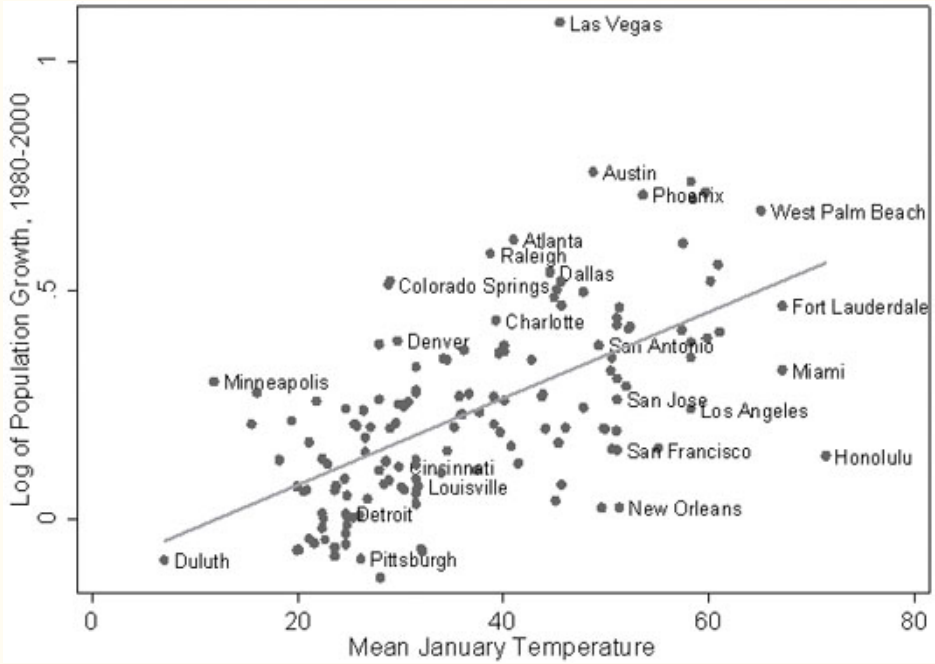
Coping with the climate

- One fundamental observation: it is much easier to warm up than to cool down.
- Warm up:
  1. Evidence of human ancestors' fire control between 1.8 to 1 million years ago.
  2. Clothing probably existed around 250,000 years ago, when H. Neanderthalensis had to survive winters in Europe.
  3. Dutch responses to the Little Ice Age.
- Cool down:
  1. Romans circulated aqueduct water through their walls to reduce heat.
  2. Use of water imitated by other times: Persians, Arabs, etc.
  3. Modern electrical air conditioning was invented in 1902 by Willis Haviland Carrier (his company, Carrier, is still a leading producer worldwide).
     3.1 First industrial application: 1906, Chronicle Cotton Mills of Belmont, NC.
     3.2 First house with A/C: 1914, Charles Gates' mansion in Minneapolis ($1 million).


THE FRIGID GOLDEN AGE
Climate Change, the Little Ice Age, and the Dutch Republic, 1560–1720
DAGOMAR DEGROOT

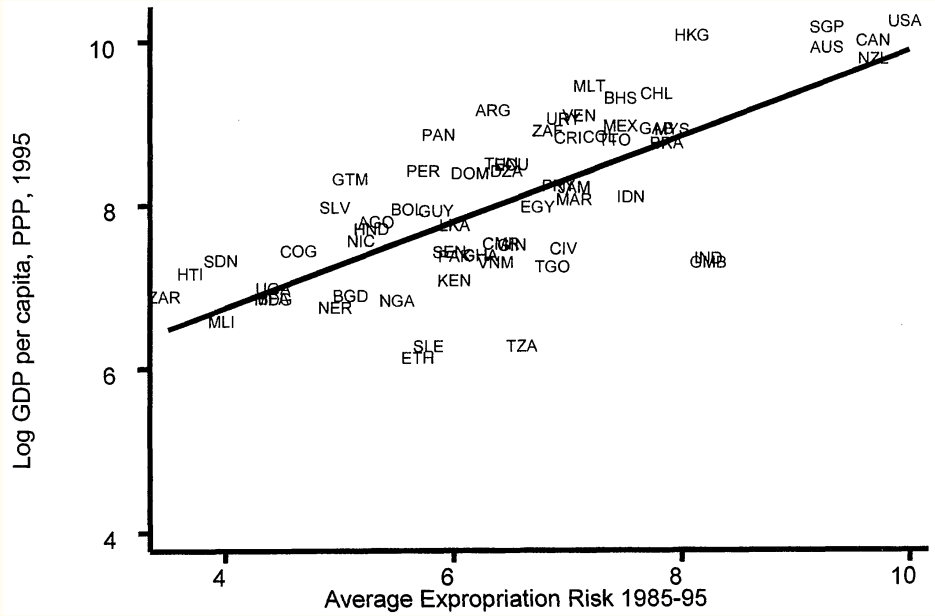
Consequences

- Much easier to populate and work in very cold areas than in very hot areas.
- Expansion of the U.S. in the 19^{th} century: much faster in the North than in the South.
- Reversal in the second half of the 20^{th} century: Buffalo versus Atlanta.
- Glaeser and Tobiot (2008).
- Political-economic consequences.


Las Vegas
Austin
Phoenix
West Palm Beach
Atlanta
Raleigh
Dallas
Colorado Springs
Fort Lauderdale
Charlotte
Denver
San Antonio
Miami
Minneapolis
San Jose
Los Angeles
San Francisco
Honolulu
Cincinnati
Louisville
New Orleans
Detroit
Duluth
Pittsburgh
Log of Population Growth, 1980-2000
0
.5
1
0
20
40
60
80
Mean January Temperature

Climate determines political structure

- Former European colonies have performed very differently: U.S. versus Belize.
- No clear correlation with former colony.
- Differences in settlers' mortality induced different institutions.
- Differences in outcomes.
- Karen Kupperman: Providence Island, 1630-1641: The Other Puritan Colony, compares Providence Island and New England.
- Daron Acemoglu, Simon Johnson, and James Robinson: The Colonial Origins of Comparative Development: An Empirical Investigation.


Log GDP per capita, PPP, 1995
Average Expropriation Risk 1985-95
10
8
6
4
4
6
8
10
HKG
SGP
USA
AUS
CAN
NZL
MLT
BHS
CHL
ARG
PAN
MEX
PER
GTM
SLV
EGY
MAR
IDN
SDN
COG
HTI
ZAR
MLI
NGA
KEN
TGO
CIV
SLE
ETH
TZA

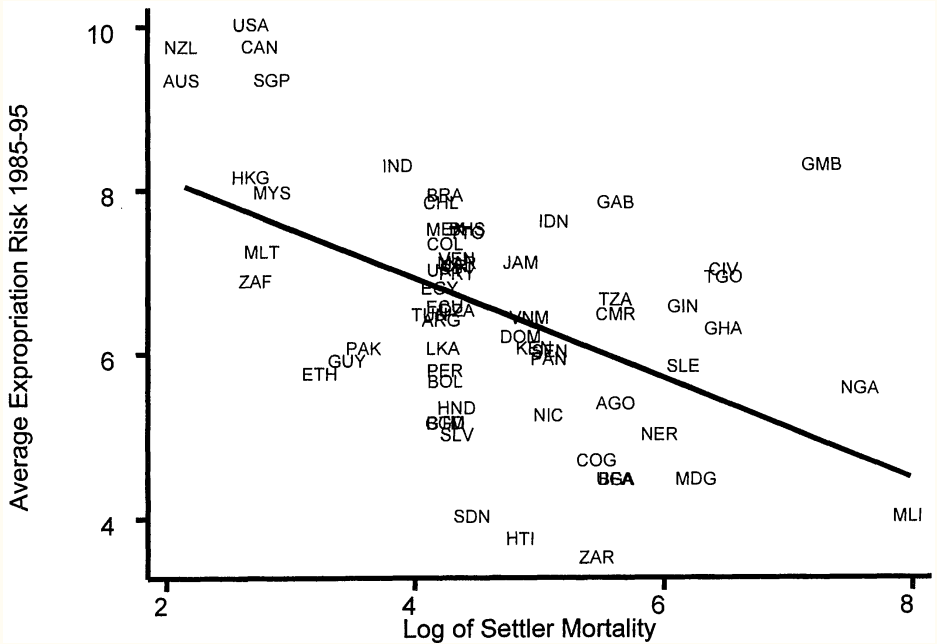

Average Expropriation Risk 1985-95
10
8
6
4
2
4
6
8
Log of Settler Mortality
USA
NZL
CAN
AUS
SGP
HKG
MYS
IND
GMB
BRA
CHL
GAB
IDN
MLT
ZAF
COL
JAM
CIV
TGO
EGY
TZA
CMR
GIN
GHA
ARG
DOM
PAK
LKA
GUY
ETH
PER
BOL
PAN
SLE
NGA
HND
NIC
AGO
SLV
NER
COG
MDG
SDN
MLI
HTI
ZAR

TABLE 4—IV REGRESSIONS OF LOG GDP PER CAPITA

	Base sample (1)	Base sample (2)	Base sample without Neo-Europes (3)	Base sample without Neo-Europes (4)	Base sample without Africa (5)	Base sample without Africa (6)	Base sample with continent dummies (7)	Base sample with continent dummies (8)	Base sample, dependent variable is log output per worker (9)
Panel A: Two-Stage Least Squares									
Average protection against expropriation risk 1985–1995	0.94	1.00	1.28	1.21	0.58	0.58	0.98	1.10	0.98
	(0.16)	(0.22)	(0.36)	(0.35)	(0.10)	(0.12)	(0.30)	(0.46)	(0.17)
Latitude		−0.65		0.94		0.04		−1.20	
		(1.34)		(1.46)		(0.84)		(1.8)	
Asia dummy							−0.92	−1.10	
							(0.40)	(0.52)	
Africa dummy							−0.46	−0.44	
							(0.36)	(0.42)	
"Other" continent dummy							−0.94	−0.99	
							(0.85)	(1.0)	
Panel B: First Stage for Average Protection Against Expropriation Risk in 1985–1995									
Log European settler mortality	−0.61	−0.51	−0.39	−0.39	−1.20	−1.10	−0.43	−0.34	−0.63
	(0.13)	(0.14)	(0.13)	(0.14)	(0.22)	(0.24)	(0.17)	(0.18)	(0.13)
Latitude		2.00		−0.11		0.99		2.00	
		(1.34)		(1.50)		(1.43)		(1.40)	
Asia dummy							0.33	0.47	
							(0.49)	(0.50)	
Africa dummy							−0.27	−0.26	
							(0.41)	(0.41)	
"Other" continent dummy							1.24	1.1	
							(0.84)	(0.84)	
R^2	0.27	0.30	0.13	0.13	0.47	0.47	0.30	0.33	0.28