3.3 — The Diamond Hypothesis

ECON 317 • Economic Development • Fall 2021

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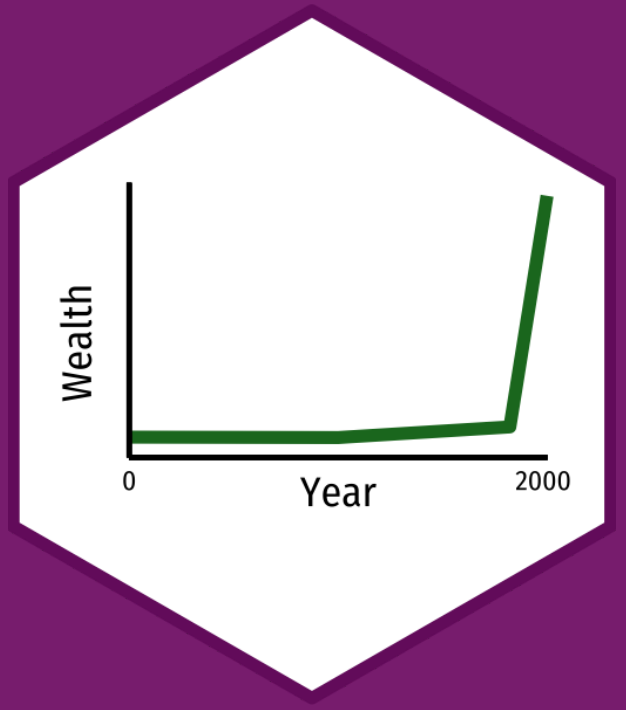
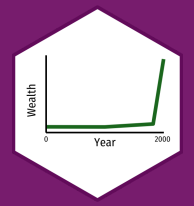


Outline



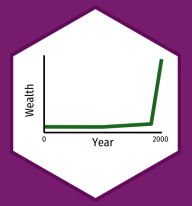
Guns, Germs, and Steel

Geography and the “Deep Roots” of Development

Geography's Mechanisms: Trade and Health

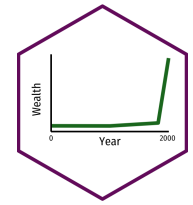
Geography and Trade/Market Access

Geography and Health

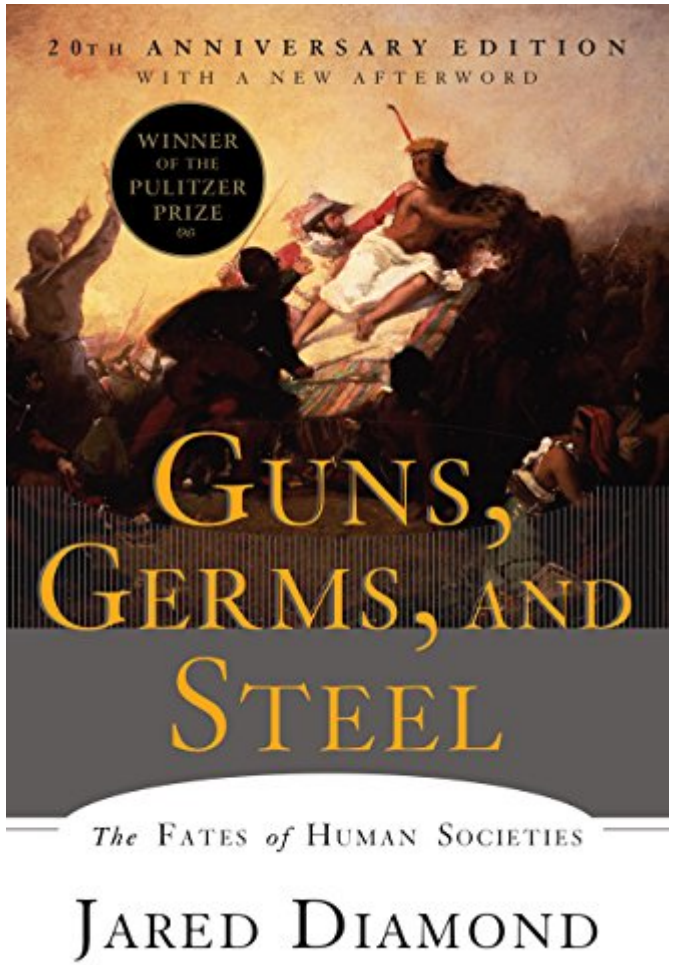


Guns, Germs, and Steel

Guns, Germs, and Steel I



- Why are some countries poor and others rich?



Yali's Question (to Diamond) I

Guns, Germs, and Steel
(PBS)

> "The conversation remained friendly, even though the tension between the two societies that Yali and I represented was familiar to both of us. Two centuries ago, all New Guineans were still "living in the Stone Age." That is, they still used stone tools similar to those superseded in Europe by metal tools thousands of years ago, and they dwelt in villages not organized under any centralized political authority. Whites had arrived, imposed centralized government, and brought material goods whose value New Guineans instantly recognized, ranging from steel axes, matches, and medicines to clothing, soft drinks, and umbrellas. In New Guinea all these goods were referred to collectively as "cargo," (p.14).

Diamond, Jared, 1999, *Guns, Germs, and Steel: The Fates of Human Societies*

Yali's Question (to Diamond) II

Guns, Germs, and Steel
([PBS])

> "[H]e asked me, "Why is it that you white people developed so much cargo and brought it to New Guinea, but we black people had little cargo of our own?" (p.14)

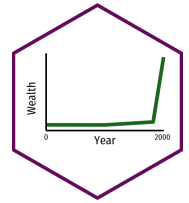
Diamond, Jared, 1999, *Guns, Germs, and Steel: The Fates of Human Societies*

Cargo Cults

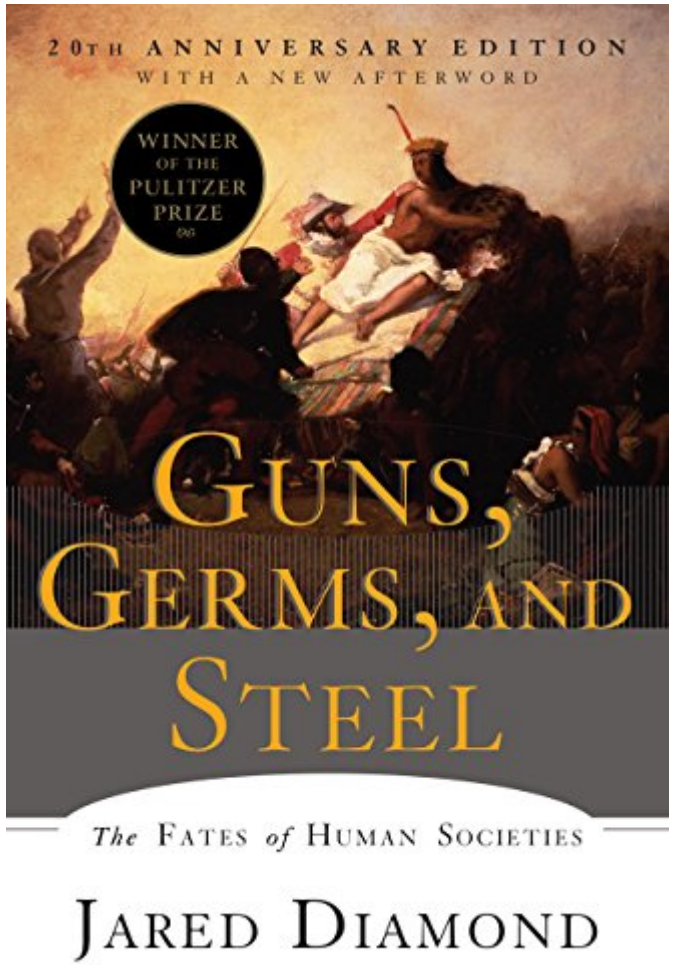
Guns, Germs, and Steel II

Franscisco Pizarro's conquest of the Incan Empire

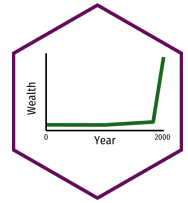
Guns, Germs, and Steel II



- *Europeans* colonized the *rest of the world* because they had *"guns, germs, and steel"*
- Why did (Western) *Eurasia* develop *first*, not Africa, North America, South America, or Oceania?

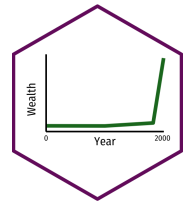


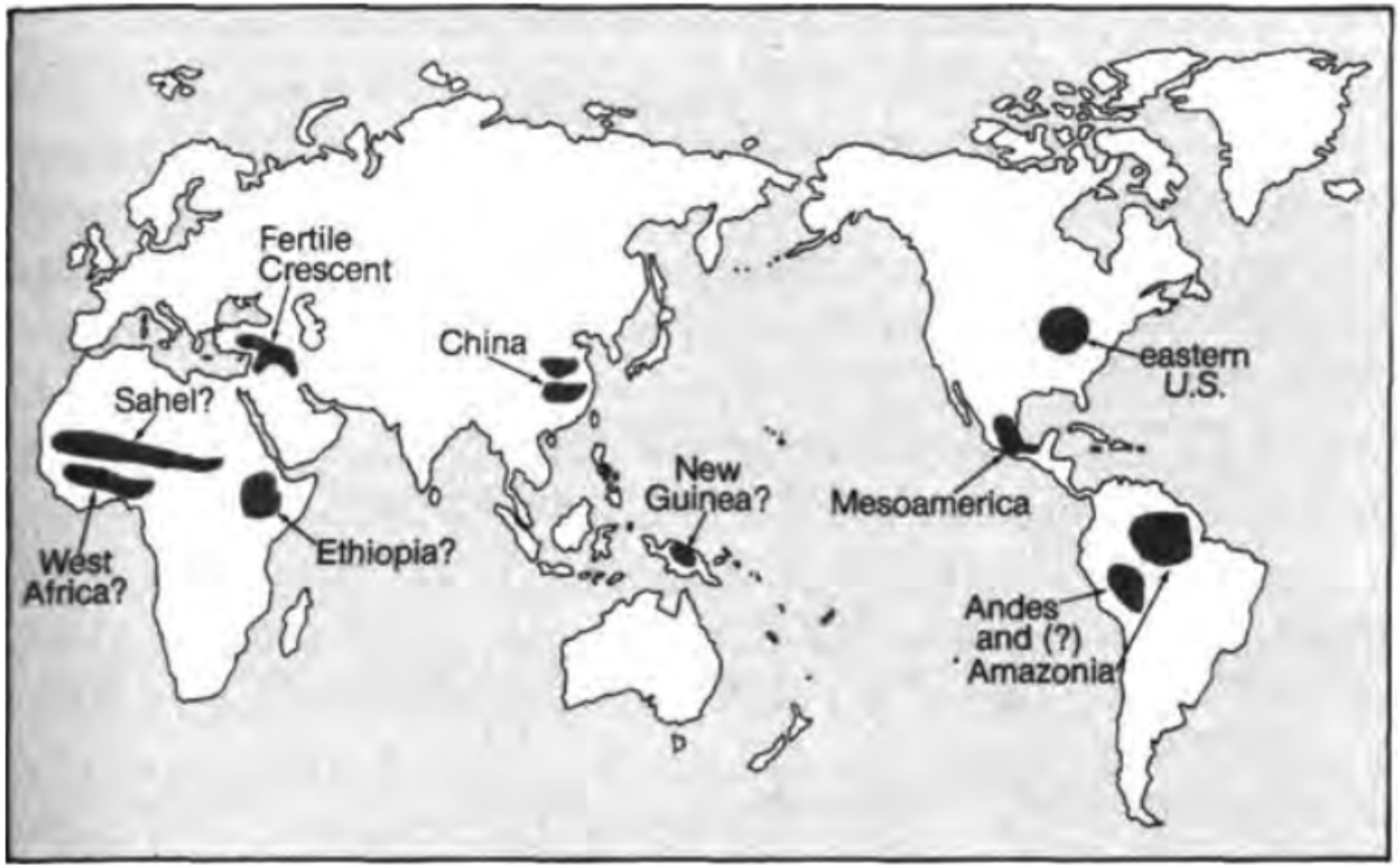
Domesticable Animal Species I



- Surprisingly few species of animals are domesticable
- "The major 5":
    1. Cattle (Cow, Ox)
    2. Horses
    3. Sheep
    4. Pigs
    5. Goats
- "The minor 9": Arabian camel, Bactrian camel, Llama and Alpaca, Donkey, Reindeer, Water Buffalo, Yak, Bali cattle, Mithun cattle

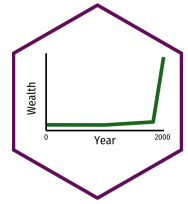
Independent Origins of Agriculture and Civilization





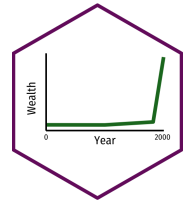
Diamond (1999: p. 99)

Domesticable Animal Species II



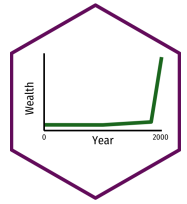
- The wild ancestors of these 14 animal species were **not** evenly distributed across the world
- Sub-Saharan Africa: 0
- North and South America: 1
- Eurasia: 13

Are These The Only Domesticable Animals?



- Clear demand for domestication: these have been domesticated *independently* around the world several times
- Rapid use of these animals when introduced to a non-indigenous area
- Many animals cannot be domesticated (temperament, diet, inefficient food/power ratio, lack of herd, breeding problems)

What's Important About Domesticated Animals?



- **Nutrition**: source of milk and meat
- **Supplies**: leather, clothing, shelter
- **Power Source**: particularly for agriculture (plowing)
- **Military**: mounted cavalry

Domesticable Animal Species

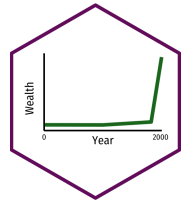


TABLE 9.2 Mammalian Candidates for Domestication

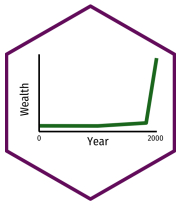
	Continent			
	Eurasia	Sub-Saharan Africa	The Americas	Australia
Candidates	72	51	24	1
Domesticated species	13	0	1	0
Percentage of candidates domesticated	18%	0%	4%	0%

A "candidate" is defined as a species of terrestrial, herbivorous or omnivorous, wild mammal weighing on the average over 100 pounds.

Diamond (1999: p. 162)

Diamond, Jared, 1999, *Guns, Germs, and Steel: The Fates of Human Societies*

Domesticable Plant Species I



- Today, wheat and rice account for 41% of all total calories consumed in the world
    - Wheat (originally from Fertile Crescent)
    - Rice (originally from China)
- Wheat, rice, barley, sorghum, and corn are the top 5 crops
    - indigenous ancestors are *very* close to the modern domesticated version
    - *EXCEPT* for corn — wild maize in Meso-America is very different, took longer to domesticate
- Other plants surprisingly hard to domesticate

Domesticable Plant Species II

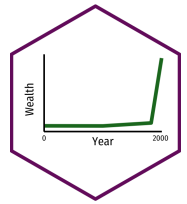
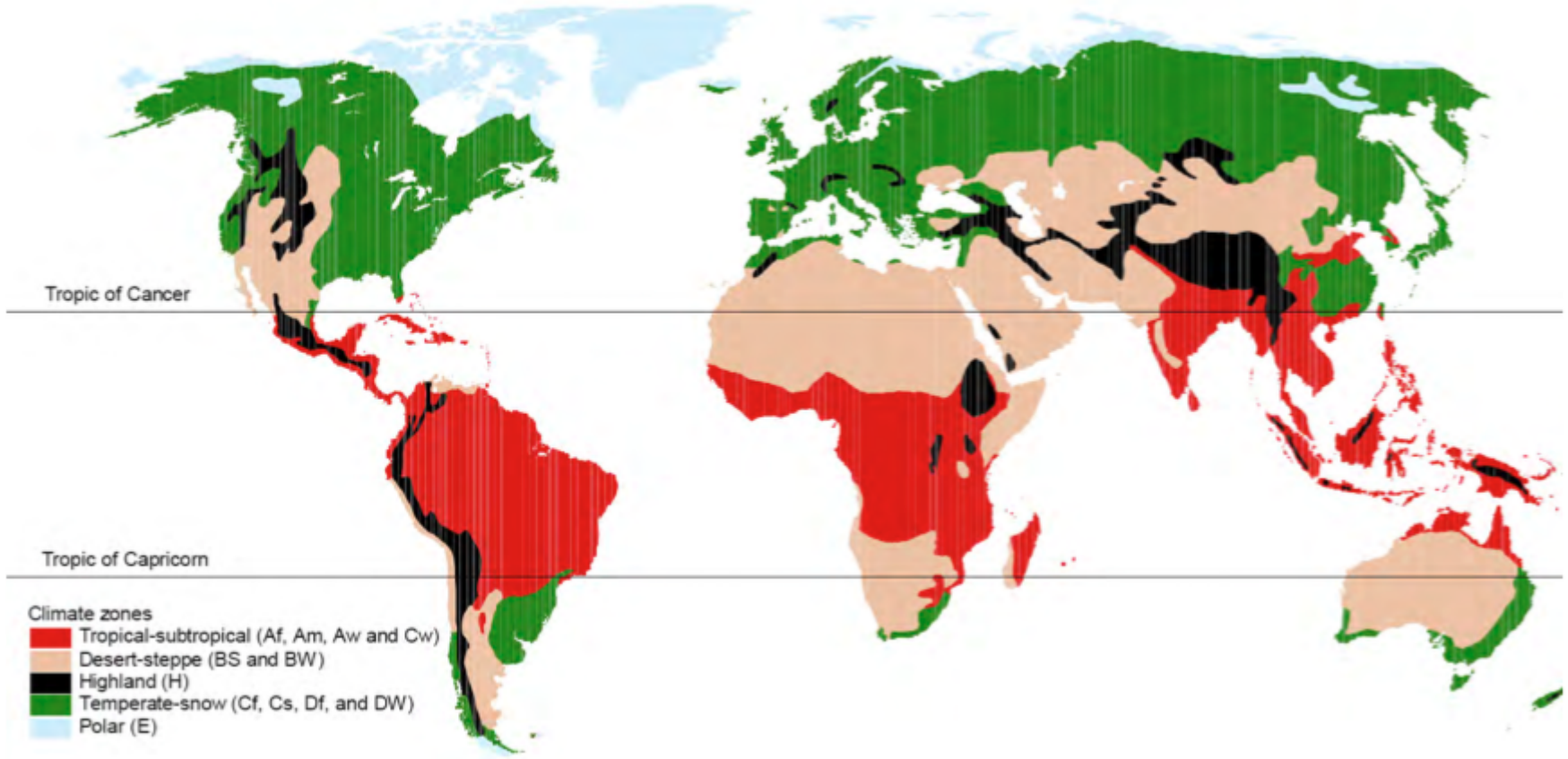


TABLE 8.1 World Distribution of Large-Seeded Grass Species

Area	*Number of Species*	
West Asia, Europe, North Africa		33
Mediterranean zone	32	
England	1	
East Asia		6
Sub-Saharan Africa		4
Americas		11
North America	4	
Mesoamerica	5	
South America	2	
Northern Australia		2
	Total:	56

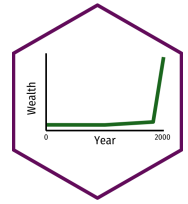
Diamond (1999: p. 140)

Variation and Spread of Species I

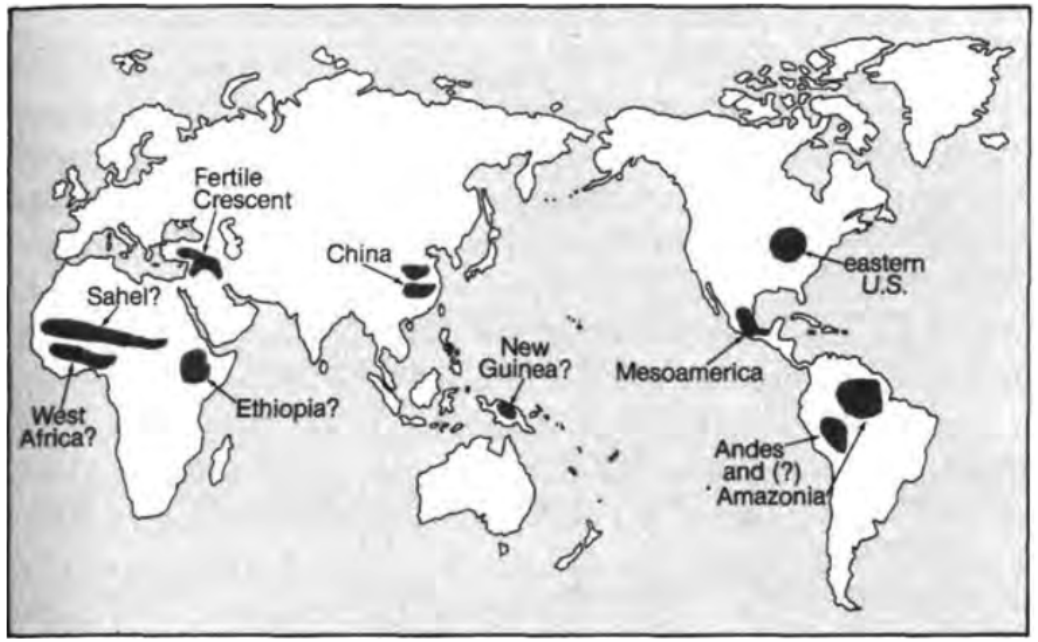


Sachs, Jeffrey, (2000), "Tropical Underdevelopment." CID Working Paper No. 57.

Variation and Spread of Species II



- Before ocean-going ships, domesticable species cannot easily traverse different climates
- Easier to spread across **latitude** (E/W) than **longitude** (N/S)
- Societies across the same latitude have access to more species
- **Ideas, best practices, and technology can more easily spread *East-West* than *North-South***
    - More species, specialization, division of labor, innovation



Variation and Spread of Species III

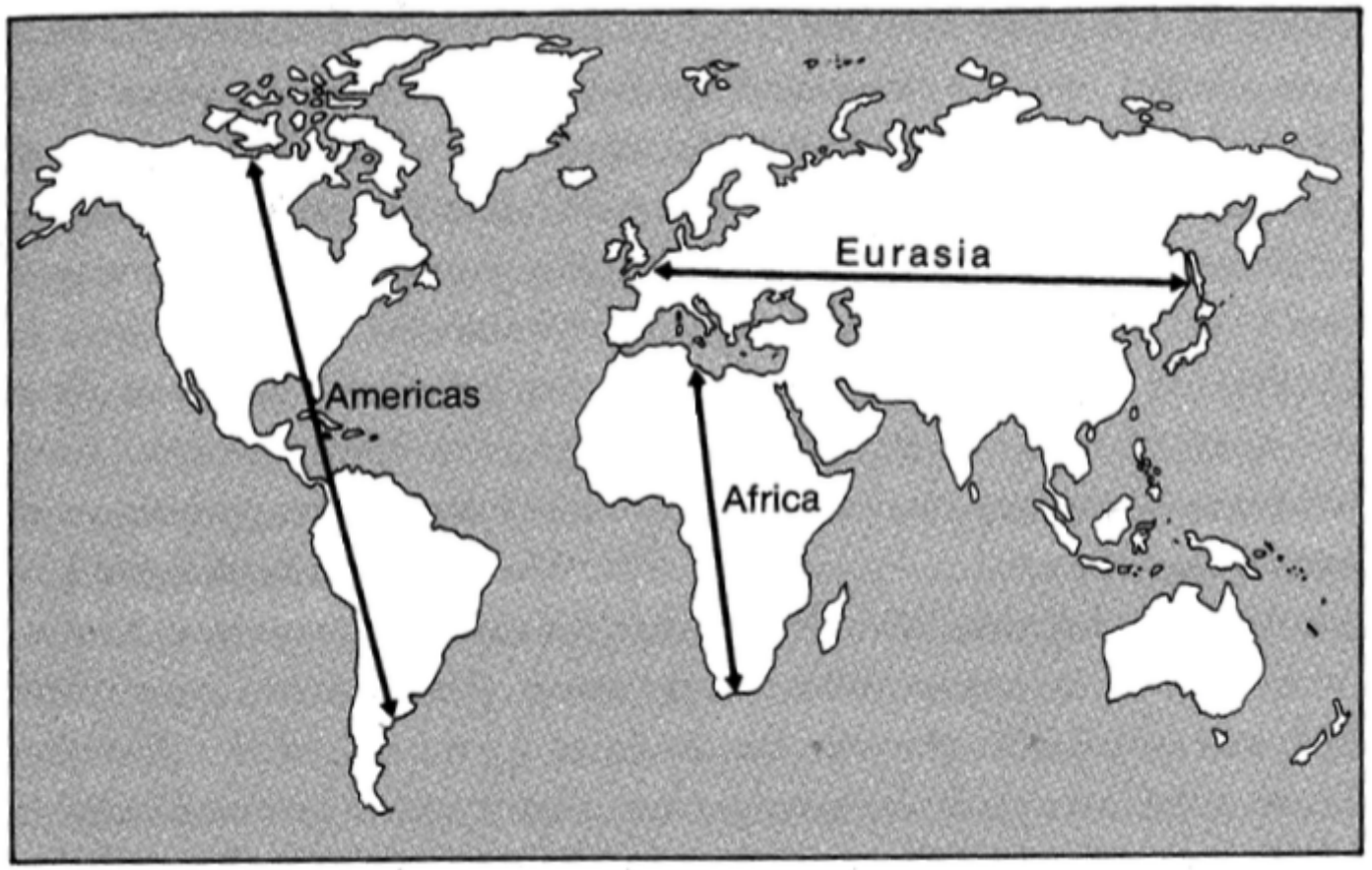
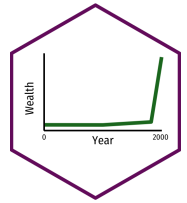


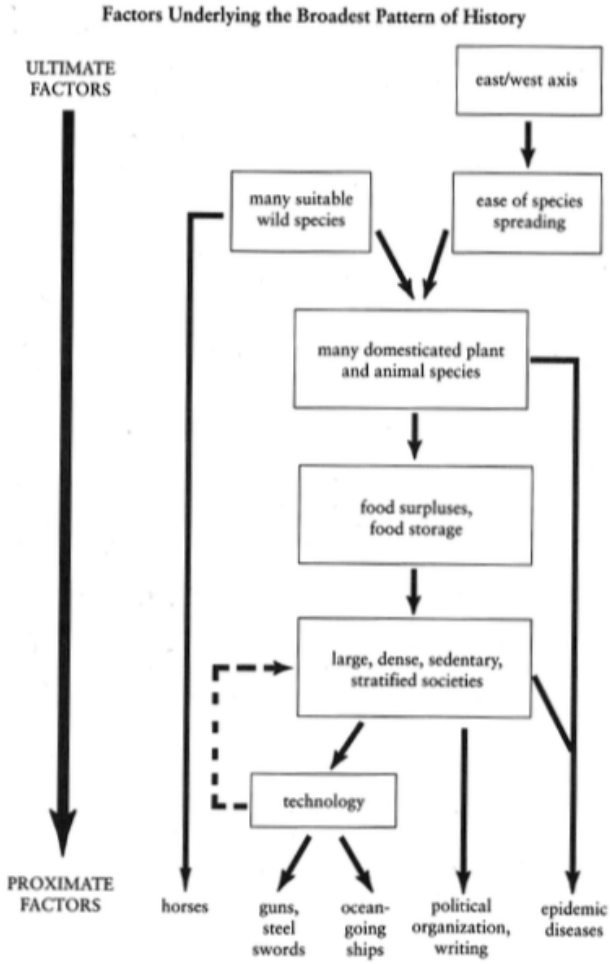
Figure 10.1. Major axes of the continents.

Diamond (1999: p. 177)

Diamond's Argument I



- Regions of the world with access to more species (Eurasia) ...
- ... develop agriculture earlier ...
- ... leading to cities and civilization ...
- ... which acquires and adopts technology sooner ...
- ... and gets "guns, germs, and steel"

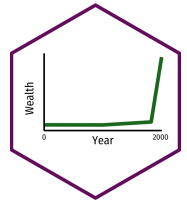


Diamond, Jared, 1999, *Guns, Germs, and Steel: The Fates of Human Societies*

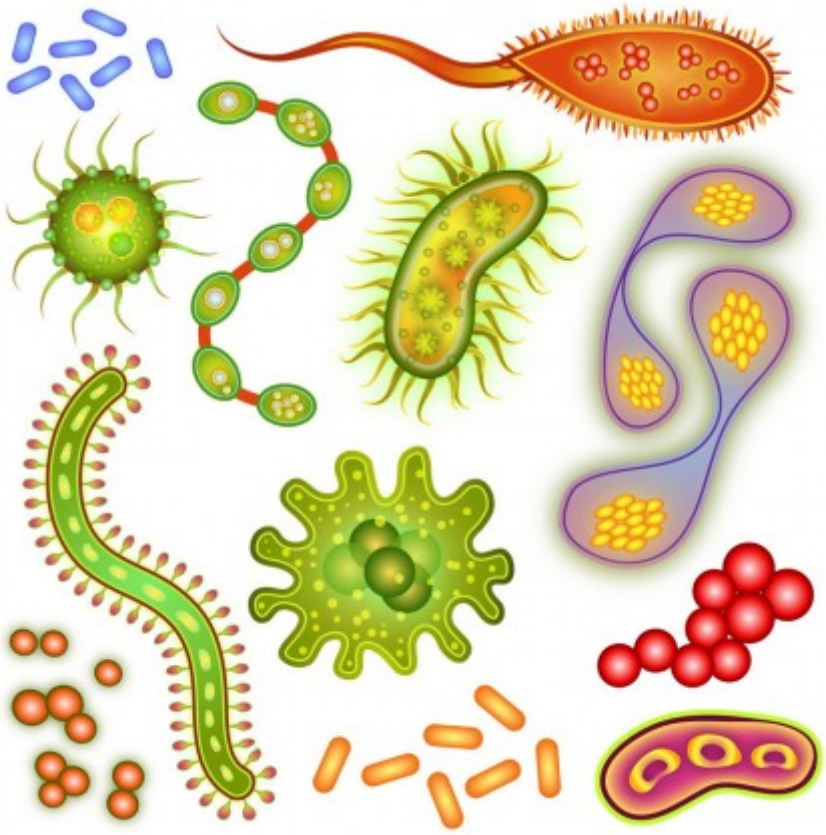
Guns and Steel

So how can 168 men with a few guns and horses conquer a 10,000,000 person empire?

Germs



- In 1520, it took one sick person to bring smallpox to South America, where it may have killed **90% of the population**



Germs II

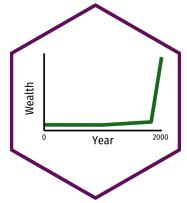


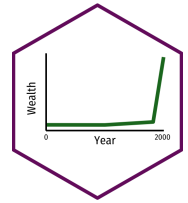
TABLE 11.1 Deadly Gifts from Our Animal Friends

Human Disease	*Animal with Most Closely Related Pathogen*
Measles	cattle (rinderpest)
Tuberculosis	cattle
Smallpox	cattle (cowpox) or other livestock with related pox viruses
Flu	pigs and ducks
Pertussis	pigs, dogs
Falciparum malaria	birds (chickens and ducks?)

Diamond (1999: 207)

Diamond, Jared, 1999, *Guns, Germs, and Steel: The Fates of Human Societies*

Germs III



- Europeans lived in extremely close proximity to their domesticated animals
- Repeatedly decimated by these diseases
- Evolved some immunity to them

Germs IV

John Winthrop

(1587-1649)

3rd Governor of Massachusetts Bay Colony

> "But for the natives in these parts, God hath so pursued them, as for 300 miles space the greatest part of them are swept away by the smallpox which still continues among them. So as God hath thereby cleared our title to this place, those who remain in these parts, being in all not 50, have put themselves under our protection."

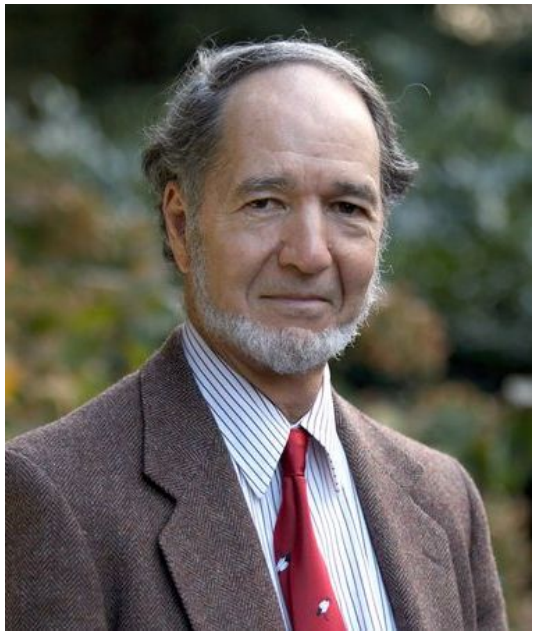
Germs V

James I, King of England

(1566-1625)

> "Almighty God in his great goodness and bounty towards us [for sending] this wonderful plague among the savages."

Assessing Diamond

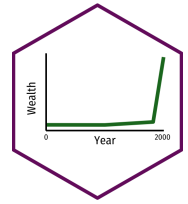


Jared Diamond

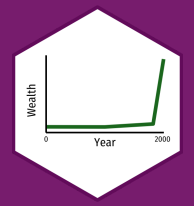
(1937-)

- One of the most influential books of the last 30 years, especially among general public
- A great (*great*) big-picture story
- Is it testable??

Diamond Gets Us To About 1500

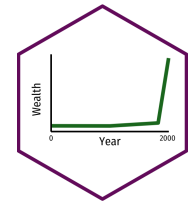


- Consider modern France and China
- Both have favorable geography according to Diamond's hypothesis
- Roughly equally developed in 1500 (China moreso)
- GDP/capita today (WB, 2021):
    - France: $38,625 (Source: WB, 2021)
    - China: $10,500 (Source: WB, 2021)



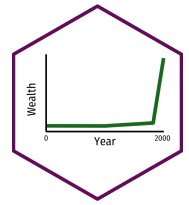
Geography and the “Deep Roots” of Development

The "Deep Roots" of Development I



- Literature on "deep roots" of development with really provocative titles (and implications)
- Many aspects to this literature:
  - “state history”
  - culture
  - migration (origins)
  - technology adoption
- We will focus on the role of **geography** in economic development

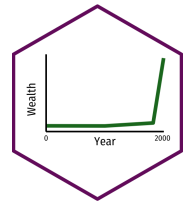
The "Deep Roots" of Development II



- Main question:

> How much of variation in GDP per capita TODAY can we explain by unchangable geographic factors?

The "Deep Roots" of Development II



- Main question:

> How much of variation in GDP per capita TODAY can we explain by unchangable geographic factors?

- Answer: **a surprising amount.**

Geography and Economic Development I

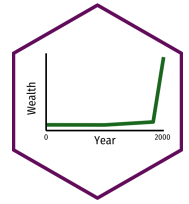
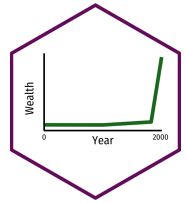


TABLE 1
GEOGRAPHY AND CONTEMPORARY DEVELOPMENT
(*Dependent variable: log per capita income, 2005; estimator: OLS*)

Sample:	Whole World	Olsson–Hibbs sample[a]	Olsson–Hibbs sample[a]	Olsson–Hibbs sample[a]	Olsson–Hibbs sample[a]	Old World only
	(1)	(2)	(3)	(4)	(5)	(6)
Absolute latitude	0.044 (6.645)***	0.052 (7.524)***				
Percent land area in the tropics	–0.049 (0.154)	0.209 (0.660)	–0.410 (1.595)	–0.650 (2.252)**	–0.421 (1.641)	–0.448 (1.646)
Landlocked dummy	–0.742 (4.375)***	–0.518 (2.687)***	–0.499 (2.487)**	–0.572 (2.622)**	–0.505 (2.523)**	–0.226 (1.160)
Island dummy	0.643 (2.496)**	0.306 (1.033)	0.920 (3.479)***	0.560 (1.996)**	0.952 (3.425)***	1.306 (4.504)***
Geographic conditions (Olsson–Hibbs)[b]			0.706 (6.931)***		0.768 (4.739)***	0.780 (5.167)***
Biological conditions (Olsson–Hibbs)[c]				0.585 (4.759)***	–0.074 (0.483)	0.086 (0.581)
Constant	7.703 (25.377)***	7.354 (25.360)***	8.745 (61.561)***	8.958 (58.200)***	8.741 (61.352)***	8.438 (60.049)***
Observations	155	102	102	102	102	83
Adjusted R^2	0.440	0.546	0.521	0.449	0.516	0.641

Spolaore, Enrico and Romain Wacziarg, 2013, "How Deep Are the Roots of Economic Development?" *Journal of Economic Literature* 51(2): 1-45

Geography and Economic Development II

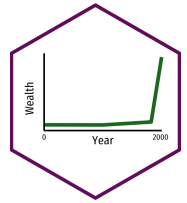


> "In order to reduce the effect of post-1500 population movements, the Olsson–Hibbs sample excludes the neo-European countries (Australia, Canada, New Zealand, and the United States), as well as countries whose current income is based primarily on extractive wealth. Column 2 replicates the estimates of column 1 using this restricted sample—the joint explanatory power of geographic variables rises to 55 percent, since the new sample excludes regions that are rich today as a result of the guns, germs, and steel of colonizing Europeans rather than purely geographic factors," (p.5).

Spolaore, Enrico and Romain Wacziarg, 2013, "How Deep Are the Roots of Economic Development?" *Journal of Economic Literature* 51(2): 1-45

Olsson, Ola, and Douglas A. Hibbs Jr, 2005, "Biogeography and Long-Run Economic Development," *European Economic Review* 49(4): 909-938

Geography and Economic Development III



> These empirical results provide **strong evidence in favor of Diamond's hypotheses,** while suggesting that **the geographic component of the story is empirically more relevant than the biological component.** Column 6 goes further in the attempt to control for the effect of post-1500 population movements, by restricting the sample to the Old World (defined as all countries minus the Americas and Oceania). The effect of geography now rises to 64 percent—again highly **consistent with Diamond's idea that biogeographic conditions matter mostly in the Old World**," (p.5).

Spolaore, Enrico and Romain Wacziarg, 2013, "How Deep Are the Roots of Economic Development?" *Journal of Economic Literature* 51(2): 1-45

Geography and Economic Development IV

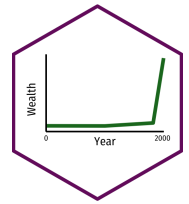
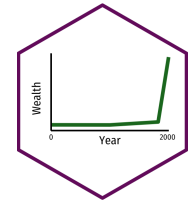


TABLE 2
GEOGRAPHY AND DEVELOPMENT IN 1500 AD

Dependent Variable:	Years since agricultural transition	Population density in 1500	Population density in 1500	Population density in 1500
Estimator:	OLS	OLS	OLS	IV
	(1)	(2)	(3)	(4)
Absolute latitude	–0.074 (3.637)***	–0.022 (1.411)	0.027 (2.373)**	0.020 (1.872)*
Percent land area in the tropics	–1.052 (2.356)**	0.997 (2.291)**	1.464 (3.312)***	1.636 (3.789)***
Landlocked dummy	–0.585 (2.306)**	0.384 (1.332)	0.532 (1.616)	0.702 (2.158)**
Island dummy	–1.085 (3.699)***	0.072 (0.188)	0.391 (0.993)	0.508 (1.254)
Number of annual or perennial wild grasses	0.017 (0.642)	0.030 (1.105)		
Number of domesticable big mammals	0.554 (8.349)***	0.258 (3.129)***		
Years since agricultural transition			0.426 (6.694)***	0.584 (6.887)***
Constant	4.657 (9.069)***	–0.164 (0.379)	–2.159 (4.421)***	–2.814 (5.463)***
Observations	100	100	98	98
Adjusted R^2	0.707	0.439	0.393	—

Notes: Robust t statistics in parentheses.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

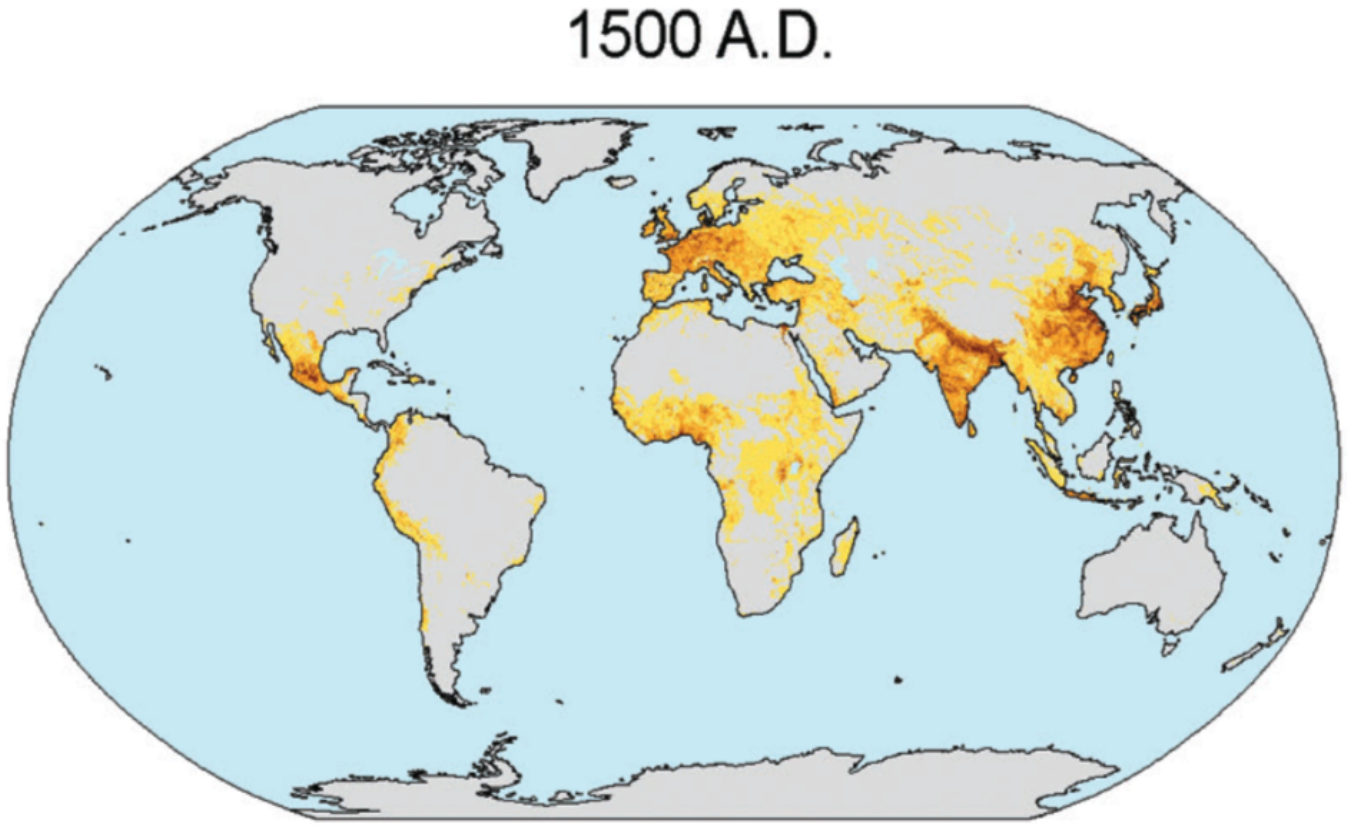
Geography and Economic Development V



> While geographic factors may have continued to affect economic development after the introduction of agriculture, the availability of prehistoric domesticable wild plant and animal species did not influence population density in the past two millennia other than through the timing of the Neolithic transition...The results of column 3 (OLS) and column 4 (IV) of table 2 illustrate their findings: **years since the agricultural transition has a strong, statistically significant positive effect on population density in 1500**...The magnitude of the effect is large, as a one standard deviation change in years of agriculture is associated with 63 percent of a standard deviation change in log population density in 1500 (OLS)..All of the other regressors feature much smaller standardized effects.
>
> They show, not only that **an earlier onset of the Neolithic transition contributed to the level of technological sophistication in the preindustrial world**, but also that **the effect of Diamond's biogeographic factors may well operate through the legacy of an early exposure to agriculture**," (pp.7-8).

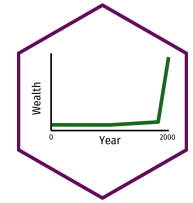
Spolaore, Enrico and Romain Wacziarg, 2013, "How Deep Are the Roots of Economic Development?" *Journal of Economic Literature* 51(2): 1-45

Population Density in 1500



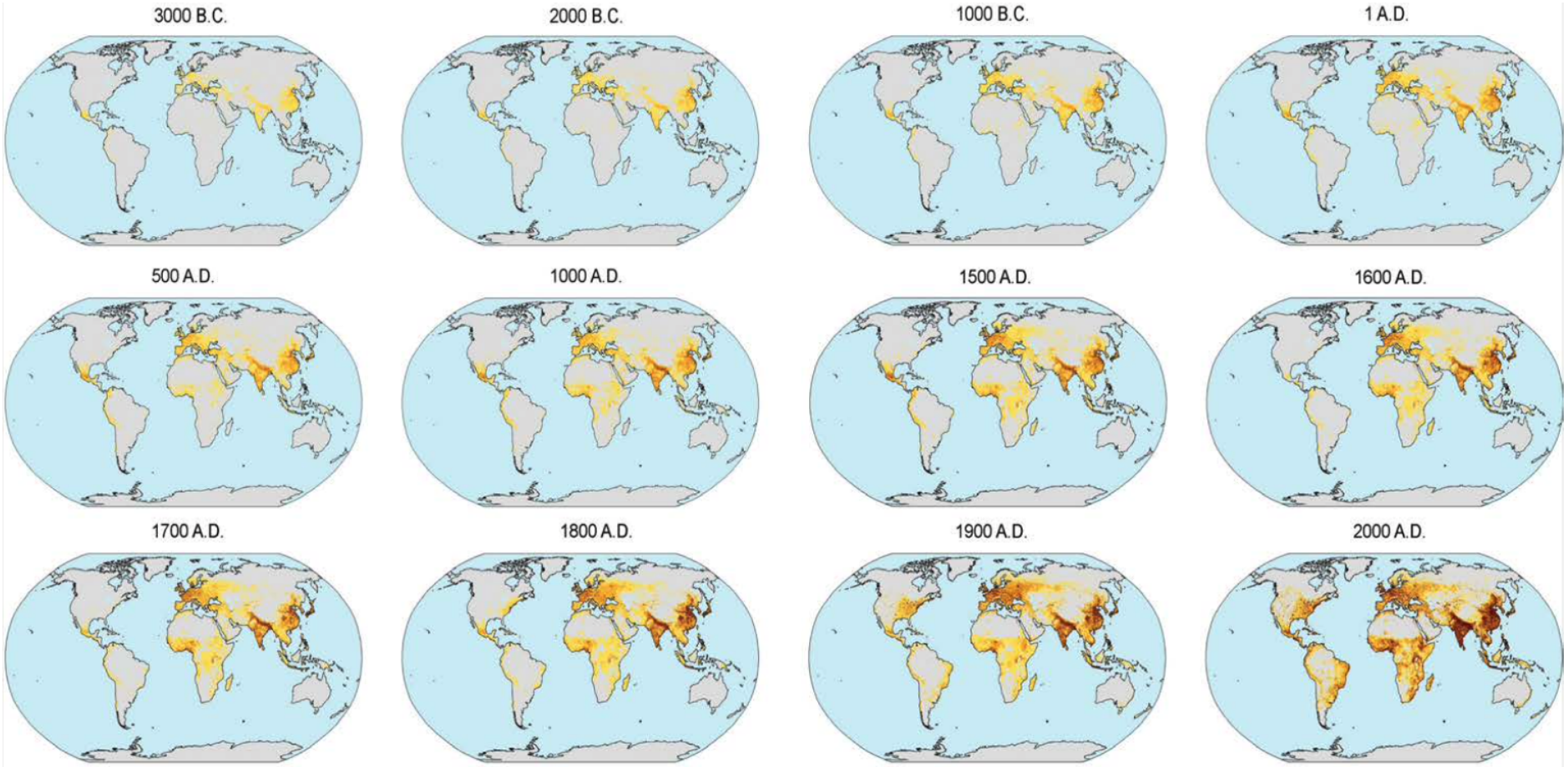
Gallup, J. L., J. D. Sachs, and A. D. Mellinger, 1999; Wikipedia; A Great Interactive Version

Aside: Population Density as Proxy for Development



- Population density is a good proxy for economic development
- Better than wages or real incomes
- Malthusian dynamics of a pre-modern economy
    - More prosperous regions have high population $\Longrightarrow$ lowers real wages
- Population is also easier to measure and get data for than real wages!

Population Density Since 3000 B.C.



Source: Kees Klein Goldewijk, Arthur Beusen and Peter Janssen (2010) – *Long-term dynamic modeling of global population and built-up area in a spatially explicit way*: HYDE 3.1. The Holocene June 2010 vol. 20 no. 4 565-573.

Deep Roots, Tech. Adoption, & Urbanization

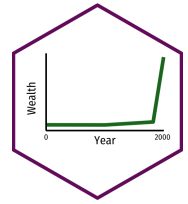


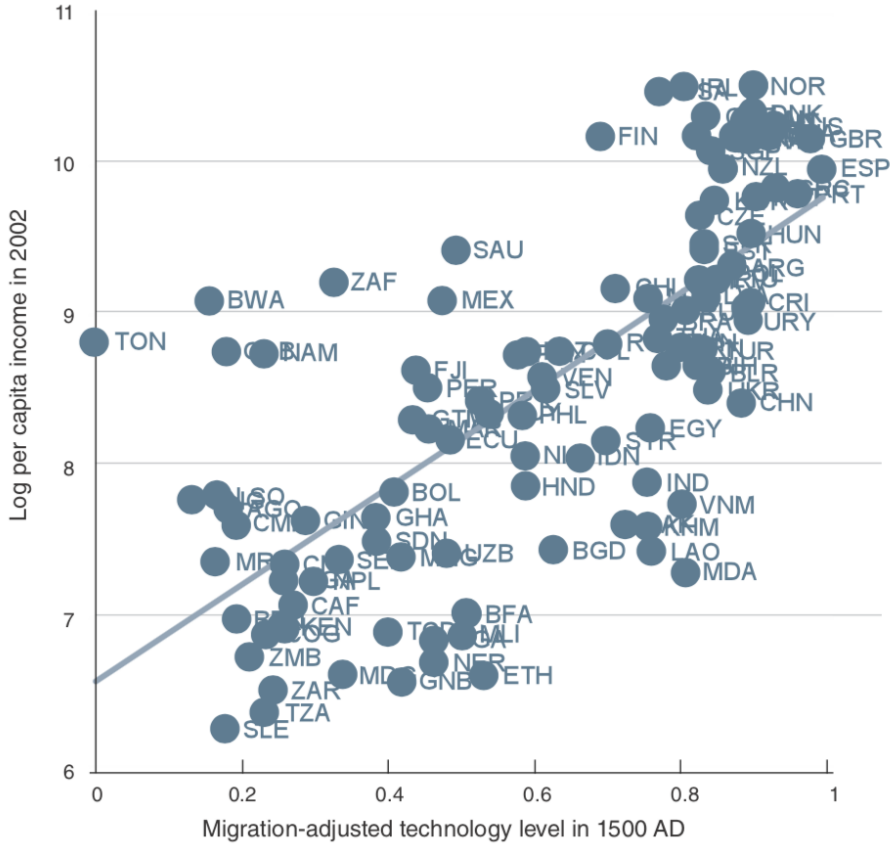
TABLE 6—TECHNOLOGY MEASURES AND CONTEMPORARY URBANIZATION ESTIMATES

Dependent variable: urbanization rate in	1000 BC	0 AD	1500 AD
Overall technology adoption level in 1000 BC	2.08		
	(10.48)		
Overall technology adoption level in 0 AD		1.69	
		(6.99)	
Overall technology adoption level in 1500 AD			8.04
			(2.57)
Distance from equator			
Observations	113	135	54
R^2	0.5	0.58	0.18

Notes: *t*-statistics in parentheses computed using robust standard errors clustered to take into account the correlation in the information used in the coding of technology. All regressions include a constant.

Comin, Diego, William Easterly, and Erick Gong, (2010), "Was the Wealth of Nations Determined in 1000 BC?" *American Economic Journal: Macroeconomics* 2: 65-97

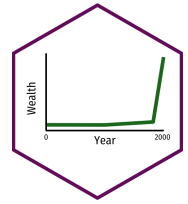
Deep Roots, Tech. Adoption, & Urbanization



"1500 AD technology is a particularly powerful predictor of per capita income today. 78 percent of the difference in income today between sub-Saharan Africa and Western Europe is explained by technology differences that already existed in 1500 A.D. – even BEFORE the slave trade and colonialism…Moreover, these technological differences had already appeared by 1000 BC. The state of technology in 1000 BC has a strong correlation with technology 2500 years later, in 1500 AD." - Easterly, blog post about paper

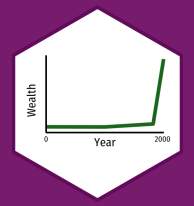
Comin, Diego, William Easterly, and Erick Gong, (2010), "Was the Wealth of Nations Determined in 1000 BC?" *American Economic Journal: Macroeconomics* 2: 65-97

Deep Roots, Tech. Adoption, & Urbanization



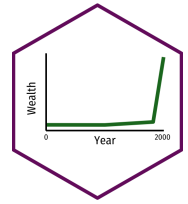
> "The main finding of this paper is a simple one. **Technology in 1500 AD is associated with the wealth of nations today.** This is robust to including continent dummies and geographic controls, so **it is not just driven by "Europe versus Africa" or " tropical versus temperate zones."** There are two notable parts of the finding. The first is that technology as old as 1500 AD is a historical correlate of development when we consider that **most historical discussions of developing countries start with post-1500 European contact and colonization.** The second notable aspect of our finding is that **the magnitude of the association between historical technology adoption and current development is nontrivial.** In our baseline specification for migration-adjusted technology, going from having none to **having adopted all the technologies available in 1500 AD is associated with an increase in current per capita GDP by a factor of 26.** More realistically, after including a battery of controls, this multiple is still between 5.9 and 13.3."
>
> "In an effort toward understanding what drives this correlation, we have found suggestive results that **technology is very persistent, that this persistence is not driven only by the persistence of population,** and that it does not disappear when calculated only within sectors after removing the country average adoption level in the period and country-sector fixed effects (hence, controlling for any factors that operate at a country-wide level such as institutions). This evidence provides support to the hypothesis that the technology adoption dynamics, in which the cost of adopting new technology falls with the stock of previous technology, are one of the mechanisms that generates the propagation uncovered in the data," (p.94).

Comin, Diego, William Easterly, and Erick Gong, (2010), "Was the Wealth of Nations Determined in 1000 BC?" *American Economic Journal: Macroeconomics* 2: 65-97



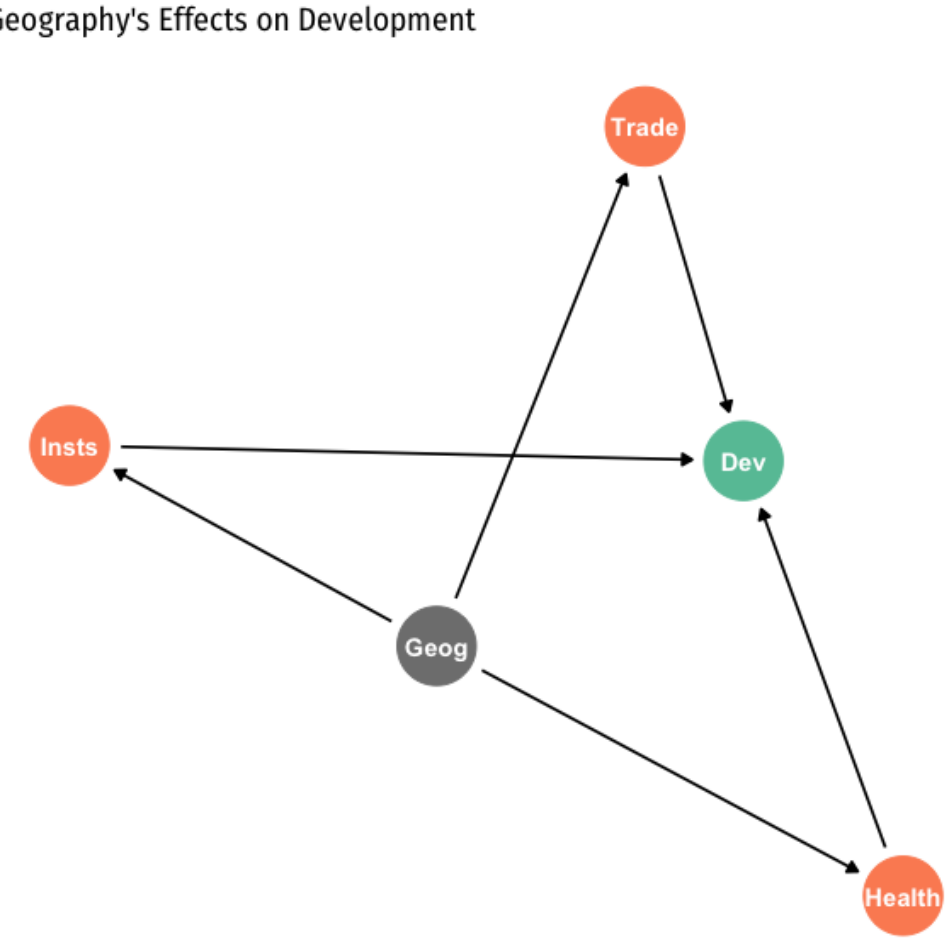
Geography's Mechanisms: Trade & Health

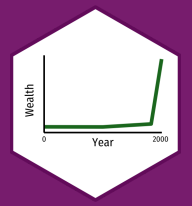
Geography's Mechanisms



- How, *specifically* does geography impact economic development?
- In the language of the literature, and econometrics, what are the specific **mechanisms** or channels by which (good/bad) geography leads to (high/low) growth?
- (At least) three major ones:

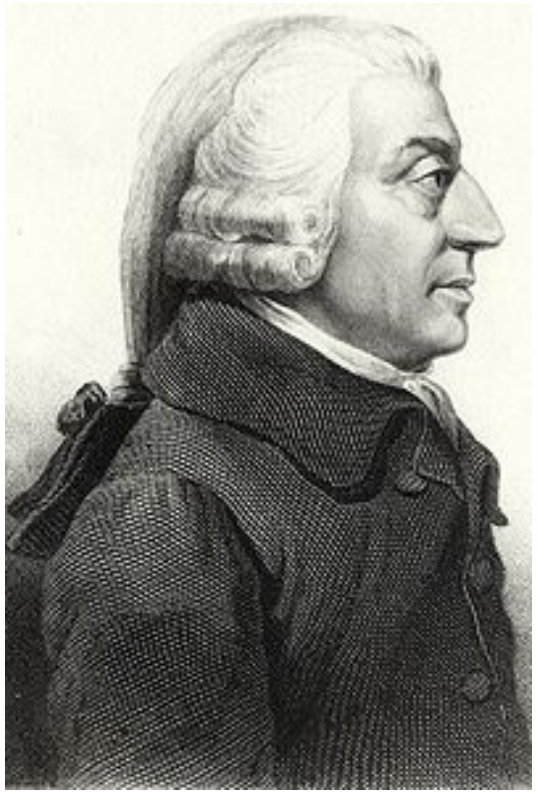
    1. Trade (market access/division of labor)
    2. Health
    3. Institutions





Geography and Trade/Market Access

DOL Is Limited By the Extent of the Market



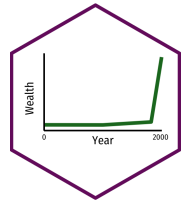
Adam Smith

1723-1790

> "As it is the power of exchanging that gives occasion to the division of labour, so **the extent of this division must always be limited by...the extent of the market.** When the market is very small, no person can have any encouragement to dedicate himself entirely to one employment, for want of the power to exchange all that surplus part of the produce of his own labour, which is over and above his own consumption, for such parts of the produce of other men's labour as he has occasion for," (Book I, Chapter 3).

Smith, Adam, 1776, *An Enquiry into the Nature and Causes of the Wealth of Nations*

Access to Markets Increases Productivity

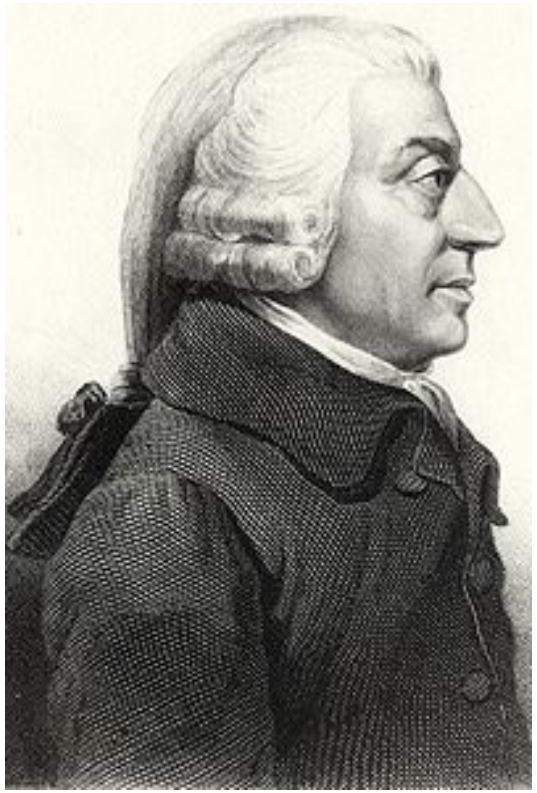


- **Division of labor**: process where people *specialize* in production and then *exchange* their produce with others to acquire all of their desired goods

- **The more trading opportunities, the greater the benefits of specialization**

- Romer (1990) model predicts increasing returns to market access (through human capital and knowledge production)

Geography & Market Access



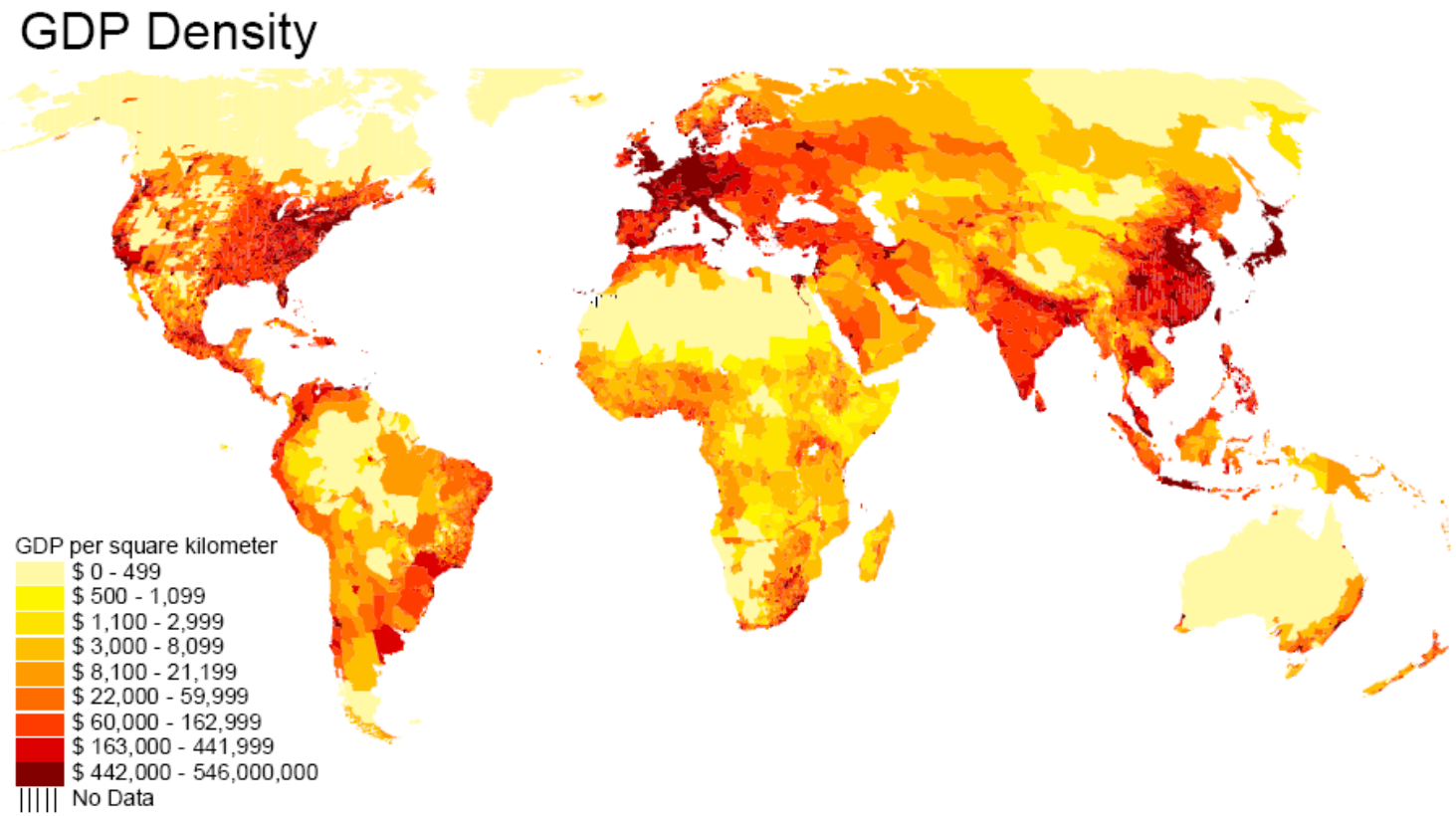
Adam Smith

1723-1790

> "As by means of water carriage a more extensive market is opened to every sort of industry than what land carriage alone can afford it, so it is upon the sea-coast, and along the banks of navigable rivers that industry of every kind begins to sub-divide and improve itself, and it is frequently not till a long time after that those improvements extend themselves to the inland part of the country," (Book I, Chapter 1)

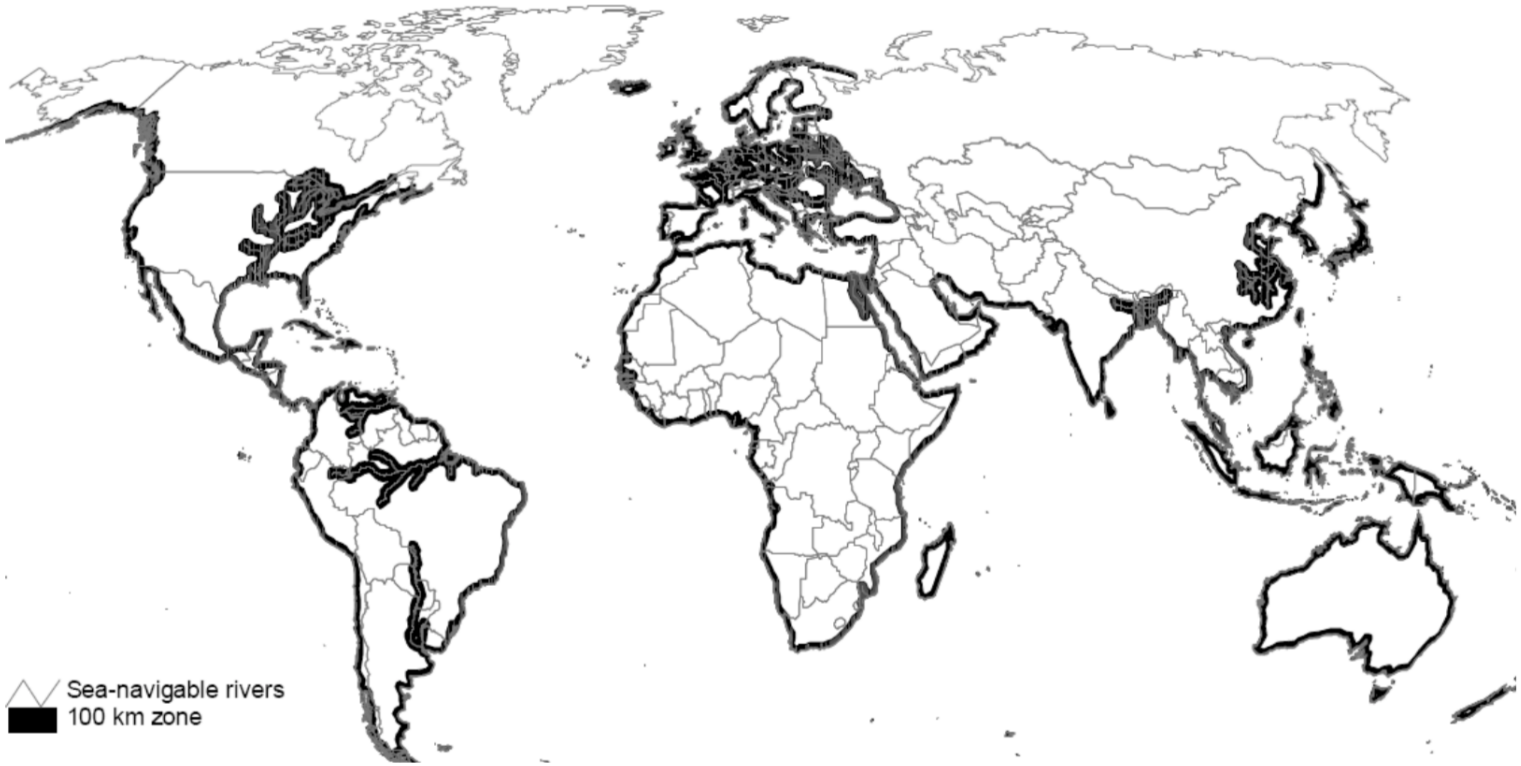
Smith, Adam, 1776, *An Enquiry into the Nature and Causes of the Wealth of Nations*

Geography & Market Access: Today



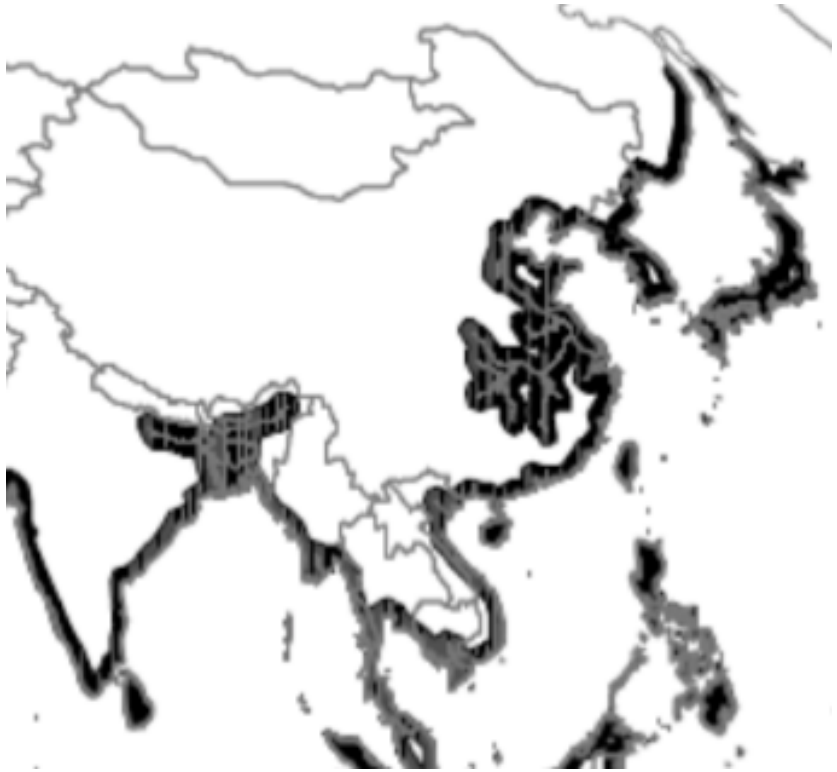
Gallup, J. L., J. D. Sachs, and A. D. Mellinger, 1999, "Geography and Economic Development," *International Regional Science Review* 22(2):179-224; Land of Maps

Access to Coastline and Navigable Rivers I



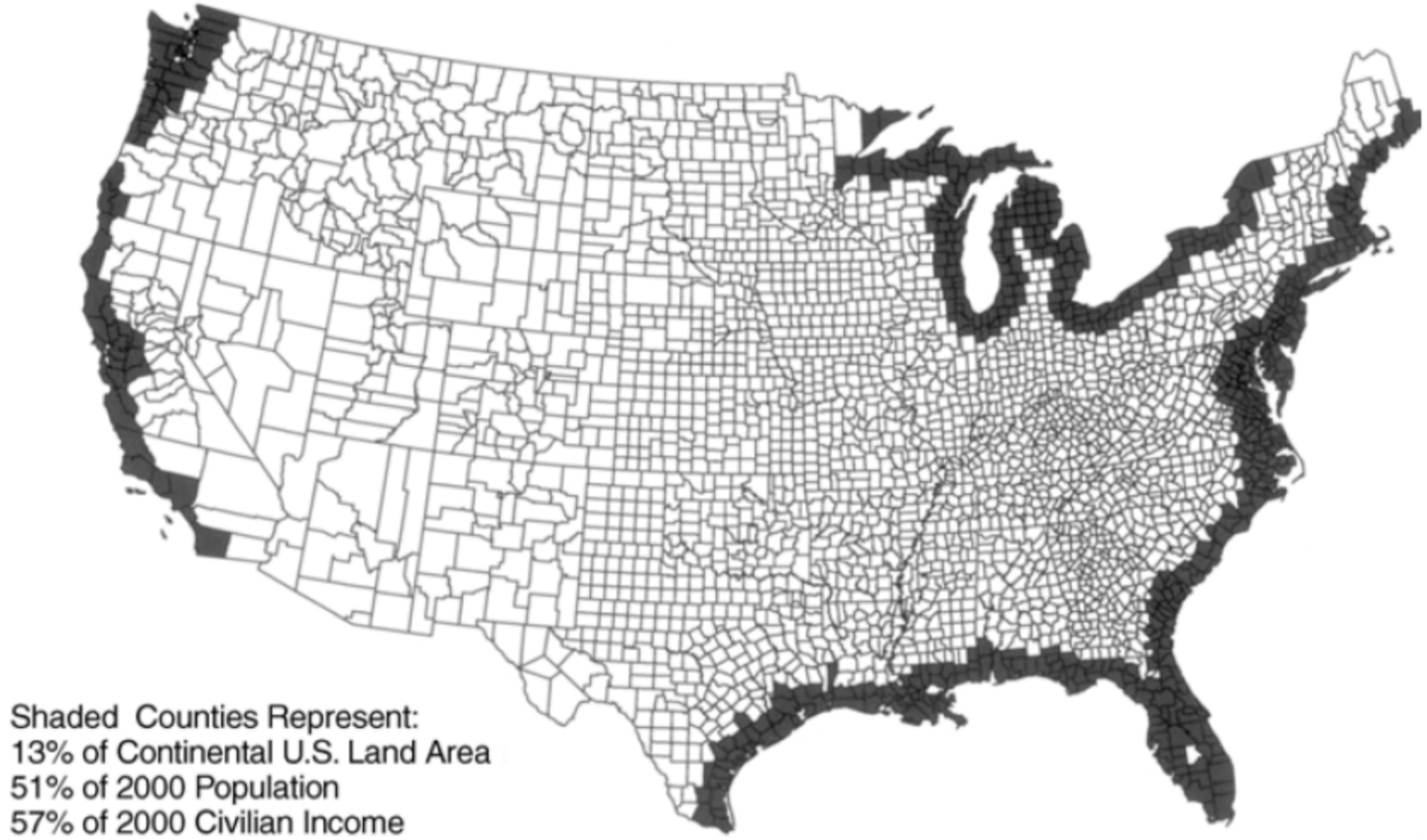
Mellinger, Andrew D., Jeffrey Sachs, and John L. Gallup, (1999), "Climate, Water Navigability, and Economic Development," *CID Working Paper* No. 24

Access to Coastline and Navigable Rivers II



Mellinger, Andrew D., Jeffrey Sachs, and John L. Gallup, (1999), "Climate, Water Navigability, and Economic Development," *CID Working Paper* No. 24

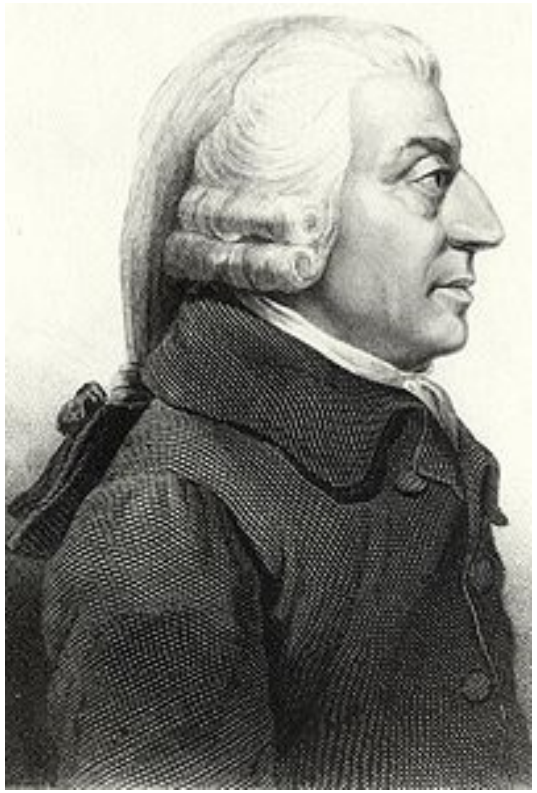
Access to Coastline and Navigable Rivers III



Rappaport, Jordan, and Jeffrey Sachs, (2003), "The United States as a Coastal Nation," *Journal of Economic Growth* 8(1):5-46

Access to Coastline and Navigable Rivers IV

Geography & Market Access: Africa



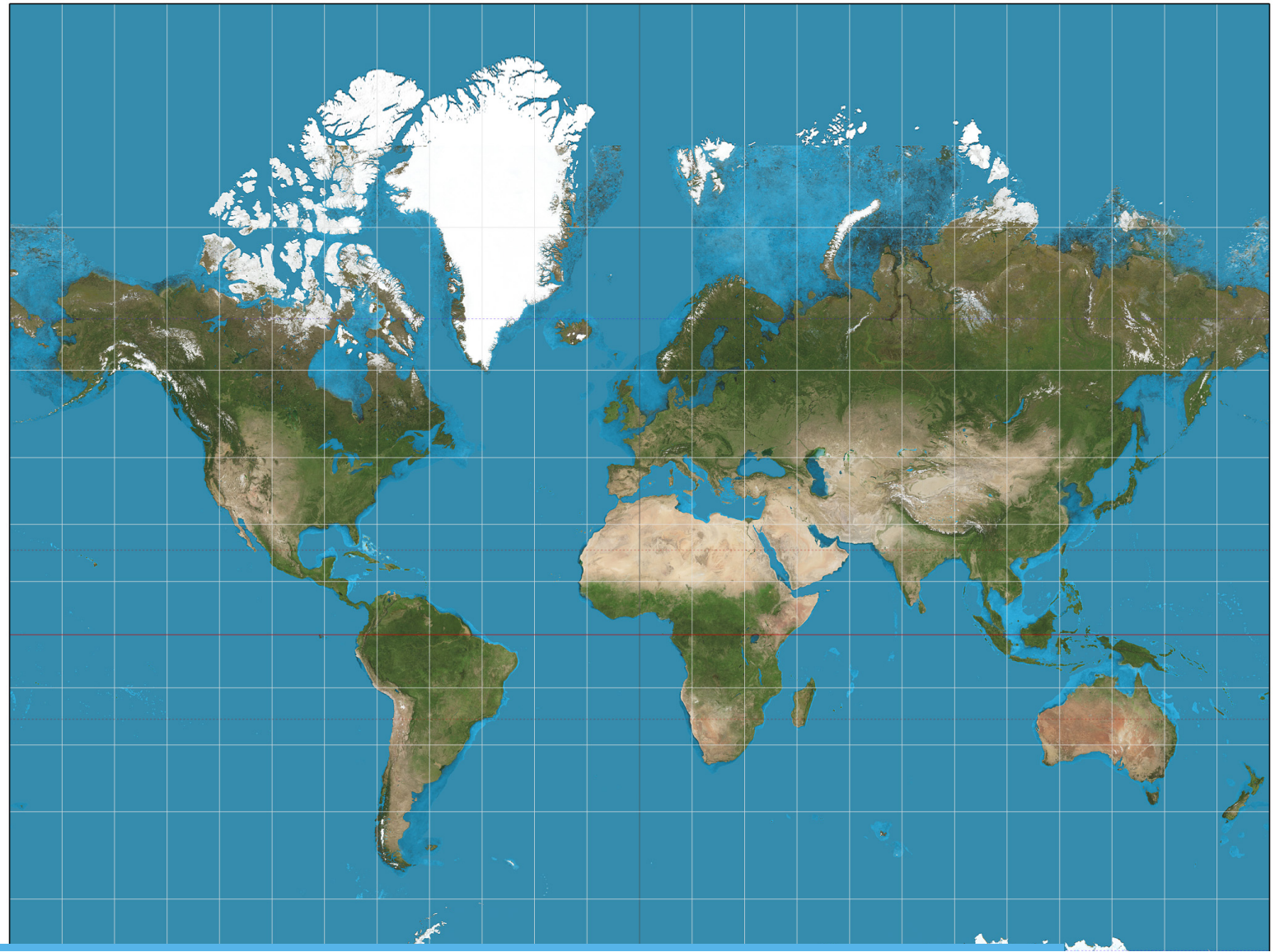
Adam Smith

1723-1790

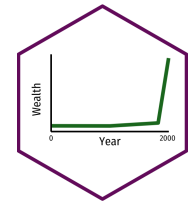
> "All the inland parts of Africa, and all that part of Asia which lies any considerable way north of the Black and Caspian Seas...seem in all ages of the world to have been in the same barbarous and uncivilized state in which we find them at present..."
>
> "There are in Africa none of those great inlets...to carry maritime trade into the interior parts of that great continent...," (Book I, Chapter 1)

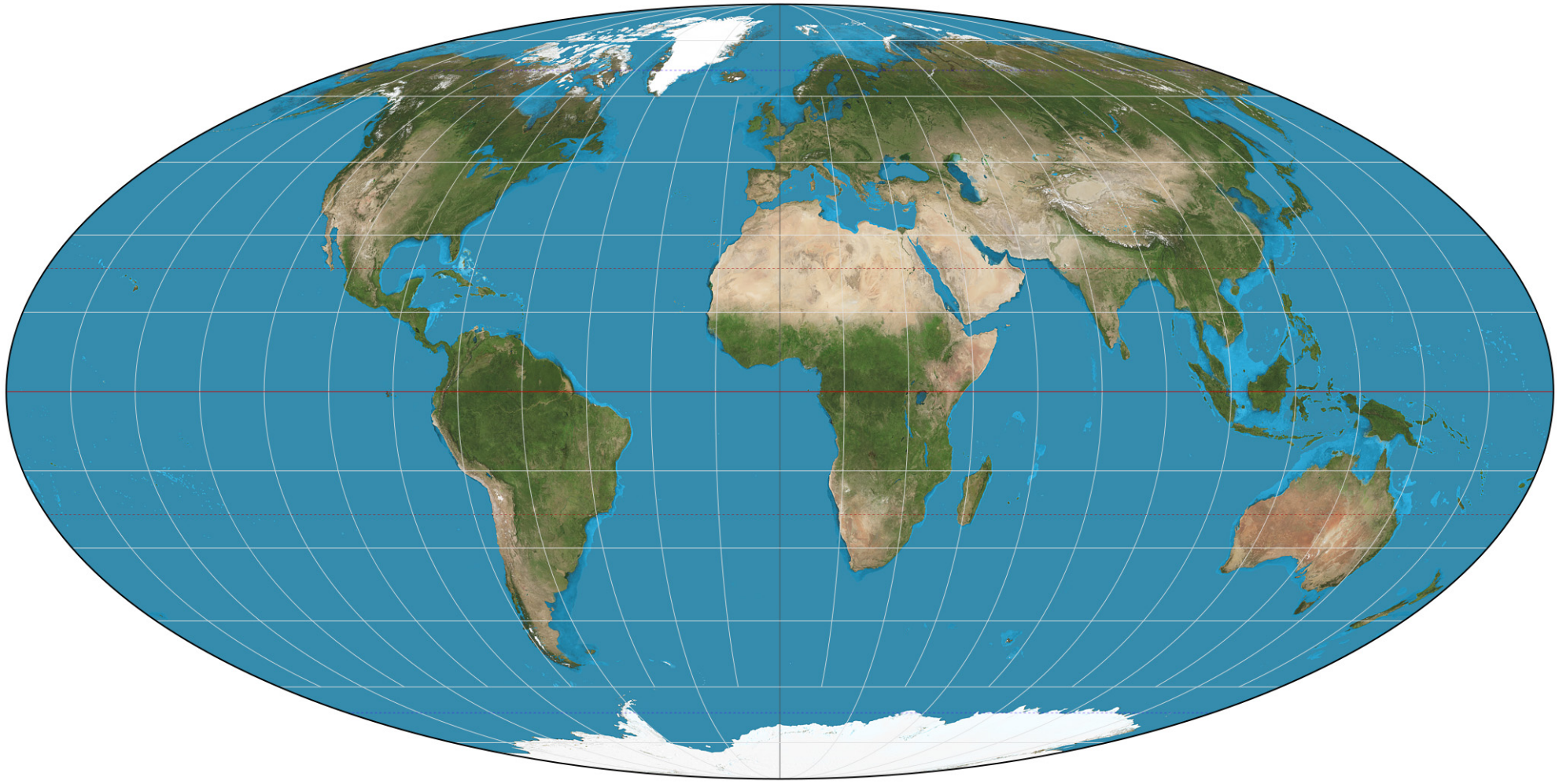
Smith, Adam, 1776, *An Enquiry into the Nature and Causes of the Wealth of Nations*

Distorted Views of Africa: Mercator

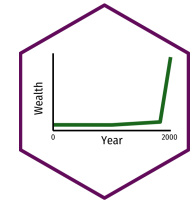


Better Views of Africa: Mollweide





Africa is Huge



The True Size of Africa

A small contribution in the fight against rampant *Immappancy*, by **Kai Krause**

Graphic layout for visualization only (some countries are cut and rotated)
But the conclusions are very accurate: refer to table below for exact data

COUNTRY	AREA x 1000 km²
China	9.597
USA	9.629
India	3.287
Mexico	1.964
Peru	1.285
France	633
Spain	506
Papua New Guinea	462
Sweden	441
Japan	378
Germany	357
Norway	324
Italy	301
New Zealand	270
United Kingdom	243
Nepal	147
Bangladesh	144
Greece	132
TOTAL	**30.102**
AFRICA	**30.221**

In addition to the well known social issues of *illiteracy* and *innumeracy*, there also should be such a concept as "*immappancy*", meaning *insufficient geographical knowledge*.

A survey with random American schoolkids let them guess the population and land area of their country. Not entirely unexpected, but still rather unsettling, the majority chose *"1-2 billion"* and *"largest in the world"*, respectively.

Even with Asian and European college students, geographical estimates were often off by factors of 2-3. This is partly due to the highly distorted nature of the predominantly used mapping projections (such as *Mercator*).

A particularly extreme example is the worldwide misjudgement of the true size of *Africa*. This single image tries to embody the massive scale, which is larger than the *USA, China, India, Japan* and *all of Europe..... combined!*

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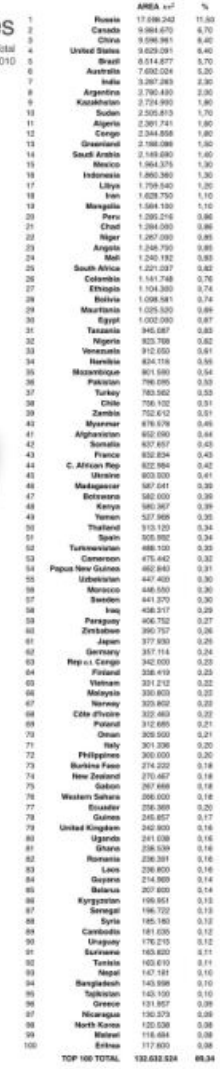
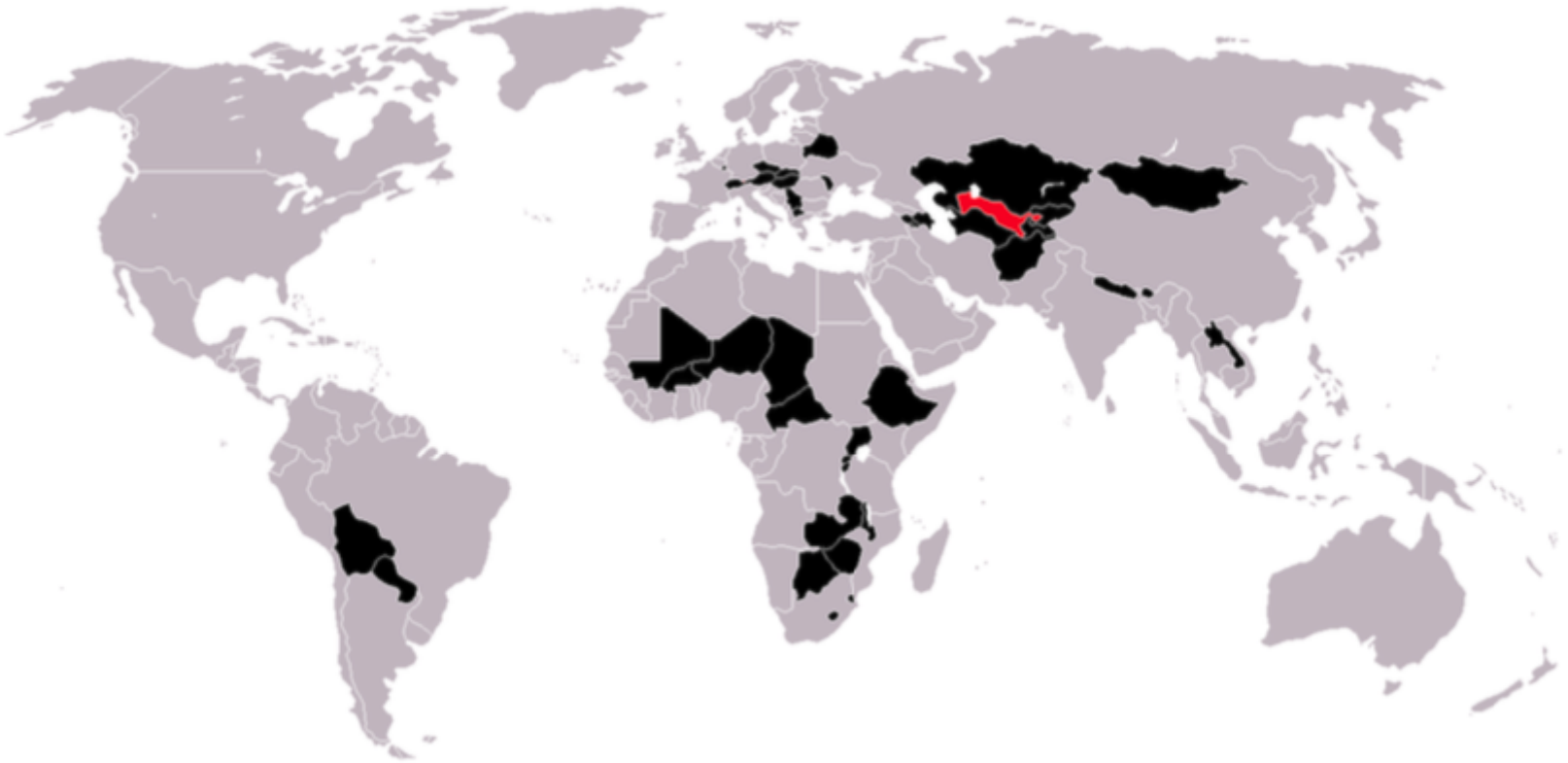
© Kai Krause, IO9

Top 100 Countries

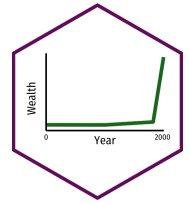
Area in square kilometers, Percentage of World Total
Sources: Britannica, Wikipedia, Almanac 2010



Most Landlocked Countries in Africa



Lack of Market Access Hurts Development



> "Location and climate have large effects on income levels and income growth through their effects on transport costs, disease burdens, and agricultural productivity, among other channels. Geography also seems to affect economic policy choices. Many geographic regions that have not been conducive to modern economic growth have high population densities and are experiencing rapid increases in population. **At particular disadvantage are regions located far from coasts and ocean-navigable rivers, for which the transport costs of international trade are high, and tropical regions, which bear a heavy burden of disease.** Moreover, a large portion of population growth over the next thirty years is expected to occur in these geographically disadvantaged regions."

Gallup, John Luke, Jeffrey D. Sachs, and Andrew D. Mellinger, 1999, "Geography and Economic Development," *International Regional Science Review* 22(2): 179-232

Lack of Market Access Hurts Development

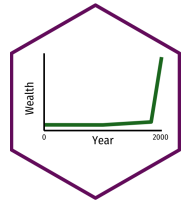


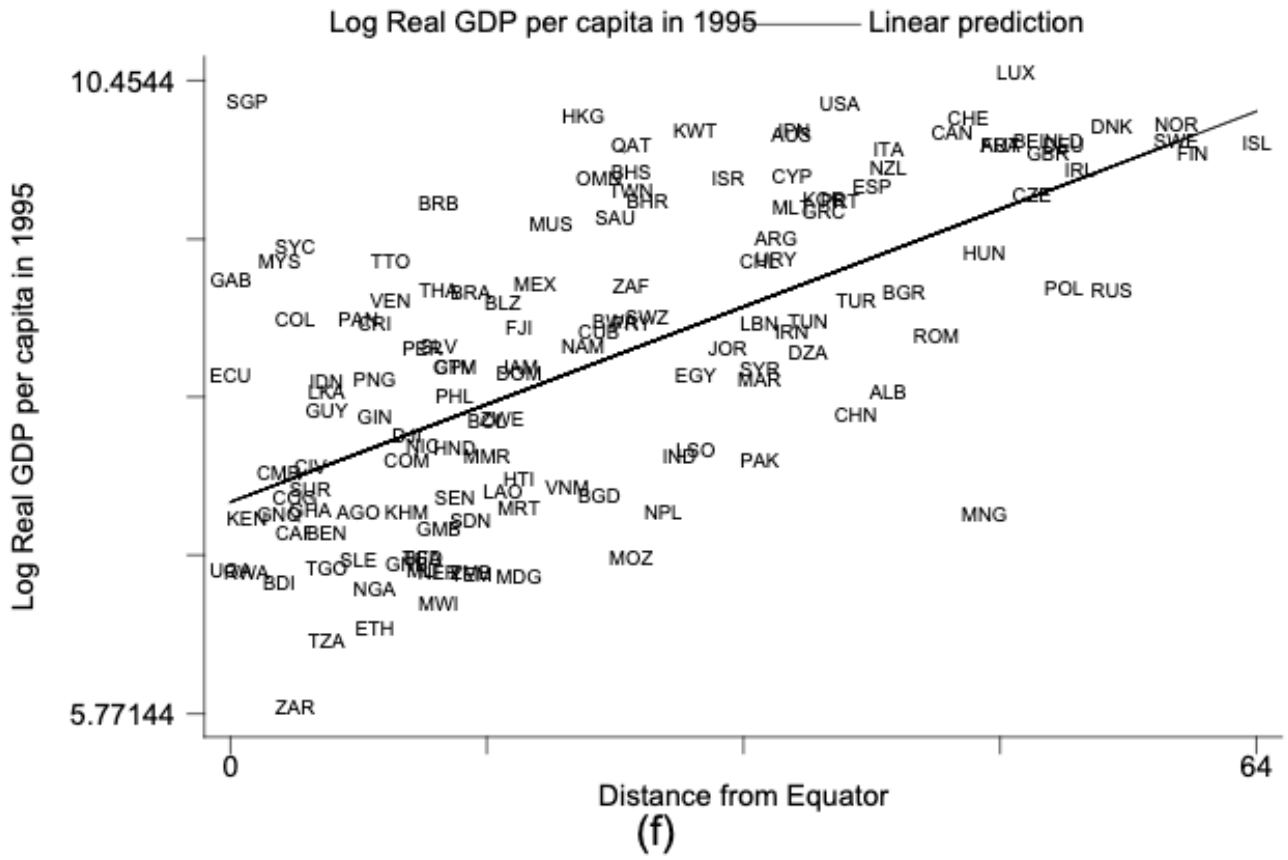
TABLE 1. Characteristics of Selected Regions

Region	*GDP per Capita (U.S. dollars)*	*Population (millions)*	*Land Area (millions of square km)*	*Land in Tropics (%)*	*Population within 100 Km of Coast (%)*	*Population within 100 Km of Coast or Ocean-Navigable River (%)*	*Landlocked Population (%)*	*Distance to core market (km)*	*Coastal Density (population per square km)*	*Interior Density (population per square km)*
Sub-Saharan Africa	1,865	580	24	91	19	21	28	6,237	40	22
Western Europe	19,230	383	3	0	53	89	4	922	109	125
East Asia	10,655	1,819	14	30	43	60	0	3,396	381	91
South Asia	1,471	1,219	4	40	23	41	2	5,744	387	287
Transition economies	3,902	400	24	0	9	55	21	2,439	32	16
Latin America and the Caribbean	5,163	472	20	73	42	45	3	4,651	52	18

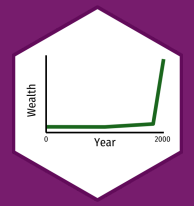
Source: See appendix.
Note: GDP = gross domestic product. Transition economies = Eastern Europe and the former Soviet Union.

Gallup, John Luke, Jeffrey D. Sachs, and Andrew D. Mellinger, 1999, "Geography and Economic Development," *International Regional Science Review* 22(2): 179-232

Relationship Between Latitude & Development

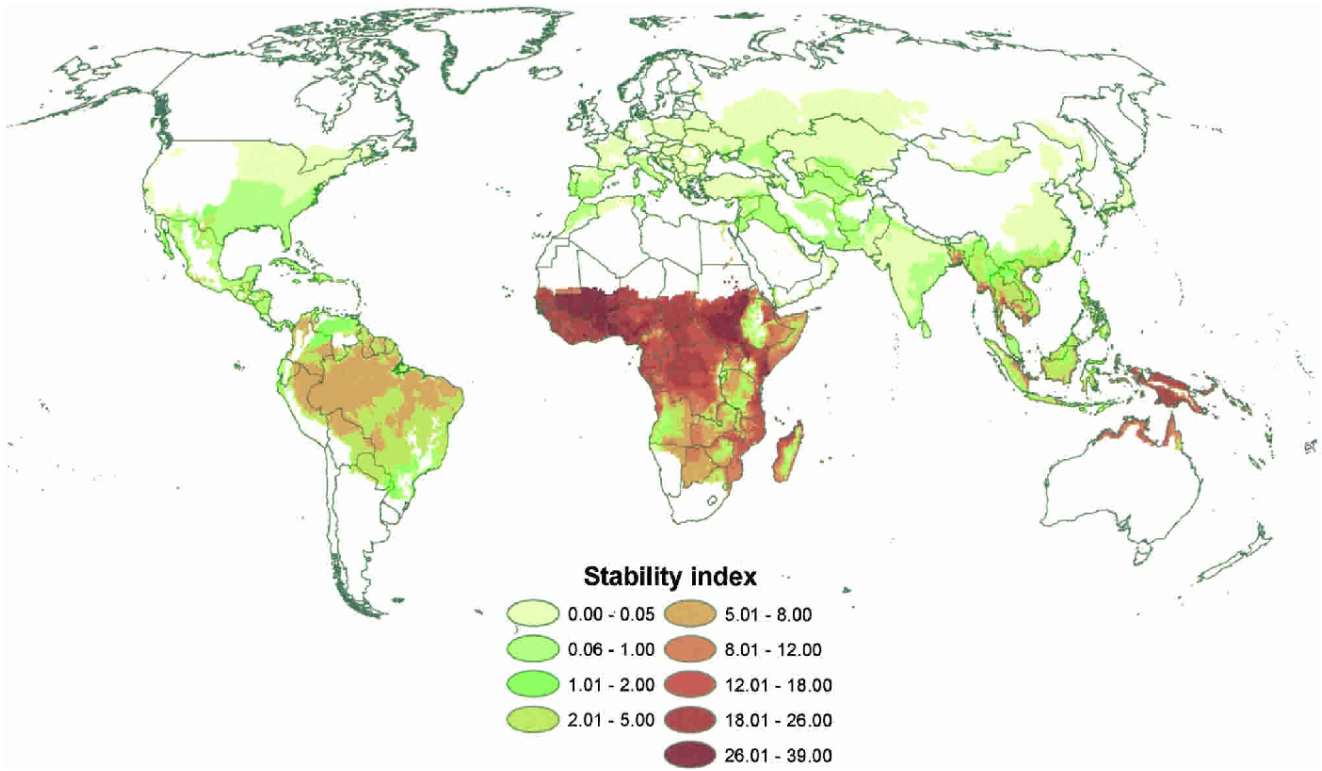


Rodrik, Dani, Arvind Subramanian, and Francesco Trebbi, 2002, "Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development," *NBER Working Paper* 9305



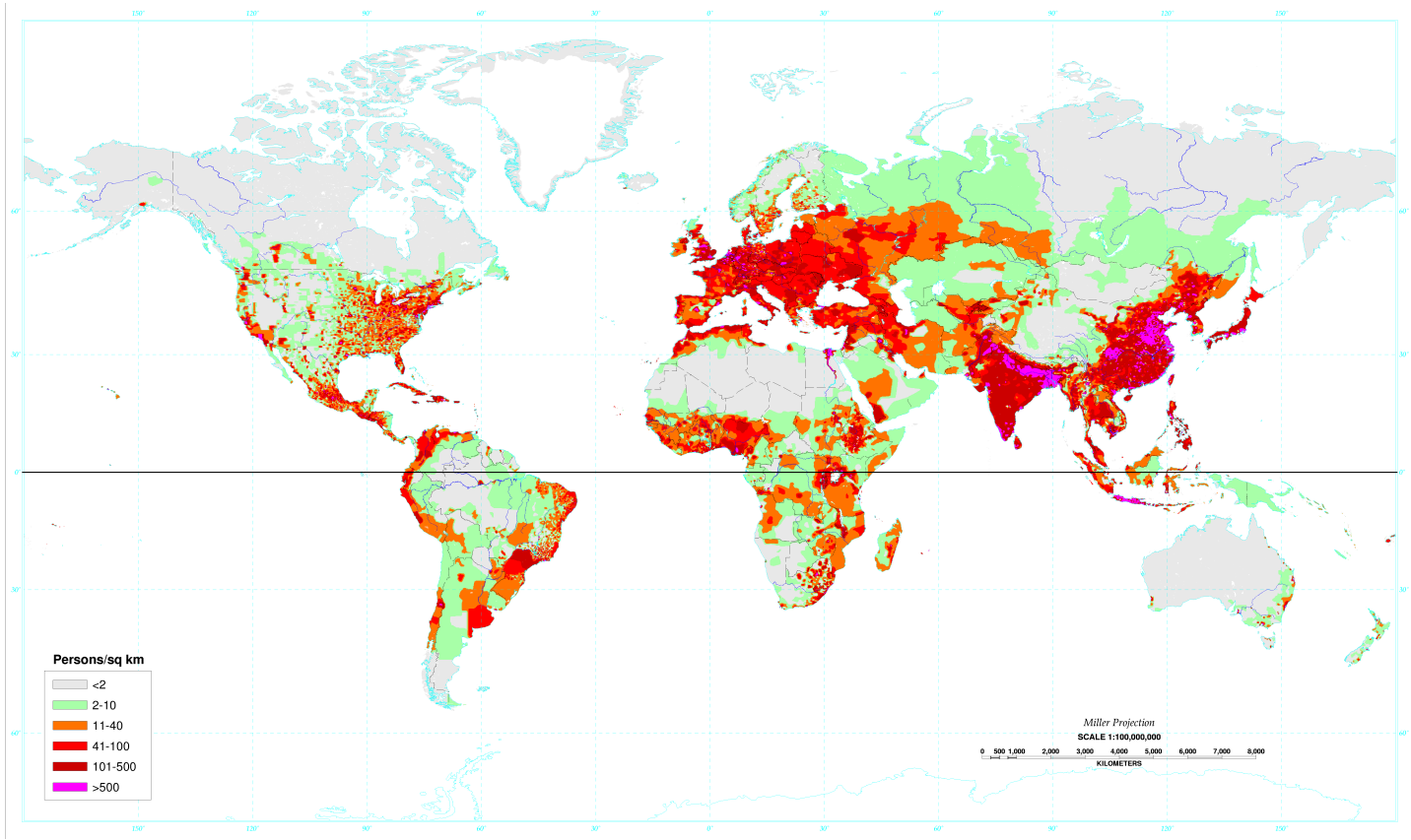
Geography and Health

Geography and Development: Disease I



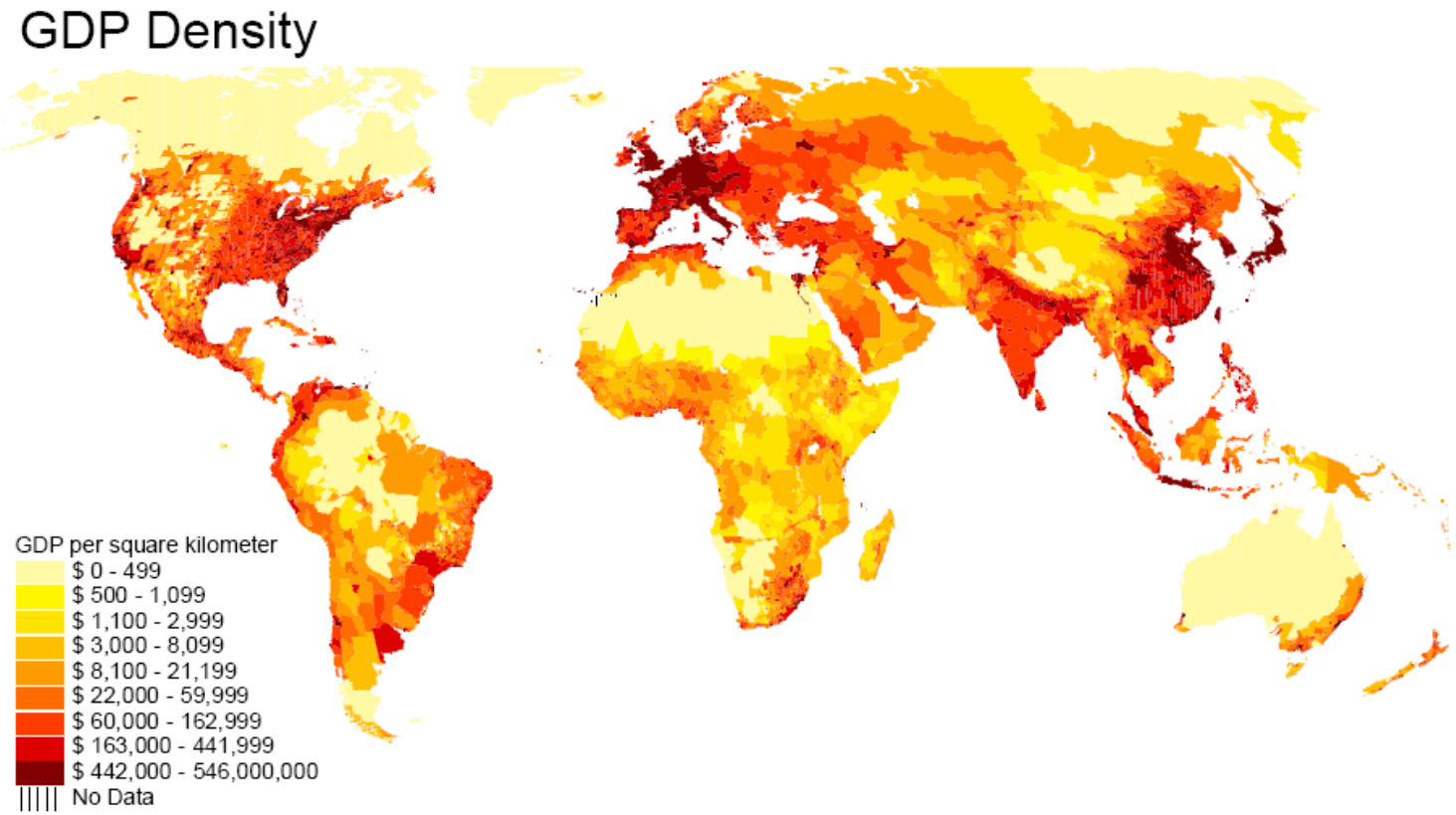
Kiszewski, Anthony E, Andrew Mellinger, Andrew Spielman, Pia Nandini Malaney, Sonia Ehrlich Sachs, and Jeffrey Sachs, (2004), "A Global Index Representing the Stability of Malaria Transmission", *American Journal of Tropical Medicine Hygiene* 70(5): 486-498

Compare: Population Density



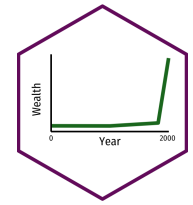
Gallup, J. L., J. D. Sachs, and A. D. Mellinger, 1999; Wikipedia; A Great Interactive Version

Compare: GDP Density



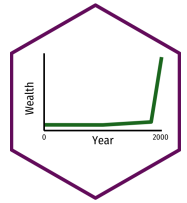
Gallup, J. L., J. D. Sachs, and A. D. Mellinger, 1999, "Geography and Economic Development," *International Regional Science Review* 22(2):179-224; Land of Maps

Geography and Development: Disease I

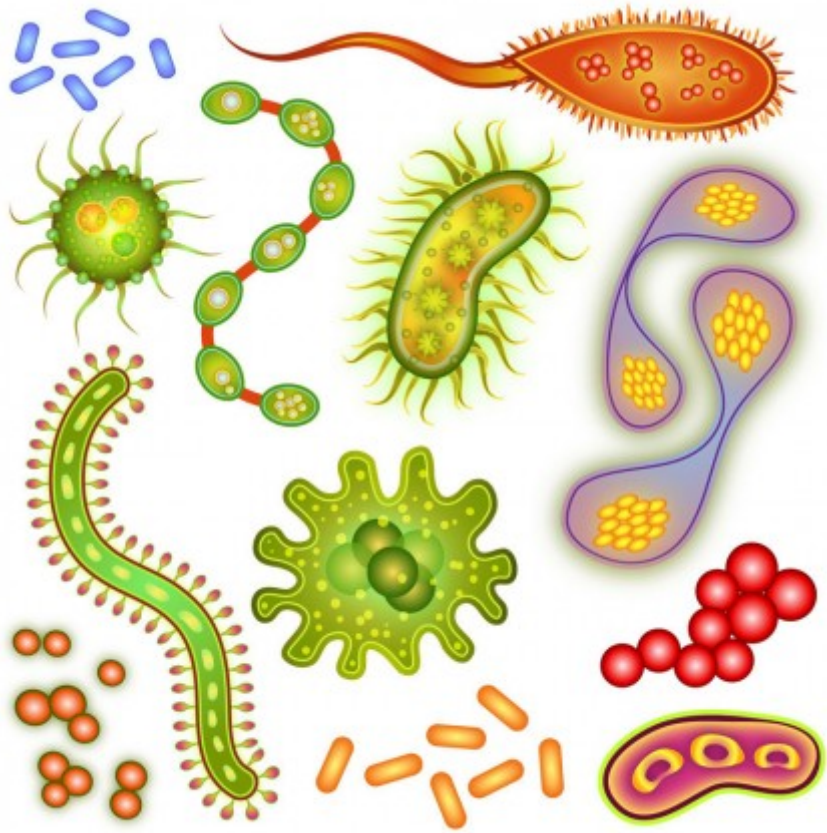


- Strong inverse relation between locations with population & GDP density and malaria transmission stability
- 300-500 million people get malaria each year
    - 1 million die (often young children)
    - children's growth and IQ can be permanently stunted

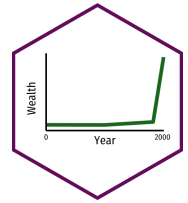
Geography and Development: Disease II



- A *lot* of diseases are more common in the tropics:
  - malaria
  - yellow fever
  - chagas disease
  - African trypanosomiasis (sleeping sickness)
  - River blindness
  - Schistosomiasis (snail fever)
  - parasitic worms (roundworm, hookworm, whipworm)
    - 1/4 of the world's population has at least one of these worms (UN)

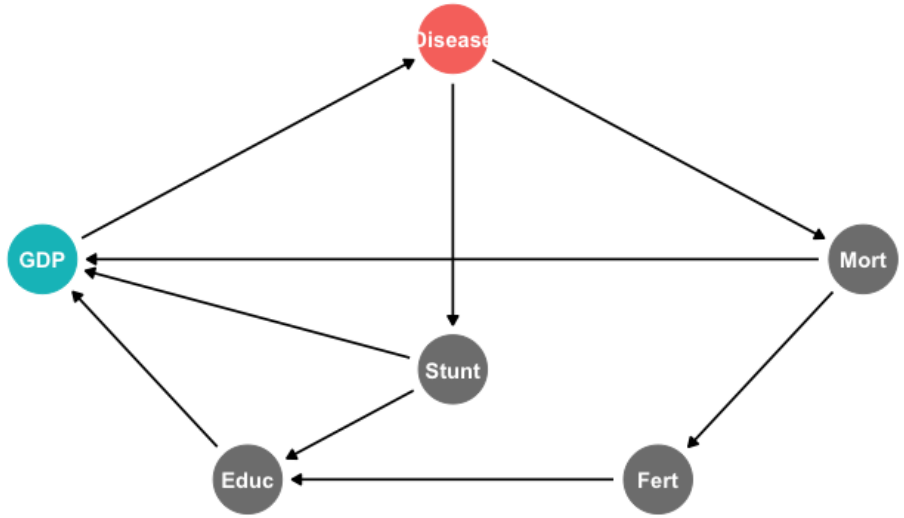


Geography and Development: Disease III

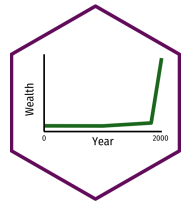


- Vicious circle of disease
- OR
- Virtuous circle of eradicating disease

Disease's Effects on Development



Mitigating Disease has BIG Long-Run Payoffs



> "This study estimates **long-run impacts** of a child health investment, exploiting community-wide experimental variation [i.e. an RCT] in **school-based deworming**. The program increased labor supply among men and education among women, with accompanying shifts in labor market specialization. **Ten years after de-worming treatment, men** who were eligible as boys **stay enrolled for more years of primary school, work 17% more hours each week, spend more time in non-agricultural self-employment, are more likely to hold manufacturing jobs, and miss one fewer meal per week. Women** who were in treatment schools as girls **are approximately one quarter more likely to have attended secondary school, halving the gender gap.** They **reallocate time from traditional agriculture into cash crops and nonagricultural self-employment.** We estimate a conservative annualized financial internal **rate of return to deworming of 32%**, and show that **mass deworming may generate more in future government revenue than it costs in subsidies.**

Geography and Development: Insects I

"The TseTse is the "greatest curse" nature laid upon Africa and the "value of the country would be centupled" in its absence" - Commissioner H.H. Johnston (1894)

"The presence of Tsetse-fly preclude the animal transport by carts, which in the interior is the great incentive for road-making. In Witu, for instance, ...the bullocks employed for the waggons on it all died, and the old wretched system of human porterage has still to be resorted to for transport." - Sir A. Harding (1897)

"It seems reasonable to suppose that for hundreds of years tsetse dictated that the economy of the African should be based on the hoe and the head-load..." - Entomologist T.A.M. Nash (1969)

Geography and Development: Insects II

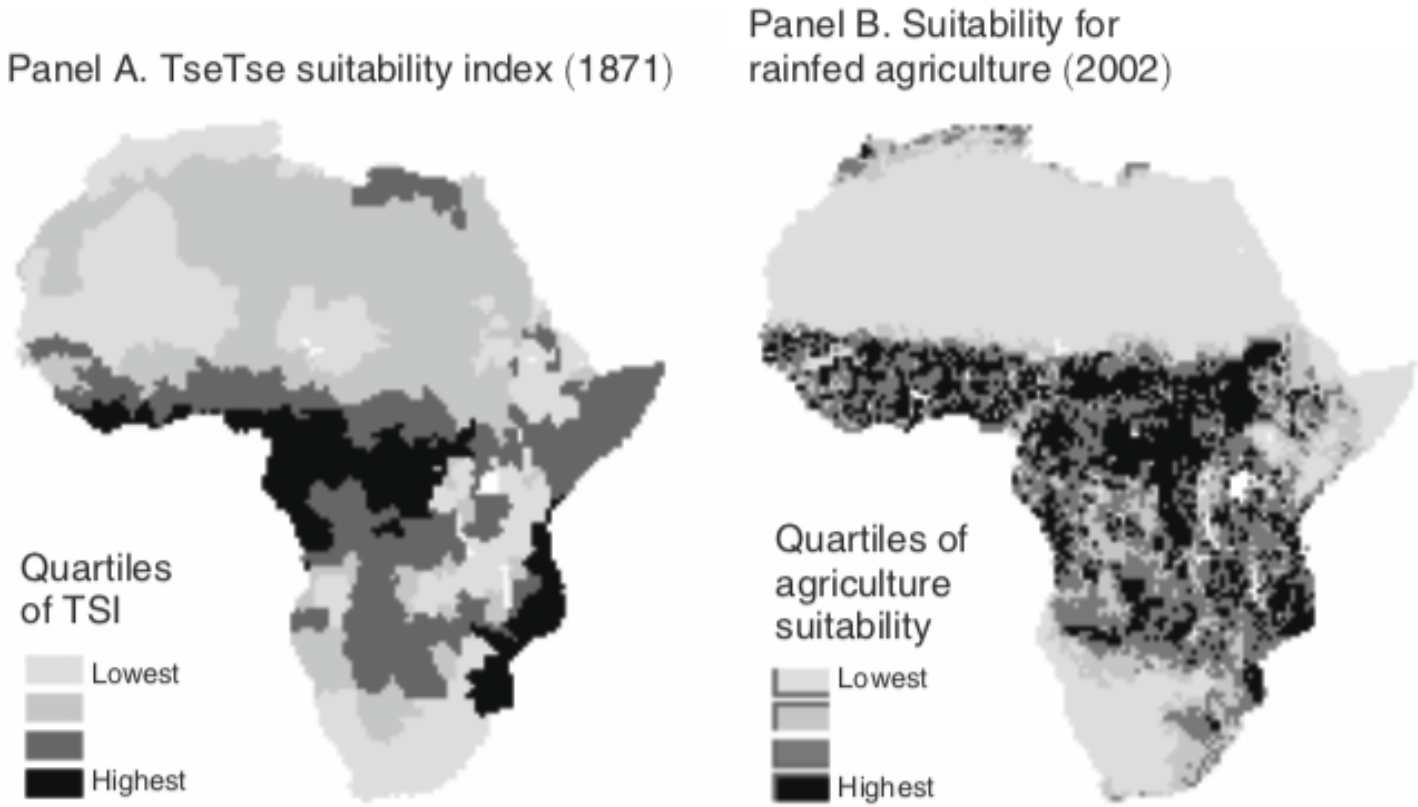
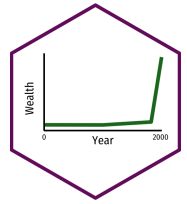


FIGURE 3. TSETSE SUITABILITY INDEX AND THE SUITABILITY FOR RAINFED AGRICULTURE

Alsan, Marcella, (2015), "The Effect of the TseTse Fly on African Development," *American Economic Review* 105(1): 382-410

Geography and Development: Insects III



> "The TseTse fly is unique to Africa and transmits a parasite harmful to humans and lethal to livestock. This paper tests the **hypothesis that the TseTse reduced the ability of Africans to generate an agricultural surplus historically. Ethnic groups inhabiting TseTse-suitable areas were less likely to use domesticated animals and the plow, less likely to be politically centralized, and had a lower population density.** These correlations are not found in the tropics outside of Africa, where the fly does not exist. The evidence suggests current economic performance is affected by the TseTse through the channel of precolonial political centralization," (p. 382).
>
> "**[A] one standard deviation increase in the TSI is associated with a 23 percentage point decrease in the likelihood an African ethnic group had large domesticated animals, a 9 percentage point decrease in intensive cultivation, and a 6 percentage point reduction in plow use.** A one standard deviation increase in the TSI is correlated with **a significant reduction in historical population density.** Motivated by the land abundance literature, two institutions are explored in this paper: political centralization and indigenous slavery. **A one standard deviation increase in the TSI is associated with a 10 percentage point increase in the likelihood that an ethnic group used slaves and an 8 percentage point decrease in the probability it was centralized**," (p.384).

Alsan, Marcella, (2015), "The Effect of the TseTse Fly on African Development," *American Economic Review* 105(1): 382-410

So How Bad is All This for Development? I

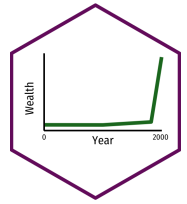
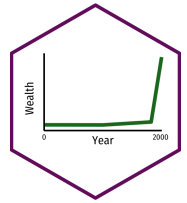


TABLE 6. Impact of Geography on Log Population Density, 1994

Variable	*Impact of Geography on Population Density Given Population in 1800 (1)*	*Overall Impact of Geography on Population Density (2)*
Log population density 1800	0.612	
	(79.63)**	
Eurasian continent		1.136
		(28.15)**
Lands of new settlement		–0.998
		(23.73)**
LDistance (kilometers) to:		
Coast	–0.040	–0.145
	(2.26)*	(8.13)**
Ocean-navigable river	–0.113	–0.188
	(6.28)**	(10.2)**
Inland river	–0.324	–0.235
	(26.48)**	(18.4)**
Log elevation in temperate zone		
Less than 1,000 meters	0.018	0.096
	(1.35)	(6.77)**
1000 to 2,000 meters	0.859	1.108
	(9.63)**	(11.67)**
More than 2,000 meters	–1.361	–0.279
	(12.83)**	(8.47)**
Log elevation in tropics		
Less than 1,000 meters	–0.034	0.034
	(6.47)**	(7.28)**
1,000 to 2,000 meters	1.801	2.133
	(6.04)**	(6.2)**
More than 2,000 meters	0.846	1.296
	(3.2)**	(3.15)**
Malaria (fraction of area)	0.109	2.104
	(2.48)*	(4.72)**
Soil and water		
Rice-growing land (fraction of area)	1.064	1.335
	(10.44)**	(13.41)**
Soil suitability (0-100)	0.127	0.134
	(21.47)**	(22.25)**
Log stream density[a] (number per cell)	0.144	0.192
	(17.77)**	(23.42)**
Ecozones (relative to moist temperate)[b]		
Polar and boreal	–2.273	–3.202
	**	**
Desert	–1.224	–1.840
	**	**
Dry temperate	–0.176	–0.409
	**	**
Very wet temperate	–1.204	–1.539
	**	**

Gallup, John Luke, Jeffrey D. Sachs, and Andrew D. Mellinger, 1999, "Geography and Economic Development," *International Regional Science Review* 22(2): 179-232

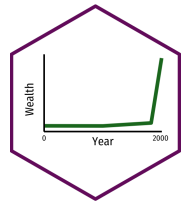
So How Bad is All This for Development? II



> "[T]he policy implications of these findings, if the findings are true, are staggering. Aid programs should be rethought, and the crucial issue of migration should be brought into much sharper focus."
>
> "The research agenda needs to be reshaped in light of the importance of geographic variables. We know precious little about the underlying relationships between climate and agricultural productivity, disease vectors, and public health. Not only do we not know the costs of malaria in terms of economic development but we barely know the quantitative extent of the disease. Cause-of-death data are not available for most developing countries and even fewer data are available on illness. We lack basic data on transport costs that are comparable across countries and, even more important, within countries between hinterlands and urban areas. By neglecting geographic variables, we may overstate the role of policy variables in economic growth and neglect some deeper obstacles (although, because policy variables are often so poorly measured in cross-country work, there is an inherent downward bias due to measurement errors)," (p.212).

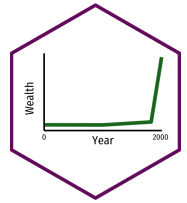
Gallup, John Luke, Jeffrey D. Sachs, and Andrew D. Mellinger, 1999, "Geography and Economic Development," *International Regional Science Review* 22(2): 179-232

So How Bad is All This for Development? III



> "The twenty-eight landlocked countries outside Europe, containing 295 million people in 1995, are among the poorest in the world, with an average per capita income of $1,673. In many cases, the infrastructure linking these countries to world markets is seriously deficient. Coastal countries harass landlocked countries, neglect the road networks that would link them to the coast, or impose punitive effective taxation through transit and port charges. In some cases, heated political clashes have taken place between interior and coastal countries. Bolivia and Chile, for example, still lack diplomatic relations 119 years after the War of the Pacific cost Bolivia its coastline. Aid programs to improve transport infrastructure linking landlocked countries to ports almost necessarily require the cooperation of several countries," (pp.213-214).
>
> "Second, policy makers should examine the likelihood and desirability of large-scale future migrations from geographically disadvantaged regions. Suppose that sizable populations face local cost or disease conditions that prohibit economic growth. The result is likely to be growing pressures for mass migration, first within countries, then across national borders, and finally internationally," (p.214).

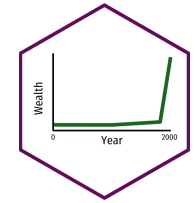
So How Bad is All This for Development? IV

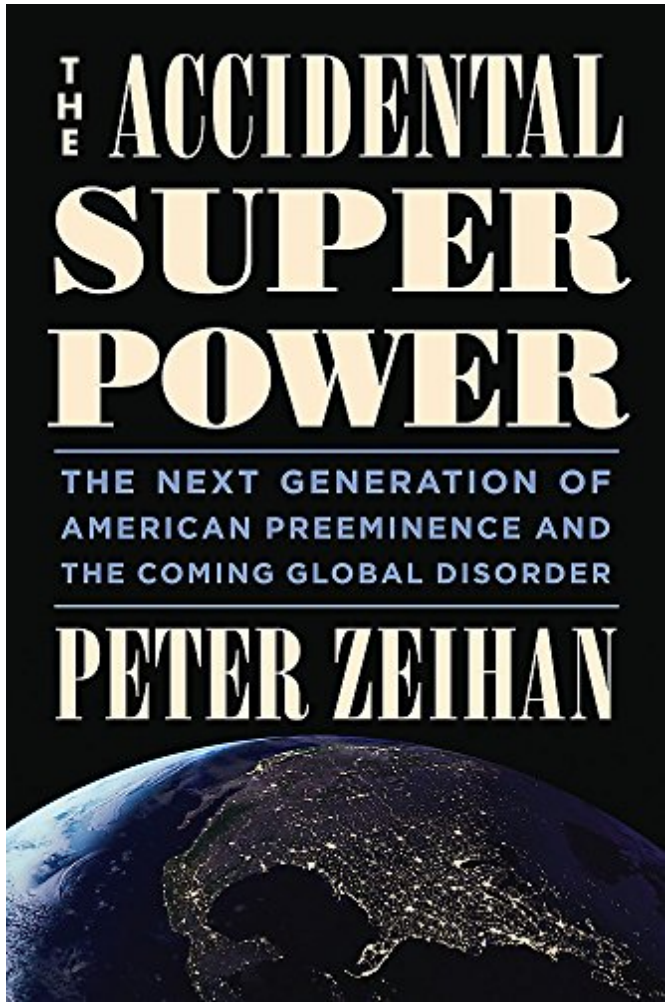


> "Finally, donors should reexamine the balance of aid between policy-based lending to individual governments—which is the most popular form—and greatly enhanced aid for basic research on tropical agriculture and tropical public health. Our results suggest that the tropics are damned not just, or even mainly, by bad policies but by difficult inherent conditions. If this is the case, the relentless focus on policy reform may be misguided. A more effective approach to controlling malaria might do more to improve the economic environment—and incidentally, might improve policy by enhancing the incentives for good policies facing the sovereign," (p.215).

Gallup, John Luke, Jeffrey D. Sachs, and Andrew D. Mellinger, 1999, "Geography and Economic Development," *International Regional Science Review* 22(2): 179-232

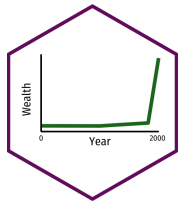
The Flipside





> "[T]he Mississippi is only one of twelve major navigable American rivers. Collectively, all of America's temperate-zone rivers are 14,650 miles long. China and Germany each have about 2,000 miles, France about 1,000. The entirety of the Arab world has but 120..."
>
> "Even catastrophic losses abroad would never actually harm the base of American power, rooted as it was in the charmed nature of American geography. If Britain lost its empire, it was reduced to secondary-power status. If the Maginot Line were breached, France would fall. If the Americans lost every scrap of land they held internationally, they would still be the most powerful country in human history..."

A good review of the book, which I have not yet read.


Wealth
0
Year
2000