

Lecture 4

"Underdevelopment": Contributing Factors Geography

Nurgul Tilenbaeva

American University - Central Asia

08.02.2023

Contents

- Introduction
- Definitions
- GNP per Capita
- GDP per Capita
- Climate Zones
- GNP Density
- Channels
- Tropical Underdevelopment
- Tropical Success Stories
- Policy Implications

Why are some countries stupendously rich and others horrendously poor?

Introduction

- Most economists link prosperity to a free market economy.
- Also, the usual view is that differences in national wealth arise from differences in the accumulation of physical and social capital and in the adoption of new technology, due in turn to differences in the quality of political and economic institutions.

But is this all?

- **Geography** plays an important role in shaping the distribution of world income and economic growth:
 - Economists tended to neglect the role of geography.
 - They implicitly assume that all parts of the world have the same prospects for economic growth and long-term development and that differences in performance are the result of differences in institutions.

"... an unpleasant truth, namely, that nature like life is unfair, unequal in its favors; further, that nature's unfairness is not easily remedied."

Landes(1998)

Some nice video on Geography and Economic Growth

Physical **geography** of a region can influence its economic performance:

- Economies of coastal regions usually outperform the economies of inland areas.
 - ① *Why?*
- An area's climate can also affect its economic development.
 - ② *What climatic conditions are better/worse for economic development and why?*

Introduction

Physical **geography** of a region can influence its economic performance:

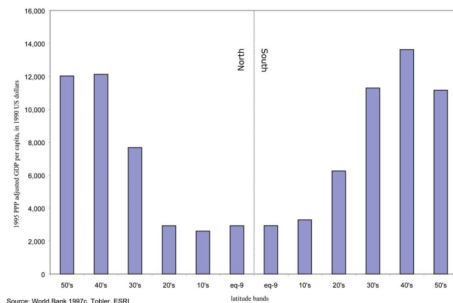
- Economies of coastal regions usually outperform the economies of inland areas.
 - ① *Why?*
 - Coastal regions have access to sea trade.
- An area's climate can also affect its economic development.
 - ② *What climatic conditions are better/worse for economic development and why?*
 - Nations in tropical climate zones generally face higher rates of infectious disease and lower agricultural productivity (especially for staple foods) than do nations in temperate zones. Similar burdens apply to the desert zones.
- The very poorest regions in the world are those that suffer from both: distance from sea trade and a tropical or desert ecology.

Definitions

The **tropics** may be understood in two main ways: on a geographical basis and on an ecological basis.

- 1 The **geographical tropics** are defined as the region of the Earth in which the sun passes directly overhead at some point during the year.
 - The geographical tropics include the area between 23.5 degrees North latitude (Tropic of Cancer) and 23.5 degrees South latitude (Tropic of Capricorn).

Figure 2. GDP per capita by Latitude

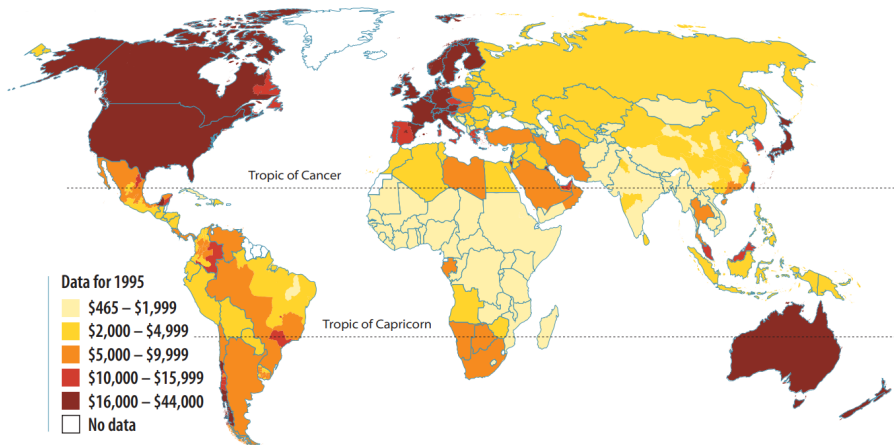


Source: World Bank 1997c, Tobler, ESRI

The **tropics** may be understood in two main ways: on a geographical basis and on an ecological basis.

- 2 The **ecological tropics** are defined by high year-round temperatures and the absence of winter frost.
 - Temperature patterns are combined with precipitation patterns to distinguish the following categories:
 - humid tropics (or equatorial or rainforest tropics);
 - wet-dry tropics (or savannah and monsoon tropics);
 - arid tropics (or hot desert regions).

GNP per Capita



GNP per Capita

- The great majority of the poorest countries lie in the geographical tropics - the area between the tropic of Cancer and the tropic of Capricorn.
 - *"[If] one marks off a belt a couple of thousand miles in width encircling the earth at the equator one finds within it no developed countries... Everywhere the standard of living is low and the span of human life is short"* (Kenneth Galbraith)
- In contrast, most of the richest countries lie in the temperate zones.
- Regions far from the sea, such as the landlocked countries of South America, Africa and Asia, tend to be considerably poorer than their coastal counterparts.

GDP per Capita

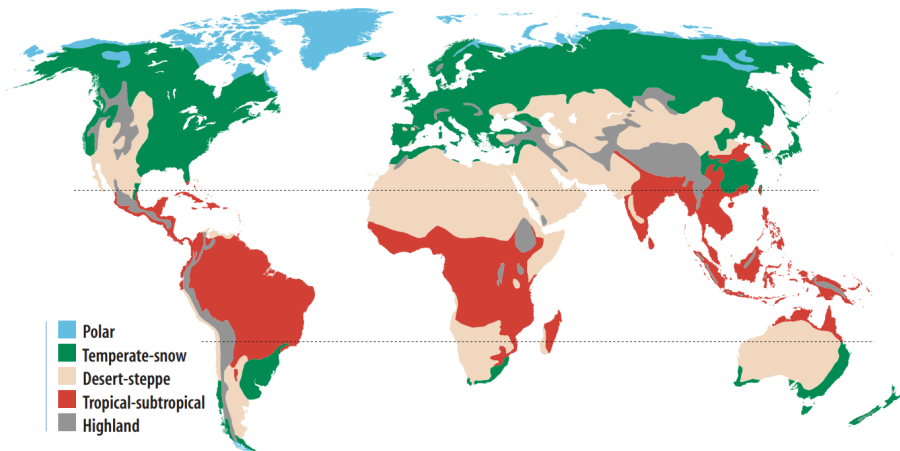
Table 2. Long-term Growth of Temperate and Non-Temperate Regions, Maddison Data

GDP per capita, 1990 International Dollars

	1820	1992	Average Annual Growth, 1820-1992 (%)
Temperate	794	10,095	1.4
Non-Temperate	543	2,556	0.9
Ratio of Temperate/Non-Temperate	0.68	0.25	

Source: Based on Maddison (1995). The Temperate Region is taken to be Western Europe, the Western Offshoots, Southern Europe, Eastern Europe, Japan and half of China. The Non-Temperate Region is the rest of the world. We assume that half of China's population is in the temperate zone both in 1820 and 1992, and that the per capita income in both zones of China are equal to the overall country average. Data are from Tables G-1, G-2, and G-3 for Europe, Western Offshoots and the World; and A-3a, C-16a, and D-1a for Japan; and A-3e, C-16e, and D-1e for China.

Climate Zones



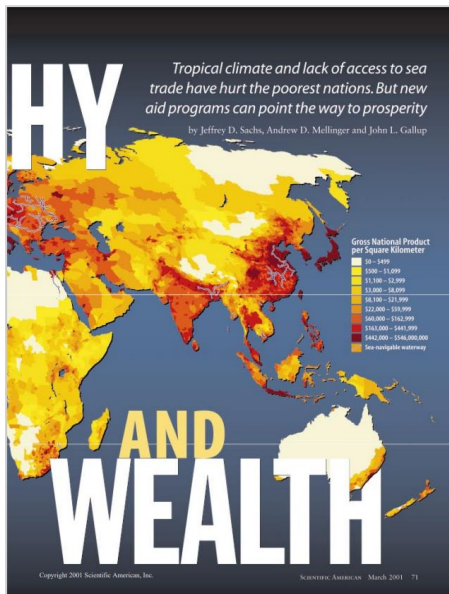
Climate Zones

- Among 28 economies categorized as high income by the World Bank (with populations of at least one million), only Hong Kong, Singapore and part of Taiwan are in the tropical zone, representing a mere 2 % of the combined population of the high-income regions.
- Almost all the temperate-zone countries have either high-income economies (as in the cases of North America, western Europe, Korea and Japan) or middle-income economies burdened by socialist policies in the past (as in the cases of eastern Europe, the former Soviet Union and China).
- There is a strong temperate-tropical divide within countries that have both types of climates. Most of Brazil, for example, lies within the tropical zone, but the richest part of the nation - the southernmost states - is in the temperate zone.

GNP Density

- **GNP density** is the amount of economic output per square kilometer.
- Geographic information system software is used to divide the world's land area into five-minute-by-five-minute sections.
- We can estimate the GNP density for each section by multiplying its population density and its GNP per capita.
- Authors classified the world's regions in broad categories defined by climate and proximity to the sea.
 - A region is "**near**" if it lies within 100 km of a sea-coast or a sea-navigable waterway (a river, lake or canal in which oceangoing vessels can operate);
 - A region is "**far**" otherwise.
- Regions in each of the four climate zones can be either near or far, resulting in a total of eight categories.

GNP Density



The Wealth of Regions

Climate Zone (percent of world total)		Near*	Far*
Tropical			
Land area	19.9%	5.5%	14.4%
Population	40.3%	21.8%	18.5%
GNP	17.4%	10.5%	6.9%
Desert			
Land area	29.6%	3.0%	26.6%
Population	18.0%	4.4%	13.6%
GNP	10.1%	3.2%	6.8%
Highland			
Land area	7.3%	0.4%	6.9%
Population	6.8%	0.9%	5.9%
GNP	5.3%	0.9%	4.4%
Temperate			
Land area	39.2%	8.4%	30.9%
Population	34.9%	22.8%	12.1%
GNP	67.2%	52.9%	14.3%

* "Near" means within 100 kilometers of seacoast or sea-navigable waterway; "far" means otherwise.

- Global production is highly concentrated in the coastal regions of temperate climate zones.
- Regions in the "temperate-near" category constitute a mere 8.4% of the world's inhabited land area, but they hold 22.8% of the world's population and produce 52.9% of the world's GNP.
- Per capita income in these regions is 2.3 times greater than the global average, and population density is 2.7 times greater.
- In contrast, the "tropical-far" category is the poorest, with a per capita GNP only about one third of the world average.

Three major ways in which **geography** affects **economic development**:

- 1 Economies differ in their ease of transporting goods, people and ideas.
 - Because sea trade is less costly than land- or air-based trade, economies near coastlines have a great advantage over hinterland economies.
 - *Example:* The cost of shipping a six-meter-long container from Rotterdam, Netherlands, to Dar-es-Salaam, Tanzania - an air distance of 7,300 kilometers - was about \$1,400.
 - *Example:* Transporting the same container overland from Dar-es-Salaam to Kigali, Rwanda - a distance of 1,280 kilometers by road - cost about \$2,500, or nearly twice as much.

Three major ways in which **geography** affects **economic development**:

- ② Geography affects the prevalence of disease.
 - Many kinds of infectious diseases are endemic to the tropical and subtropical zones.
 - *"Heat, especially year-round heat, has an even more deleterious consequence: it encourages the proliferation of life forms hostile to man. Insects swarm as the temperature rises, and parasites within them mature and breed more rapidly. The result is faster transmission of disease and development of immunities to countermeasures"* (Landes (1980))
 - This tends to be true of diseases in which the pathogen spends part of its life cycle outside the human host:
 - *Example: malaria (carried by mosquitoes) and helminthic infections (caused by parasitic worms).*

Three major ways in which **geography** affects **economic development**:

- ② Geography affects the prevalence of disease.
 - Cold winters in temperate zones naturally control the mosquito-based transmission of the disease.
 - *"Winter, then, in spite of what poets may say about it, is the great friend of humanity: the silent white killer, slayer of insects and parasites, cleanser of pests."* (Landes (1998))
 - It is much more difficult to control malaria in tropical regions, where transmission takes place year-round and affects a large part of the population.

Three major ways in which **geography** affects **economic development**:

- ② Geography affects the prevalence of disease.
 - According to the WHO, 300 million to 500 million new cases of malaria occur every year, almost entirely concentrated in the tropics.
 - Widespread illness and early deaths hold back a nation's economic performance by significantly reducing worker productivity.
 - A high incidence of disease can alter the age structure of a country's population.
 - Societies with high levels of child mortality tend to have high levels of fertility: mothers bear many children to guarantee that at least some will survive to adulthood.
 - With so many children, poor families cannot invest much in each child's education.
 - High fertility also constrains the role of women in society, because child rearing takes up so much of their adult lives.

Channels

Three major ways in which **geography** affects **economic development**:

- ③ Geography affects agricultural productivity.
 - Of the major food grains - wheat, maize and rice - wheat grows only in temperate climates, and maize and rice crops are generally more productive in temperate and subtropical climates than in tropical climates.
 - *Example:* On average, a hectare of land in the tropics yields 2.3 metric tons of maize, whereas a hectare in the temperate zone yields 6.4 tons.
 - In tropical environments that have wet and dry seasons farmers must contend with the rapid loss of soil moisture resulting from high temperatures, the great variability of precipitation, and the risk of drought.
 - *"Tropical areas generally average enough rainfall, but the timing is often irregular and unpredictable, the downpours anything but gentle. The drops are large; the rate of fall torrential. The averages mean nothing when one goes from one extreme to the other..."* (Landes (1998))
 - Tropical environments are plagued with diverse infestations of pests and parasites that can devastate both crops and livestock.

Here is a Bangladeshi diplomat recalling his own experience and that of compatriots when visiting temperate climates:

"In countries like India, Pakistan, Indonesia, Nigeria and Ghana I have always felt enervated by the slightest physical or mental exertion, whereas in the UK, France, Germany or the US I have always felt reinforced and stimulated by the temperate climate, not only during long stays, but even during brief travels. And I know that all tropical peoples visiting temperate countries have had a similar experience. I have also known hundreds of people from the temperate zone in the tropics feeling enervated and exhausted whenever they were not inside an air-conditioned room..."

...In India and other tropical countries I have noticed farmers, industrial labourers, and in fact all kinds of manual and office workers working in slow rhythm with long and frequent rest pauses. But in the temperate zone I have noticed the same classes of people working in quick rhythm with greater vigour and energy, and with very few rest pauses. I have known from personal experience and the experience of other tropical peoples in the temperate zone that this spectacular difference in working energy and efficiency could not be due entirely or even mainly to different levels of nutrition."

Landes (1998)

Alternative explanations for **tropical underdevelopment**:

- Colonial heritage of the tropical world.
 - 3 *What is the problem with this explanation?*

Tropical Underdevelopment

Alternative explanations for **tropical underdevelopment**:

- Colonial heritage of the tropical world.

③ *What is the problem with this explanation?*

- Tropical Africa, the world's poorest region, was colonized only in the 1870s and onward, and yet the pre-colonial period was characterized by the world's lowest living standards.
- Tropical Latin America had gained independence by the 1820s, without decisive breakthroughs in development as of the late 21st century.
- Decolonization did not break the pattern of tropical underdevelopment.

Tropical Underdevelopment

Alternative explanations for **tropical underdevelopment**:

- Modern economic growth is inextricably linked to capitalism, and capitalism is linked to European culture. The essential source of the temperate-zone advantage is that it is a European advantage, whether directly in Europe or in "offshoot" settlements of North America and Oceania.

④ *What are counter-examples and counter-arguments?*

Tropical Underdevelopment

Alternative explanations for **tropical underdevelopment**:

- Modern economic growth is inextricably linked to capitalism, and capitalism is linked to European culture. The essential source of the temperate-zone advantage is that it is a European advantage, whether directly in Europe or in "offshoot" settlements of North America and Oceania.
 - ④ *What are counter-examples and counter-arguments?*
 - The rise of temperate-zone East Asia - Japan, Korea, Northeast China, Taiwan.
 - Europeans established colonies throughout the world - in North and South America, Africa, and Asia - but the levels of income reached by these former colonies is highly dependent on geography.
 - The temperate Southern Cone former colonies of Spain (Argentina, Uruguay, Chile) outperformed the tropical American colonies of Spain.
 - Temperate Southeast Brazil outperformed tropical Northeast Brazil.
 - Temperate Southern and Northern Africa are far richer than tropical Africa though all parts of Africa were colonized by the Europeans.

Alternative explanations for **tropical underdevelopment**:

- Food production in temperate and tropical zones.
 - Grain yields per hectare are considerably higher in the temperate regions.
 - Productivity per hectare in temperate climate zones is 51% higher than in non-temperate climate zones on average.
 - Soil formation and erosion;
 - Pests and parasites;
 - Effects of ambient temperature on plant respiration and net photosynthesis;
 - Water availability in conditions of high evapo-transpiration.

Tropical Underdevelopment

Alternative explanations for **tropical underdevelopment**:

- Health in temperate and tropical climate zones.
 - The burden of disease is considerably higher in the tropics than in the temperate climates.
 - Infant mortality in the temperate climate zones is 52% lower than in non-temperate climates zones, controlling for the level of income.
 - Life expectancy in the temperate climate zones is 8% higher than in non-temperate climate zones, controlling for the GDP per capita of the country.
 - Reduced labor productivity as a result of lost workdays;
 - Reduced physical and cognitive capacities as the result of acute and chronic illness;
 - Effects on fertility rates, population age structure, and overall population growth rates.

Alternative explanations for **tropical underdevelopment**:

- Energy resources in temperate and tropical climate zones.
 - Industrialization was fueled by coal and then by hydrocarbons.
 - Coal deposits are overwhelmingly concentrated in the temperate zone.
 - As of 1998, 10 countries accounted for 90.2% of global coal reserves, and of these 10 countries, all but India (with 7.6%) are in the temperate zone.
 - As of 1995, 82.5% of production of hydrocarbons (oil and gas) was in non-tropical countries.

Tropical Underdevelopment

Forces of amplification of **tropical underdevelopment**:

- *Technological change in the temperate and tropical climate zones.*
 - The rate of technological innovation in the temperate-zone economies was much higher than in the tropical-zone economies in the 19th and 20th centuries, while the rate of technological diffusion between the two zones was very limited because key technologies could not cross the ecological divide.
 - Temperate-zone countries could more easily partake of technological advances in other temperate zone economies, since they faced similar ecological conditions.

Tropical Underdevelopment

Forces of amplification of **tropical underdevelopment**:

- *Technological change in the temperate and tropical climate zones.*

Table 3. Shares of Tropics in World Population, GDP, and U.S. Patents in 1995

	Population (millions)	GDP (billions)	Patents issued, 1995
Tropics	2,019	5,893	1,880
World	5,653	34,519	101,330
Tropics (% of world)	35.7%	17.1%	1.9%

Source: Tropical population is the number of individuals living with the tropical climate zones. GDP is allocated to climate zones by assuming that GDP per capita is identical for all individuals within a country. Thus, the “Tropical GDP” of a country is calculated as the proportion of the population within the tropical climate zones in the country, multiplied by the aggregate GDP of the country in 1995 (PPP adjusted). “Tropical patents” are calculated as follows. The U.S. Patent Office reports patents by country according to the residence of the lead inventor. I then count as “tropical patents” in a country as the number of patents of the country multiplied by the proportion of the population within the country living in tropical climate zones.

Tropical Underdevelopment

Forces of amplification of **tropical underdevelopment**:

- *Demographic transition and tropical underdevelopment.*
 - **Demographic transition** is the transition from a high-fertility, high-mortality society, to a low-fertility, low-mortality society.
 - Demographic transition has slowed in tropical countries.
 - For an economy with GDP per capita of \$5,000, the temperate-zone economy is predicted to have a total fertility rate of 2.6 births per woman, while the non-temperate zone economy is predicted to have a total fertility rate of 5.0.
- *What are the implications for development?*

Tropical Underdevelopment

Forces of amplification of **tropical underdevelopment**:

- *Demographic transition and tropical underdevelopment.*
 - ⑤ *What are the implications for development?*
 - Investments per child (both at the community and household levels) will be lower in tropical countries.
 - High population growth means more strain on fixed resources (arable land, mineral deposits, soils) and a small proportion of the population at working age.

Tropical Underdevelopment

Forces of amplification of **tropical underdevelopment**:

- *Temperate-zone power and tropical underdevelopment.*
 - Translation of economic weakness of the tropics into geopolitical weakness.
 - Colonial domination frustrated long-term economic growth of the colonized regions through several mechanisms:
 - the relative neglect of key public goods, especially primary education and primary health of the indigenous populations;
 - the suppression of higher education among the colonized population;
 - the creation of oppressive political mechanisms such as forced labor and head taxes to extract resources from the local population;
 - active suppression of local industry in favor of cash crops and extractive industry.

Tropical Underdevelopment

Five hypotheses regarding **tropical underdevelopment**:

- 1 Technologies in critical areas (especially health and agriculture, but also construction, energy use, and some manufacturing processes) are ecologically specific.
 - Such technologies do not easily diffuse across ecological zones.
 - *Example*: Eurasia's east-west orientation facilitated a broad diffusion of technologies across a shared ecological space, while Africa and America's north-south orientation frustrated technological diffusion by cutting across a swath of distinct ecological zones.

Five hypotheses regarding **tropical underdevelopment**:

- 2 By the start of the era of modern economic growth temperate-zone technologies were more productive than tropical-zone technologies in crucial areas of health, agriculture, energy utilization, and military technology.
 - These differences are deeply embedded in ecological characteristics of temperate and tropical zones, and could not be overcome through slight tinkering with existing temperate-zone technologies.

Five hypotheses regarding **tropical underdevelopment**:

- 3 Technological innovation is an increasing-returns-to-scale activity.
 - Temperate-zone innovation has been strongly favored by a larger and richer population.
 - This increasing-returns-to-scale property of technological innovation is probably the main amplifier of the gap between the temperate and tropical zones in the past two hundred years.

Five hypotheses regarding **tropical underdevelopment**:

- ④ Societal dynamics (especially the processes of urbanization and demographic transition) are two further amplifiers of the development process, by which technologically laggard tropical regions have experienced a widening shortfall vis-a-vis the fast-growing temperate-zone regions.

Five hypotheses regarding **tropical underdevelopment**:

- 5 Geopolitical factors are further amplifiers.
 - Temperate-zone imperial domination of tropical regions on the basis of superior military technology, and rich-country control of the institutions of globalization.

Tropical Success Stories

A few tropical economies were successful in achieving "**convergent growth**" - growth sufficiently rapid to narrow the proportionate gap in incomes with the richest countries.

- Hong Kong;
- Singapore;
- Taiwan;
- Malaysia;
- Mauritius.

Tropical Success Stories

The East Asian tropical success stories are all characterized by two main features:

- 1 Notable successes in improved public health in the lead-up to their economic takeoffs.
 - The dramatic improvements in life expectancy and infant mortality achieved by these countries translated, within a generation, to sharply reduced fertility rates as well.
- 2 Policies to diversify away from primary commodities, and especially tropical agriculture, in favor of export-oriented manufacturing activities.
 - The governments introduced special economic institutions - such as export processing zones - in order to attract multinational firms to undertake export-oriented production in their economies.
 - These economies were able to establish new productive sectors (e.g., textiles, electronic machinery, semiconductors and electronic components) where tropical production was not burdened by climatic or ecological factors.

Policy Implications

- Policymakers should pay more attention to the developmental barriers associated with geography:
 - poor health;
 - low agricultural productivity;
 - high transportation costs.
- Tropical economies should strive to diversify production into manufacturing and service sectors that are not hindered by climate conditions.
 - *Example:* The successful countries of tropical South-east Asia, most notably Malaysia, have achieved stunning advances in the past 30 years, in part by addressing public health problems and in part by moving their economies from climate-dependent commodity exports (rubber, palm oil) to electronics, semiconductors and other industrial sectors.

Policy Implications

- The World Bank and the IMF place more emphasis on institutional reforms (overhauling a nation's civil service or tax administration) than on the technologies needed to fight tropical diseases and low agricultural productivity.
- One big obstacle is that pharmaceutical companies have no market incentive to address the health problems of the world's poor.
- Wealthier nations should adopt policies to increase the companies' motivation to work on vaccines for tropical diseases.
- Similarly, biotechnology and agricultural research companies need more incentive to study how to improve farm output in tropical regions.

References

- Sachs, J. D., Mellinger, A. D., & Gallup, J. L. (2001). The Geography of Poverty and Wealth. *Scientific American*, 284(3), 70–75. <https://doi.org/10.1038/scientificamerican0301-70>
- Sachs, J. D. (2001). Tropical Underdevelopment (NBER Working Papers No. 8119). National Bureau of Economic Research, Inc. <https://EconPapers.repec.org/RePEc:nbr:nberwo:8119>
- Landes, D. S. (1999). Chapter 1. The wealth and poverty of nations: Why some are so rich and some so poor (Reprinted). Little, Brown & Company.