View online and share feedback at MRUniversity.com/geography-growth-lecture.
Your suggestions will help us improve this resource for economics teachers everywhere.
Additional resources available at MRUniversity.com/teacher-resources.
Email questions or comments to support@mruniversity.com.

MRUNIVERSITY
AN ONLINE EDUCATION PLATFORM

GEOGRAPHY AND THE DEEP DETERMINANTS OF ECONOMIC GROWTH LECTURE PLAN

Lecture Plan

Table of Contents

1. LECTURE OBJECTIVE

Why are some countries rich and others poor? Rich countries have lots of physical and human capital. But why do some countries have lots of physical and human capital? Rich countries have institutions that protect incentives to invest. But are institutions the only determinant of investment incentives? And what determines institutions? In this lecture, geography is introduced as a potentially deep determinant of growth. In so doing, the student is exposed to cutting-edge questions for which economists are uncertain of the answers and also to questions which show how economic questions draw upon and shed light upon geographic, historical, and scientific questions.

2. PRE-CLASS ASSIGNMENT

Students should watch the following videos before class:

Video: Geography and Growth: https://www.youtube.com?v=rNHY8XKOw7c | Marginal Revolution University | Principles of Macroeconomics course

Video: Geography and Development, Disease: http://mruniversity.com/courses/development-economics/geography-and-development-disease | Marginal Revolution University | Development Economics course

3. LECTURE PLAN

"Once you start thinking about growth, it's hard to think about anything else."
Robert Lucas, Nobel prize-winning economist

INTRO

Show students the graph displaying historical economic growth among major world regions. (Maddison Angus, 2007, Contours of the World Economy 1-2030AD) (Graph available in *Modern Principles: Macroeconomics*, Figure 7.3, p.120 in 3rd ed)

For most of human history, all countries were poor. However, some countries and regions eventually experienced tremendous growth and others did not. Why? Briefly discuss types of explanation from the immediate causes (e.g. human capital, physical capital, and technical knowledge) to what are perhaps the ultimate causes (institutions, culture, ideas, history and so forth, see chart on PowerPoint slide #x) and explain that today's class will be looking at geography as one potential ultimate cause.

NATURAL BARRIERS TO ECONOMIC GROWTH: GEOGRAPHICAL CLIMATE AND DISEASE

Ask students to summarize some striking facts they learned from watching the MRU video on growth and disease. Write them on the board/type them on a slide and try to highlight these facts throughout your lecture.

Quickly review some of the graphs/visual displays they saw in the video (e.g., graph correlating country's distance from the equator with GDP, income world heat map, and malaria index world heat map) and challenge students to think about how a chronic death threat from tropical diseases affects a region's culture, incentives, and growth rate over thousands of years.

For example, ask students to predict if, ceteris paribus, countries with high death rates from malaria and other diseases should have higher or lower fertility rates than countries with a lower incidence of disease-related death. (Answer: higher fertility) Why? Discuss further implications. E.g., if there is an unchanging, known large percentage of children dying, there is less incentive to invest in each individual child's education. You may want to pick some specific examples of countries with high malaria death rates and research various characteristics about the country such as literacy rate, etc. Students with laptops could look up average fertility rates for various countries. Gapminder.org can produce some visually stunning graphs showing the relationships between fertility rates, child mortality and income per capita and how these relationships are changing over time.

Revisit the concept of the vicious cycle/virtuous cycle. Ask students to think of other indicators not covered in the video signaling that a country may be in a vicious cycle.

Make sure to mention, especially if students did not, that many of these diseases were also bad for animals, a main food source, and the climate was also bad for crops, further compounding the issue.

Ask students to compare/contrast the economic impact of a country experiencing a one-time unexpected pandemic (like the Plague) versus a country continuously experiencing high mortality rates from tropical diseases (such as in Africa). Qualitative report suggests the Plague had several opposite effects on survivors' incomes.

Ask students if they can think of any reasons why the equator region would be advantageous for economic growth? (e.g., perhaps fewer people died from harsh weather?)

WORM WARS

Reiterate that much of this research is cutting edge and therefore, students should be cautious when drawing conclusions. Share with students the latest data controversy over some research on benefits of reducing hookworm-infection rates (also known as the Worm Wars).

ALTERNATE EXERCISE
If appropriate, discuss the implications of media interaction with research.

Chris Blattman's blog has a good summary of the Worm War events, but many other blogs have good coverage as well.

Though Hookworm is more common in warmer climates, it was not always primarily confined to the equator zone like it is today. As just one example, in 1910, it was believed that roughly 40% of all school children in the southern US were infected with hookworm. (http://blogs.discovermagazine.com/bodyhorrors/2011/04/25/blood-money-hookworm-economics-in-the-postbellum-south/#.Vc4NQvlVikp)

GEOGRAPHY AND INSTITUTIONS/TRADE:
Transition to geography's effects on policy such as free trade. Ask students to identify some interesting facts from the MRU video on geography and growth, and once again, write them down and try to connect the discussion to these facts/observations.

In effect, land-locked countries have a natural tariff to trade with others. Africa is enormous and the most landlocked country in the world. Ask students to recall the comparison made between Africa's and Europe's coastline. (Answer: Europe has 2-3 times more coastline than Africa even though Europe is much smaller.)

Nice visual of Africa's size: http://blog.supplysideliberal.com/post/65107804390/the-true-size-of-africa-revisited

ALTERNATE EXERCISE
Also, it may be worth noting at some point that the media tends to treat Africa like one entity when there is, at least today, significant variation in economic growth rates. It is also the case that traditional measures of GDP may overstate/understate actual measures given informal economies, etc. (See podcasts on variation in African growth rates and on measuring African poverty and progress and, more generally, research by Jerven.) Accurately measuring incidence of malaria is also challenging.

Remind students of the wide difference in GDP rates for landlocked countries and non-landlocked countries.

A nice example quantifying the effect of natural barriers to trade is with the Feyrer (2009) paper analyzing the effects of the closing of the Suez Canal from 1967-75. A natural experiment is a study where participants are exposed to an exogenous change caused by nature or some other factor outside of their control. In 1967, the Suez Canal was closed by an Egyptian blockade during the Six Day War. In effect, it was as if the countries lost access to some of their 'coastline', or easy access to other countries. Not surprisingly, as the distance between two countries artificially increased, trade between them decreased. Perhaps more surprisingly, the countries' GDPs decreased. VoxEU article: "Results suggest that a 10% decrease in ocean distance results in a 5% increase in trade. Also it estimates that every dollar of increased trades raises incomes by 25 cents." MRU also has an online video summarizing results from the Feyrer study.

Again, ask students to brainstorm reasons why being landlocked might instead be beneficial for economic growth.

QUESTIONS FOR FURTHER DISCUSSION.
Summarizing results. Show students the following regression results correlating a country's GDP with its geographic and institutional characteristics (Gallup, Sachs (2001, p. 87)); ask students to identify the relationships they find most interesting. Without reading the article, students will have difficulty interpreting magnitudes but they can interpret the sign and statistical strength of the results. Be sure to discuss the inverse relationship between the country's GDP and its malaria incidence[1] and the positive relationship between a country's GDP and proximity to coastal population/quality of institutions.

1. Note: "The index of malaria intensity used in this [regression] is the fraction of the population at risk of malaria multiplied by the fraction of cases of malaria that are falciparum malaria" p.85

TABLE 1
Level of gross domestic product (GDP) per capita

	Regression model					
	1	2	3	4	5	6
	Log GDP per capita†					
Variable	1995	1950	1995	1995	1995	1995 (non-Africa)
Population within 100 km of coast (%)	1.26	0.80	0.57	0.65	0.33	0.40
	(6.31)**	(5.19)**	(2.74)**	(3.40)**	(2.23)*	(2.76)**
Log distance to major markets	−0.35	−0.12	−0.33			
	(3.79)**	(1.37)	(4.03)**			
Log hydrocarbons per person	0.01	0.01	0.01	0.01	0.00	0.00
	(2.28)*	(2.56)*	(1.86)	(2.13)*	(1.36)	(1.27)
Tropical land area (%)	−0.68	−0.14	−0.23	−0.59	−0.09	−0.10
	(3.97)**	(0.89)	(1.01)	(3.04)**	(0.59)	(0.83)
Falciparum malaria index		−1.17	−1.22	−1.16	−1.16	−1.10
		(6.28)**	(5.67)**	(4.73)**	(6.41)**	(4.34)**
Socialist				−0.80	−0.10	−0.05
				(5.20)**	(0.66)	(0.30)
Colony				−0.14	−0.05	−0.12
				(2.18)*	(0.89)	(2.24)*
Trade openness (0–1)					0.50	0.43
					(2.99)**	(2.98)**
Quality of public institutions (0–10)					0.22	0.23
					(6.85)**	7.82)**
Constant	10.50	8.54	10.91	8.75	7.15	7.15
	(14.10)**	(13.54)**	(17.36)**	(46.40)**	(29.27)**	(32.30)**
Observations	149	127	127	149	97	66
R^2	0.47	0.59	0.62	0.62	0.88	0.88

† Robust *t*-statistics are in parentheses.
* Significant at 5% level.
** Significant at 1% level.

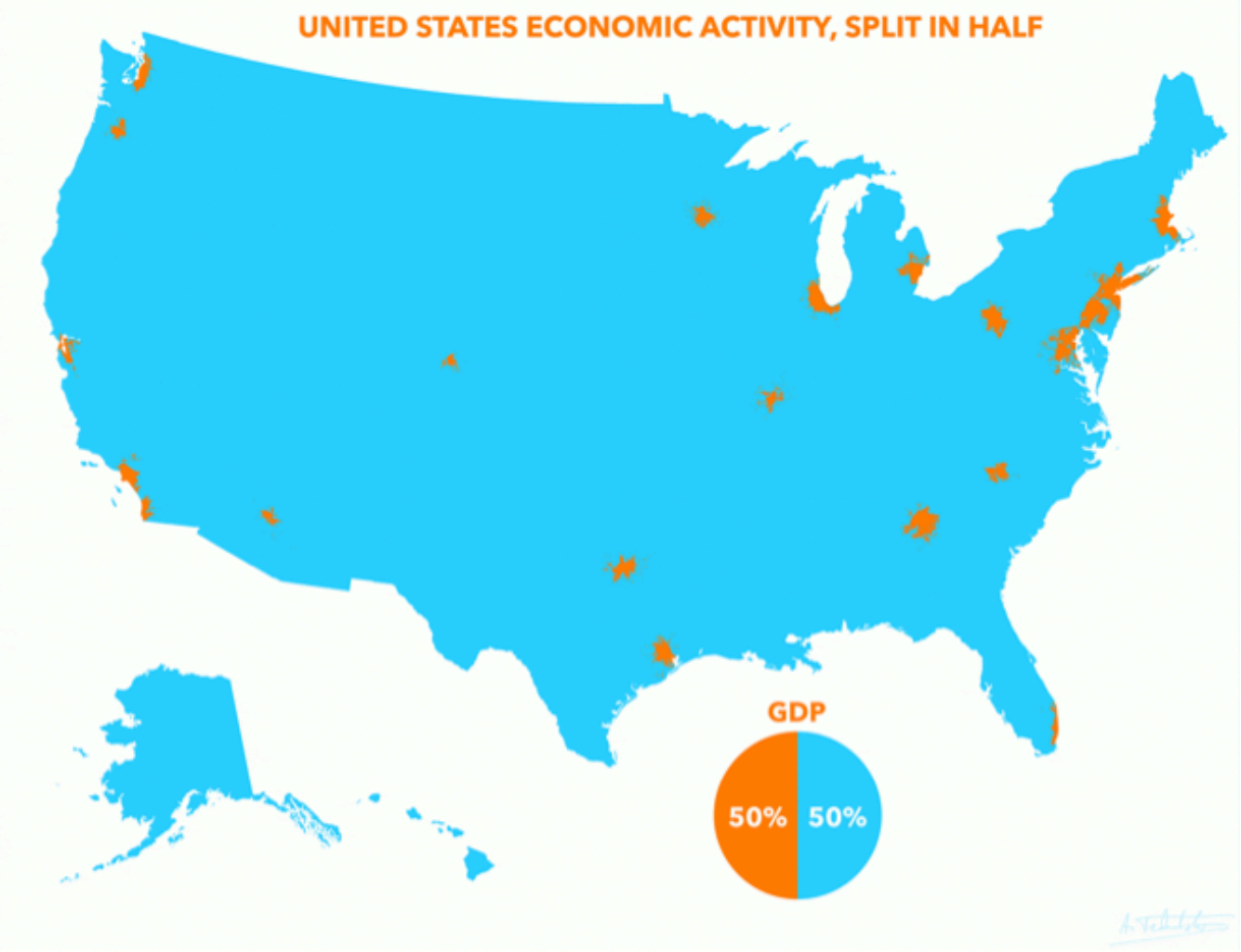
Geography and Mobility. The following map can be used to stimulate discussion. Ask the students why economic activity is clustered in the orange areas. There are two related answers. The orange areas are near coasts and navigable rivers, as discussed in the Geography and Growth video and also seen in the satellite visuals shown in the ppt. Second, the map is closely related to a map of high-population areas[2] which tells us that geography has a big influence on where people live.

How much does history matter? Would cities locate in the same places if they had to be built today when airplanes and roads are more common? Introduce the concept of path dependence.

People in the blue regions have roughly similar wages to people in the orange regions. What does this tell us about mobility? Answer: People within a country move to equalize wages.

What would happen if people from the blue regions couldn't move to the orange regions? Say if the United States were split into different countries? Answer: wages wouldn't be able to equalize as easily and we might see bigger differences across regions. Question for discussion: what does this say about international borders, wages and migration? Are some people just unlucky to be born into regions that are not well suited to mass economic activity?

2. See the xkcd comic, http://xkcd.com/1138/



ALTERNATE EXERCISE: Preview next class lecture which continues the conversation on other determinants of economic growth (such as Deirdre McClosky's ideas/video on innovation, the role of institutions, including geography's indirect role on institution formation.)

4. POST-CLASS ASSIGNMENTS

Students: Ask students to pick two neighboring countries – one that has a relatively high incidence of malaria/ tropical disease and one that has a relatively low incidence (e.g., Algeria and Mali share a border; Algeria has a low incidence of malaria and Mali has a relatively high incidence.). Students should be clear about where they obtained their data on malaria rates and how they measured it (e.g., death rates, incidence per 100,000, etc.). Discuss how the countries differ, if at all, in GDP per capita, fertility rates, etc. Do their findings support or refute the hypothesis that geography impacts economic growth?

ALTERNATE EXERCISE: Ask students to research and respond to the following scenario: Imagine that we eradicate malaria/other diseases plaguing many developing countries. Would economic growth rates for these countries improve? Consider Tyler Cowen's blog post on this subject.

ALTERNATE EXERCISE: Ask students to research a wealthy country other than the US and create a map similar to the 50%/50% economic activity map of the United States displayed above. Do they notice any similar patterns? E.g., most wealthy regions occur near major bodies of waters, path dependence, etc.?

ALTERNATE EXERCISE: Ask students to research progress to date on malaria/tropical disease eradication in a developing country of their choice. What are the barriers to success? (Suggest they research Duflo, Hoffman[3], Sachs, etc.)

Teacher: Reflect on the class discussion and student exercises. When were students most engaged? Confused? Bored? What could you do to change/improve the discussion?

5. SUPPLEMENTAL RESOURCES

PPT: Deep Determinants of Economic Growth by Alex Tabarrok

Textbook: Any principles of economics textbook. The videos are based on the section titled *The Wealth of Nations and Economic Growth* in Modern Principles of Economics (3rd ed.) by Tyler Cowen and Alex Tabarrok but are appropriate for use by any teacher using any textbook.

ADDITIONAL VIDEOS:

Video: Development and Trade: Empirical Evidence: http://mruniversity.com/courses/development-economics/development-and-trade-empirical-evidence | Marginal Revolution University | Development Economics

Video: Development and Trade: The Effect of Geography on Institutions: http://mruniversity.com/courses/development-economics/effect-geography-institutions | Marginal Revolution University | Development Economics

PODCASTS:

RadioLab: Modest Proposal to Eliminate Mosquitos

EconTalk: Jerven on Measuring African Poverty and Progress; Jerven on Variation in African Growth Rates

ARTICLES/BOOKS:

Conley, Dalton, Gordon C. McCord, and Jeffrey D. Sachs. *Africa's lagging demographic transition: evidence from exogenous impacts of malaria ecology and agricultural technology*. No. w12892. National Bureau of Economic Research, 2007. http://www.nber.org/papers/w12892

Bleakley, H. 2010. Malaria Eradication in the Americas: A Retrospective Analysis of Childhood Exposure. *American Economic Journal: Applied Economics*, 2(2): 1–45.

Gallup, J. L., & Sachs, J. D. 2001. *The economic burden of malaria. The American Journal of Tropical Medicine and Hygiene*, 64(1 suppl): 85–96. Retrieved from http://www.ajtmh.org/content/64/1_suppl/85

Venkataramani, A. S. 2012. Early life exposure to malaria and cognition in adulthood: Evidence from Mexico. *Journal of Health Economics*, 31(5): 767–780.

Masters, W. A., & McMillan, M. S. 2001. Climate and Scale in Economic Growth. *Journal of Economic Growth*, 6(3): 167–186.

3. Hoffmann, Vivian. "Intrahousehold allocation of free and purchased mosquito nets." *The American Economic Review* (2009): 236-241.

Mellinger, A. D., Sachs, J. D., & Gallup, J. L. 2000. Climate, coastal proximity, and development. *The Oxford handbook of economic geography, Oxford University Press*, Oxford, 169–194.

Smith, Adam. 1776 [1904] *An Inquiry into the Nature and Causes of the Wealth of Nations*. Edwin Cannan, ed. Library of Economics and Liberty. Retrieved July 15, 2015 from the World Wide Web: http://www.econlib.org/library/Smith/smWN.html
Feyrer, James. *Distance, trade, and income-the 1967 to 1975 closing of the Suez Canal as a natural experiment*. No. w15557. National Bureau of Economic Research, 2009. http://www.nber.org/papers/w15557

Brinkley, GL. The Economic Impact of Disease in the American South, 1860-1940 (PhD dissertation). University of California, Davis, 1994.

Landes, David S. *The wealth and poverty of nations: Why some are so rich and some so poor.* WW Norton & Company, 1999. Chapter 2: Answers to Geography- Europe and China

Jared, Diamond. "Guns, germs, and steel: the fates of human societies." *NY: WW Norton & Company* 14 (1997). Chapter 10: Spacious Skies and Tilted Axes and Epilogue: The Future of Human History as a Science

NEWS:
Article summarizing research on the Suez Canal closing's impact on trade and GDP (http://www.voxeu.org/article/1967-75-suez-canal-closure-lessons-trade)

Incidence of malaria: http://www.theguardian.com/global-development/datablog/2011/apr/25/world-malaria-day-data

BLOGS:
The true size of Africa: http://blog.supplysideliberal.com/post/65107804390/the-true-size-of-africa-revisited

Worm wars: http://chrisblattman.com/2015/07/23/dear-journalists-and-policymakers-what-you-need-to-know-about-the-worm-wars/

6. FAST FACTS

- People are not randomly distributed across the world's surface. 90% of people live on 10% of the area.
- Effects of malaria:
  - Even today, malaria causes around two hundred million sicknesses every year with a half a million to a million deaths especially in children.
  - Children stricken with malaria often have long-term impairments including to IQ and motor development.
  - The deadly effects of malaria are indicated by evolution of the sickle cell trait, a mutation of the hemoglobin gene. Inheritance of a single copy (each individual carries two) of the sickle mutation confers some immunity against malaria. But two copies of the gene cause sickle cell disease which often leads to death (especially without treatment). In some parts of Africa the mutation is present in ¼ or the population. Thus evolution is telling us that historically a ¼*1/4=6.25% chance of death was a good tradeoff for a 50% chance of some immunity to malaria.
- Over a quarter of the world's population is infected with some type of worm (e.g., roundworm, hookworm, etc.)
- In 2011, 2.2 billion people lived on less than $2 per day. (World Bank, 2011)