

AREC 345: Global Poverty & Economic Development

Lecture 4:

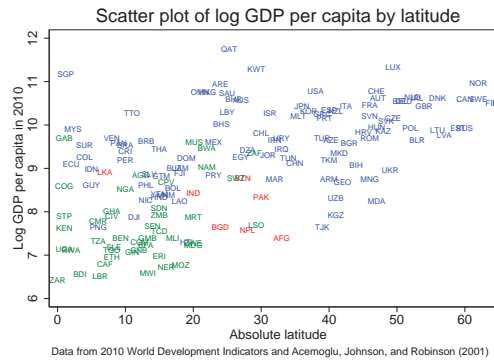
Does Geography Explain African Underdevelopment?

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Does Absolute Latitude Explain Underdevelopment?

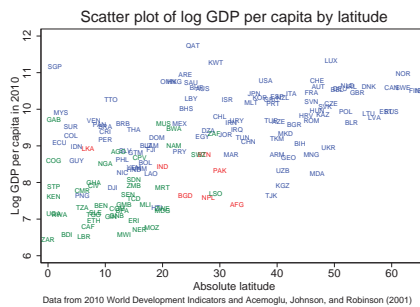
Does Latitude Explain Underdevelopment?



Q: What is the correlation between income and latitude?

A: 0.580

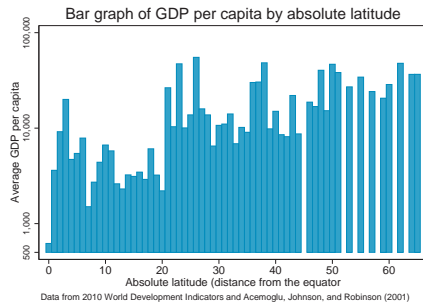
Does Latitude Explain Underdevelopment?



So, is that, like, um, large or small?

- On average, how large of a change in log GDP per capita is associated with each 1 degree increase absolute latitude?
- Could differences in distance from the equator (i.e. tropicality) explain most of the observed variation income per capita?

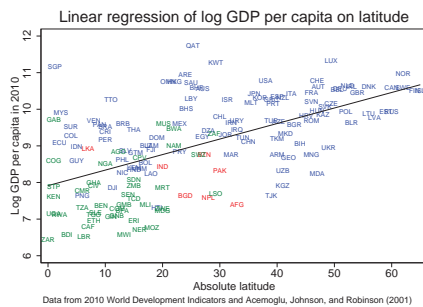
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Simple Linear Regression

Linear regression: “fitting a line” to the data

- **Dependent variable:** log GDP per capita in 2010 (on y-axis)
- **Independent variable:** absolute latitude (on x-axis)

We regress the **dependent variable** on the **independent variable**

- On average, how large of a change in the dependent variable is associated with each 1 unit increase in the independent variable?
- We are assuming that the relationship is **linear**:
 - ▶ Each 1 unit increase in the independent variable is associated with the same size change in the average value of the dependent variable

What Is a Line?

A set of points that satisfy the equation: $y = a + b \cdot x$

- a is the **intercept**
- b is the **slope**

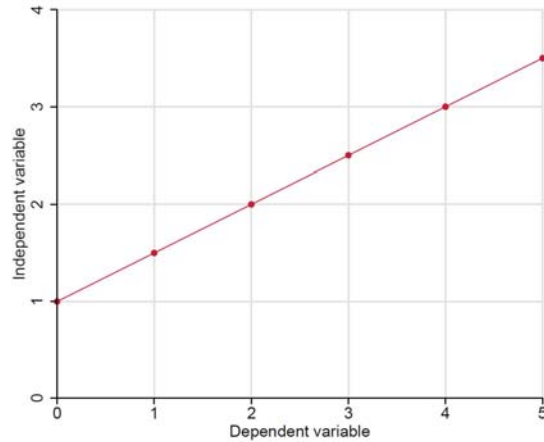
The intercept tells us the value of the dependent variable where the line cross the (horizontal) y-axis — in other words, where the line starts

The slope tells us how big of a change in the dependent variable we see (on the line) for every one unit increase in the independent variable

- We are usually more interested in the slope than the intercept

What Is a Line?

An example of a line: $y = 1 + \frac{1}{2}x$



Linear Regression: Fitting a Line to Data

All lines take the form: $y = a + b \cdot x$

- A one unit increase in x is associated with a ___ unit change in y ?

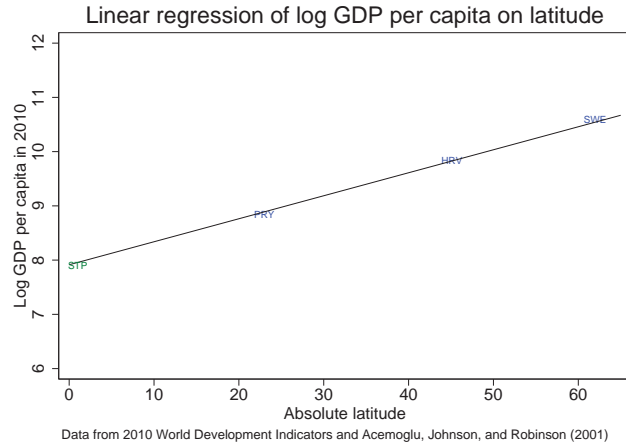
The line we are interested in:

$$\underbrace{\text{predicted GDP per capita}}_{y, \text{ the dep. var.}} = a + b \cdot \underbrace{\text{absolute latitude}}_{x, \text{ the ind. var.}}$$

We will use the data in the scatter plot to estimate this line

- By “estimate this line” we mean figure out what a and b should be
- The estimated value of b (the slope of the line) will tell us: a 1 unit increase in latitude is associated how big of a change in log GDP?

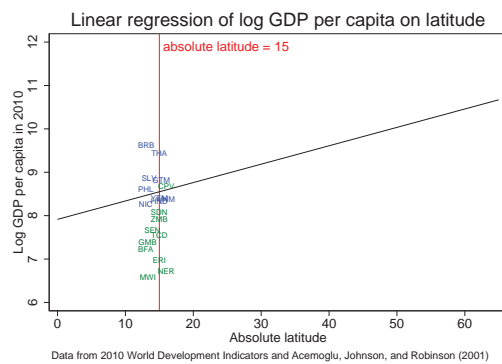
Linear Regression: Fitting a Line to Data



Easy if all countries were like Sao Tome & Principe, Paraguay, Croatia, and Sweden. . .

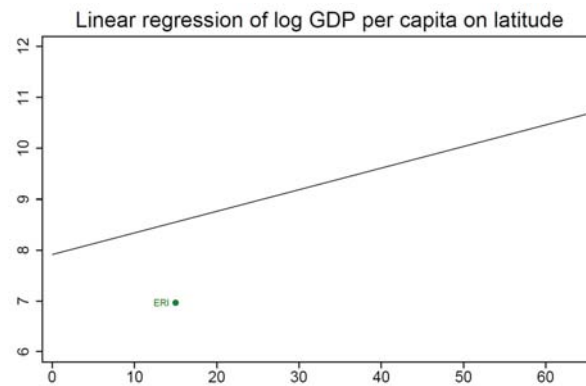
Linear Regression: Fitting a Line to Data

The regression line gives us a **predicted** relationship



On average, countries that have absolute latitudes of about 15 degrees have values of log GDP per capita around $a + b \cdot 15$

Linear Regression: Fitting a Line to Data



The difference between the actual value of the dependent variable and the average value predicted by the linear model is called the **residual**

Are GDP per Capita and Latitude Related?

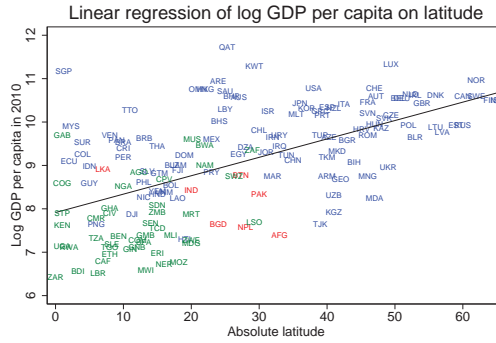
Each data point (country) is associated with its own residual

- We observe a value of the latitude variable for each country
- Gives us a regression prediction of that country's log GDP per capita
- Very few countries will have actual levels of log GDP per capita that line up precisely with the prediction of the regression model

The line estimated through simple linear regression:

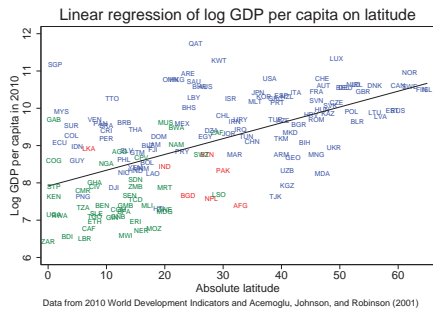
- Minimizes the sum of the squares of the residuals

Are GDP per Capita and Latitude Related?



Estimated slope coefficient: 0.0424

Are GDP per Capita and Latitude Related?



$$E(\log \text{ GDP}) = 7.915 + 0.0423 \cdot \text{latitude} \quad \leftrightarrow$$

Dep. Var. = Log GDP	
	OLS
(1)	
Latitude	0.0423*** (standard error of b)
Constant	7.915*** (standard error of a)

Are GDP per Capita and Latitude Related?

Regression results:

$$E(\log \text{ GDP per capita}) = 7.915 + 0.0423 \cdot \text{latitude}$$

Interpretation:

Location	Latitude	E(Log GDP)	E(GDP)	Actual GDP
Equator	0°	7.915	\$ 2,738	
Kinshasa, DRC	4.4°	8.098	\$ 3,287	\$ 619
Tropic of Cancer	23.4°	8.907	\$ 7,381	
Washington DC	38.9°	9.564	\$ 14,242	\$ 48,357
Oslo, Norway	59.6°	10.456	\$ 34,755	\$ 57,739

Absolute latitude explains about $\frac{1}{3}$ of the observed variation in income

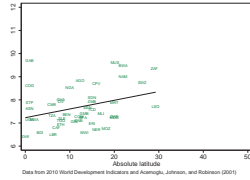
Does Geography Explain Underdevelopment?

Positive correlation between distance from the equator (absolute latitude) and development (specifically, income per capita and child mortality)

Greater distance from equator  Higher GDP per capita

Are GDP per Capita and Latitude Related?

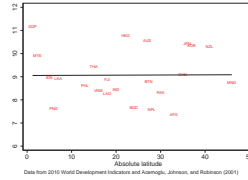
Sub-Saharan Africa



Regression results:

intercept = 7.229
slope = 0.038

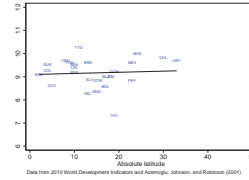
South & East Asia



Regression results:

intercept = 9.092
slope = 0.005

Latin America, etc



Regression results:

intercept = 9.053
slope = 0.001

Study Guide: Key Terms

- linear regression
- independent variable
- dependent variable
- intercept
- slope
- linear prediction
- residual