
International Studies & AAE 374
Growth and Development of Nations

Lecture 25
8 December 2009

I. Announcements:

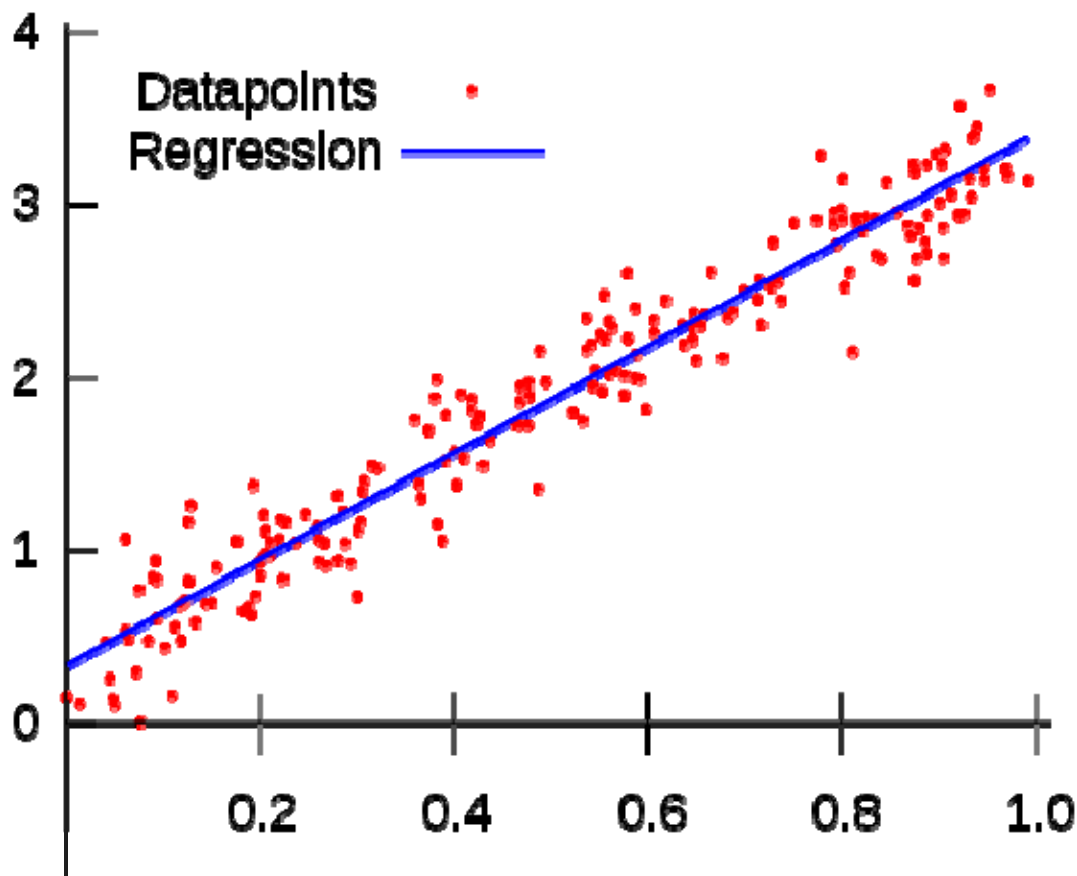
- A. Final exam: Sat (12/19) at 2:45 pm in Chemistry B371
- B. Final format same as midterm
- C. Can we schedule the discussion review this week and do a review on Thursday 7 pm in B30 Taylor Hall?

II. Overview

- A. Primacy of domestic institutions (Rodrik, Subramanian, & Trebbi)
- B. Before all that: Brief-up on Regression as an analysis tool

III. Regression Digression (or, How to become a social scientist in under 10 minutes)

- A. Regression: The ubiquitous tool of social science research
- B. Many ways of characterizing regression as a statistical tool to “convert data into results”
- C. Geometrically the line of best fit, so captures relationships between variables



D. Simple example: Lets say Brad's basketball team plays pick-up games against other faculty teams

1. Each game is numbered by i , i from 1 to 30 and if Brad's team wins we record it as $Y_i = 1$ and if they lose $Y_i = 0$
2. Every once in a while Michael Jordan drives up to play on Brad's team, and when MJ plays we record it as $M_i = 1$ and if not $M_i = 0$
3. We want to assess the effect of MJ playing on the win percentage and we can write a "regression model"

$$Y_i = \alpha + \beta M_i + \varepsilon_i$$

here β captures the effect of MJ playing (expected sign?), α is the average win percentage w/o MJ and ε_i is some random noise (team had a really good/bad game that day, etc.)

4. Here the left hand side is called the dependent variable and the right hand side the independent variables or regressors, the idea being the outcome of a game “depends” on how good Brad’s team is w/o MJ, whether MJ plays, etc.
5. The other dimension is statistical significance: if we see $\beta > 0$, is the value of β large enough (in magnitude) to be statistically different from zero? Typically papers report this as one to three stars (* to ***) in increasing significance – no stars means that we cannot conclude the parameter is different from zero at “conventional” levels of statistical confidence.
6. Actually, we’ve been using regression results to talk about a lot of things, e.g. growth. We’ve seen the following growth equation:

$$\hat{y} = \hat{A} + \alpha \hat{k} + \beta \hat{s}$$

Elsewhere we’ve said that $\alpha = 0.39$ and that $\beta = 0.27$, essentially where this is coming from is taking country data on output growth, capital growth and human capital growth and running the following regression:

$$\hat{y}_t = \alpha \hat{k}_t + \beta \hat{s}_t + \hat{A}_t$$

7. For your own use there are popular packages in the labs (SAS, SPSS, STATA) you can also use Excel or the (free!) R package at home

IV. Institutions Rule: The Primacy of Institution over Geography and the Integration in Economic Development

A. Overview of Discussion Today

1. What are they trying to explain?
2. What is their core argument?
3. How do they test or validate the argument?
4. What are the identification issues?
5. What do they use as “instruments” for institutions, integration, and geography?
6. What does the data tell them about causes of growth?
7. What do their deeper measures tell them about proximate measures?
8. Lessons and Limitation of the Study
9. How are institutions and policies related?
10. What are the take-home messages for comparative development?

B. Last lecture covered mechanisms for how institutions might shape development?

1. Institutions, property rights, savings, and investment
2. Institutions, investments in human capital, and productivity growth
3. Institutions and technology transfer
4. Institutions and innovation/R&D

C. What are some of the main mechanisms for how integration shapes or drives international development?

1. Trade and comparative advantage – Specialization and trade lead to higher incomes which drive accumulation and growth.
2. Trade leads to more competition that stimulates innovation and efficiency.
3. Trade and FDI lead to learning, technology transfer, and increased opportunities.

D. What are some of the main mechanisms for how geography shapes or drives international development?

1. Lewis model: agricultural productivity differences in tropics and temperate areas.
2. Natural resources and rents leading to Dutch Disease or Resource Curse
3. Guns, Germs, and Steel argument for Europe
 - a. Location and possibilities
 - b. East/West axis
 - c. Dynamic process of food surpluses and food storage and then to large, dense, sedentary, and stratified societies that lead to technological change that allows further advances.

E. **Engerman and Sokoloff view** combines geography and institutions because it argues that factor endowments (soils, local conditions) help to shape structure of economic opportunities, inequality outcomes, and thus institutions to perpetuate inequality.

V. *Institutions Rule: Issue, Argument, and Empirical Strategy*

A. What are they trying to explain?

1. 100:1 ratio between richest country, Luxemborg and Sierra Leone in 2000, or divergence in income per capita or diverse economic development outcomes.
2. More specifically, the role of geography, integration (e.g. trade), and institutions in this outcome.
3. Deeper drivers of physical and human capital accumulation and its endogenous growth variant, technological change.
4. Challenge is that deeper determinants are endogenous to one another. Higher income could drive better institutions, better institutions could allow for more effective integration, and so-on.
5. Figure 1 summarizes the challenge.
6. Easiest for geography because there is not a flow back to it really. It can have direct effects on income (ag productivity) and integration (location). Not so easy for institutions view that has to make sure that income levels don't flow back and drive institutions outcome (arrow 9)

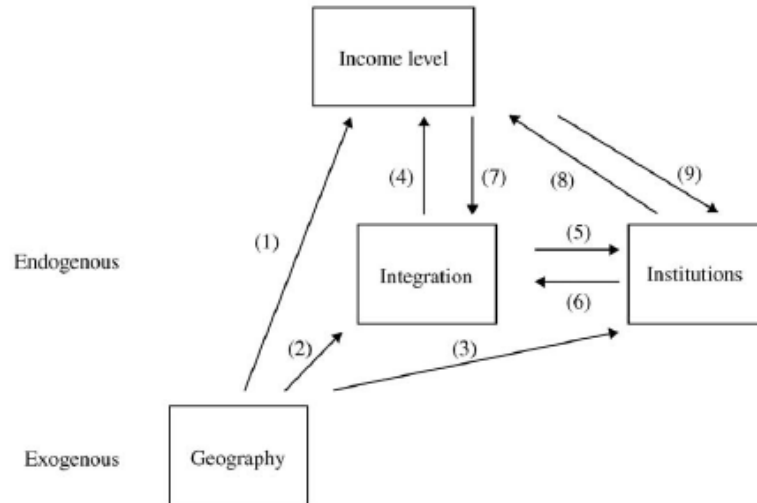


Figure 1. The “deep” determinants of income.

B. What is their empirical strategy?

1. Use instrumental variables for “institutions” and “integration” that capture the exogenous source(s) of variation in those variables that are uncorrelated with other plausible determinants of income levels.
2. Draw from two studies, one that examined “integration” and one that examined “institutions” and combine their “instruments” in various ways to see whether the results they get are robust.
3. The relationship they try to estimate is captured by this equation:

$$\log y_i = \mu + \alpha \text{INS}_i + \beta \text{INT}_i + \gamma \text{GEO}_i + \varepsilon_i,$$

4. But, they want to create instruments for INS_i and INT_i , which are evident below. The instruments are SM_i (settler mortality) and CONST_i (predicted or constructed trade openness measure recovered from “gravity” model of trade). For SM_i , the idea is that higher settler mortality makes institutions less robust because people are less likely to settle in and build good institutions where likelihood of death is high (usually due to tropical illnesses). High settler mortality areas are ones that try to get riches out fast. For CONST_i (the idea is that trade openness is endogenous but you can predict it based on measures of country mass, distance between trade partners, and some other geographical variables).

$$INS_i = \lambda + \delta SM_i + \phi CONST_i + \psi GEO_i + \varepsilon_{INS_i},$$

$$INT_i = \theta + \sigma CONST_i + \tau SM_i + \omega GEO_i + \varepsilon_{INT_i},$$

5. 2-stage regression where first you estimate INS_i and INT_i and then you put those predicted measures into the Y_i regression to identify effects. You can look for indirect effects of INT_i on INS_i or visa-versa through the first stage results of $CONST_i$ on INS_i or SM_i on INT_i .
6. Mess around with the countries covered in the data, alternative variables and see whether results are robust to changes.

C. What is their core finding?

1. INSTITUTIONS RULE. Integration has no direct effect on incomes and geography has at best weak direct effects.
2. Institutions positively shape integration and geography shapes institutions which then shape income.
3. Account for about half of the variation in income across sample. Bolivia/South Korea comparison. Institutions capture income difference.

VI. Econometrics of Institutions Rule

A. Primary Results as Illustration of the Strategy and Analysis

1. Simple bivariate comparison of 3 main determinants versus GDP per capita. All have a strong positive relationship, especially rule of law. So, a priori, they are all contenders.

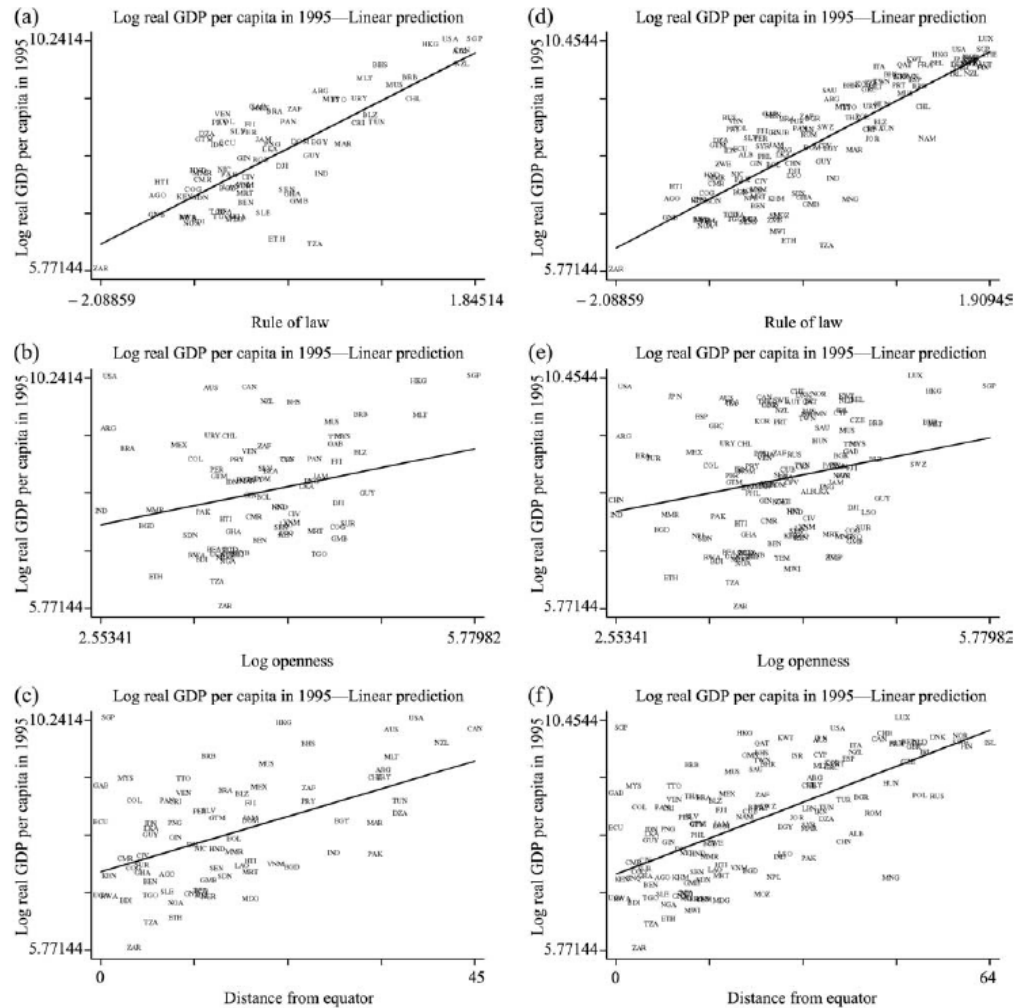


Figure 2. Simple correlations between income and its determinants (sample of 79 countries for (a)–(c); sample of 137 countries for (d)–(f)).

2. Same result is also evident in COLUMN 6 of Table 2. But, notice there that the strongest t-statistic is Institutions.

Table 2. Determinants of development: Core specifications, ordinary least squares estimates.

Dependent Variable	Log GDP per capita								
	Acemoglu et al. Sample			Extended Acemoglu et al. Sample			Large Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Geography (DISTEQ)	0.74 (4.48)*	0.20 (1.34)	0.32 (1.85)**	0.80 (5.22)*	0.22 (1.63)	0.33 (2.11)**	0.76 (10.62)*	0.20 (2.48)**	0.23 (2.63)*
Institutions (RULE)		0.78 (7.56)*	0.69 (6.07)*		0.81 (9.35)*	0.72 (6.98)*		0.81 (12.12)*	0.78 (10.49)*
Integration (LCOPEN)			0.16 (1.48)			0.15 (1.53)			0.08 (1.24)
Observations	64	64	64	79	79	79	137	137	137
R-square	0.25	0.57	0.59	0.26	0.61	0.62	0.42	0.71	0.71

Notes: The dependent variable is per capita GDP in 1995, PPP basis. There are three samples for which the core regressions are run: (i) the first three columns correspond to the sample of 64 countries in Acemoglu et al. (2001); (ii) columns (4)–(6) use a sample of 79 countries for which data on settler mortality (LOGEM4) have been compiled by Acemoglu et al.; and (iii) columns (7)–(9) use a larger sample of 137 countries. The regressors are: (i) DISTEQ, the variable for geography, which is measured as the absolute value of latitude of a country; (ii) Rule of law (RULE), which is the measure for institutions; and (iii) LCOPEN, the variable for integration, which is measured as the ratio of nominal trade to nominal GDP. All regressors are scaled in the sense that they represent deviations from the mean divided by the standard deviation. All regressors, except DISTEQ and RULE, in the three panels are in logs. See the Appendix for more detailed variable definitions and sources. *t*-statistics are reported under coefficient estimates. Significance at the 1, 5, and 10 percent levels are denoted respectively by *, **, and ***.

3. Can't just do simple OLS as in column 6 though. Reverse causality, omitted variable bias, and measurement error could all bias the relationship.
4. Two-stage approach is their remedy to this problem. They are going to create predicted variables for each measure based on “instruments”.
5. Table 3 is the core table for the regressions but again they use a set of “plots” to see what happens in the more econometrically defensible approach.
6. Core results are reversed for integration and geography views

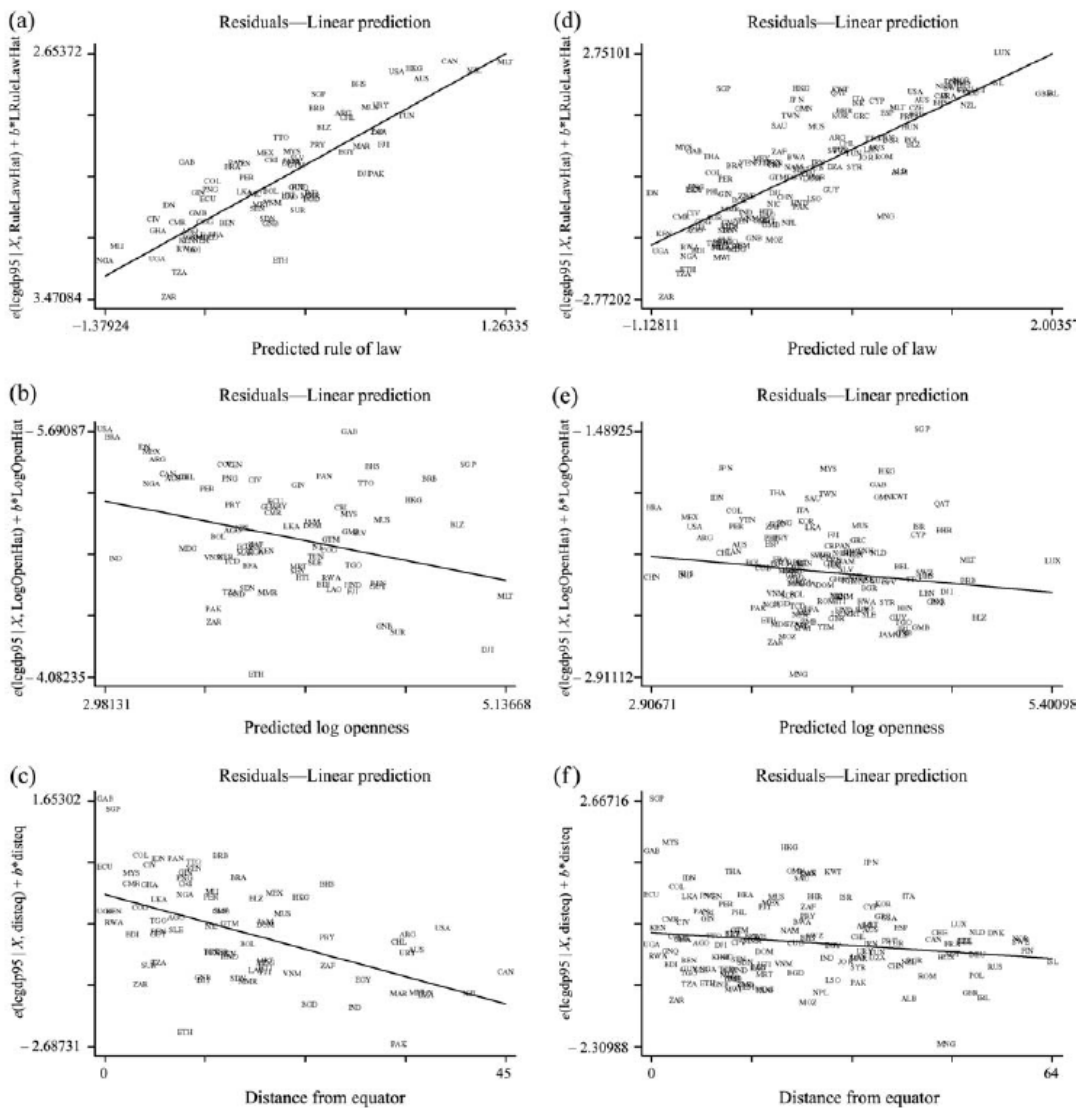


Figure 3. Conditional correlations between income and its determinants (sample of 79 countries for (a)–(c); sample of 137 countries for (d)–(f)).

7. In Table 3, the regression coefficients show that only the relationship for Institutions is positive and statistically significant in explaining income variation across the world as of 1995.
8. First stage regression results are interesting, too.
 - (a) Settler mortality has a significant and positive effect on integration (institutions shape openness)
 - (b) Geography helps to shape institutions
 - (c) Integration helps with institutions but the coefficient is not as significant.

9. Notice that in column 3 only Institutions has a positive and significant sign, same in columns 6 and 9, too.

Table 3. Determinants of development: Core specifications, instrumental variables estimates.

	Acemoglu et al. Sample			Extended Acemoglu et al. Sample			Large Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel A: Second-stage: Dependent variable = Log GDP per capita</i>									
Geography (DISTEQ)	0.74 (4.48)*	-0.42 (-1.19)	-0.56 (-1.23)	0.80 (5.22)*	-0.45 (-1.26)	-0.72 (-1.38)	0.76 (10.62)*	-0.06 (-0.5)	-0.14 (-0.93)
Institutions (RULE)		1.68 (4.29)*	1.78 (3.78)*		1.75 (4.42)*	1.98 (3.56)*		1.19 (8.02)*	1.30 (7.09)*
Integration (LCOPEN)			-0.18 (-0.71)			-0.31 (-1.10)			-0.15 (-1.09)
No. of observations	64	64	64	79	79	79	137	137	137
R-square	0.25	0.54	0.56	0.26	0.51	0.52	0.417	0.51	0.56
Test for over-identifying restrictions (<i>p</i> -value)								(0.0089)	(0.0354)
<i>Panel B: First Stage for Endogenous Variables (Institutions (RULE) and Integration (LCOPEN))</i>									
Dependent variable	RULE	RULE	LCOPEN	RULE	RULE	LCOPEN	RULE	RULE	LCOPEN
Geography (DISTEQ)	0.41 (2.8)*	0.47 (3.21)*	-0.25 (-2.00)**	0.47 (3.34)*	0.54 (3.87)*	-0.18 (-1.37)	0.67 (10.81)*	0.66 (11.23)*	-0.05 (-0.84)
Settler mortality (LOGEM4)	-0.39 (-3.87)*	-0.40 (-4.1)*	-0.30 (-3.51)*	-0.34 (-3.69)*	-0.34 (-3.82)*	-0.27 (-3.22)*			
Population speaking English (ENGFRAC)							0.19 (2.69)*	0.18 (2.69)*	0.17 (2.65)*
Population speaking other European languages (EURFRAC)							0.14 (1.94)**	0.17 (2.55)**	-0.11 (-1.67)**
Constructed openness (LOGFRANKROM)	na	0.20 (1.95)**	0.90 (10.32)*	na	0.19 (2.16)**	0.80 (9.67)*	na	0.23 (3.99)*	0.70 (12.33)*
F-statistic	22.9	17.2	41.7	24	18.5	36.9	50.09	45.79	41.39
R-square	0.41	0.44	0.66	0.37	0.40	0.58	0.52	0.57	0.54
Partial R-square		0.16	0.58		0.12	0.51		0.18	0.52
corr(RULEFIT, LCOPENFIT)			0.14			0.21			0.27

Notes: The dependent variable in panel A is per capita GDP in 1995, PPP basis. There are three samples for which the core regressions are run: (i) the first three columns correspond to the sample of 64 countries in Acemoglu et al. (2001); (ii) columns (4)–(6) use a sample of 79 countries for which data on settler mortality (LOGEM4) have been compiled by Acemoglu et al.; and (iii) columns (7)–(9) use a larger sample of 137 countries for which the instrument for institutions is similar to that in Hall and Jones (1999). The regressors in panel A are: (i) DISTEQ, the variable for geography, which is measured as the absolute value of latitude of a country; (ii) Rule of law (RULE), which is the measure for institutions; and (iii) LCOPEN, the variable for integration, which is measured as the ratio of nominal trade to nominal GDP. All regressors are scaled in the sense that they represent deviations from the mean divided by the standard deviation. The dependent variables in panel B are measures of institutions (RULE) and/or integration (LCOPEN) depending on the specification. The regressors in panel B are: (i) DISTEQ described above; (ii) settler mortality (LOGEM4) in the first six columns; (iii) the proportion of the population of a country that speaks English (ENGFRAC) and the proportion of the population that speaks any European language (EURFRAC) in the last three columns; (iv) instrument for openness (LOGFRANKROM) obtained from Frankel and Romer (1999). All regressors, except DISTEQ and RULE, in the three panels are in logs. See the Appendix for more detailed variable definitions and sources. Standard errors are corrected, using the procedure described in Frankel and Romer (1999), to take into account the fact that the openness instrument is estimated. *t*-statistics are reported under coefficient estimates. Significance at the 1, 5, and 10 percent levels are denoted respectively by *, **, and ***.

VII. Deeper Measures and Proximate Measures

A. Examine the relationship between the “deeper measures” of institutions, integration, and geography on Y/L (productivity), K/L (capital accumulation), H/L (educational attainment), TFP (total factor productivity)

B. Similar regressions to Y/per capita

C. What do they find?

1. Institutions only significant and positive coefficient estimate for all of these proximate measures we have been examining in the course.
2. Integration is negative and significant for human capital per worker which is interesting.
3. Notice that the largest coefficient estimate is on capital per worker. Could be interpreted as they try to do in terms of key role of having a secure investment context.

Table 5. Determinants of Development: Channels of Influence.

Dependent Variable	Extended Acemoglu et al. Sample				Larger Sample			
	Income per worker (1)	Capital per worker (2)	Human Capital per worker (3)	Total Factor productivity (4)	Income per worker (5)	Capital per worker (6)	Human Capital per worker (7)	Total Factor productivity (8)
Geography (DISTEQ)	-0.97 (-1.52)	-1.72 (-1.63)	-0.26 (-1.54)	-0.33 (-1.02)	-0.25 (-1.18)	-0.38 (-1.14)	-0.05 (-1.00)	-0.13 (-0.85)
Institutions (RULE)	2.21 (3.30)*	3.39 (3.03)*	0.56 (3.14)*	1.06 (3.08)*	1.32 (5.30)*	1.90 (4.72)*	0.34 (5.64)*	0.69 (3.74)*
Integration (LCOPEN)	-0.42 (-1.36)	-0.70 (-1.30)	-0.15 (-1.86)***	-0.13 (-0.84)	-0.30 (-1.79)**	-0.46 (-2.10)**	-0.11 (-3.00)*	-0.11 (-0.84)
R-square	0.60	0.52	0.51	0.44	0.58	0.54	0.58	0.36
No. of observations	73	73	73	73	119	119	119	119

Notes: The four dependent variables—income per worker, capital per worker, human capital per worker, and the level of total factor productivity—are expressed in natural logarithms and are from Hall and Jones (1999). The IV estimates for the Acemoglu et al. sample use settler mortality (LOGEM4) as the instrument for institutions and EURFRAC and ENGFAC as the instrument for the larger sample. All regressors, except RULE, are in logarithms and are scaled. Standard errors are corrected, using the procedure described in Frankel and Romer (1999), to take into account the fact that the openness instrument is estimated. *t*-statistics are reported under coefficient estimates. Significance at the 1, 5, and 10 percent levels are denoted respectively by *, **, and ***.

VIII. *What Do We Learn From Their Study?*

A. Lessons, Limits, and Take Home Messages

1. Institutions Rule but Instruments DO NOT MAKE A THEORY.
2. What do they mean by that? Explained on pages 153-154, but basic idea is that the instrument does not provide a basis for making cause and effect arguments, only that we are onto a key pathway for explanation but not how it works. They critique previous authors for stretching their argument.
3. First lesson is thus what the paper does not do.
4. Institutional quality DOES NOT MEAN THAT POLICY CANNOT BE EFFECTIVE
 - Many institutions have been successfully reformed. They point to Meiji Restoration in Japan, South Korea during the 1960s, and China since the 1980s.
 - Why? Policy = Flow variable; Institutions = Stock variable: As a reminder, income would be a flow and wealth would be a stock.
 - Think of institutions as the cumulative outcome of past policy actions (both private and public?).
 - Institutions do change and countries work on changing them through policy.
5. Does the finding that INSTITUTIONS RULE help?
 - (a) Yes and No. They may steer us away from going after Integration as the answer or help us to identify that geography is not necessarily fate.
 - (b) They do not tell us what kinds of property rights will work out best even. Great contrast between China and Russia since the 1980s. China has maintained a socialist legal system and lots of collective property right regimes (leased not owned land). Russia went private with the fall of Communism. Yet, investment has boomed in China and uncertainty plagues Russia. Credibility of property right protection may dominate whether it is formally “private” or not.
 - (c) Institutions appear very context specific (successful ones combine orthodoxy and unorthodox approaches) and why North America, Western Europe, and Japan can have such different institutional contexts and yet do well.

6. Need for more cross-national studies of what institutions work and don't work.

Further Discussion Questions:

1. Do you agree with their premise that institutions, integration, and geography may be the deeper drivers of development outcomes?
 - a. For example, do you see a connection between this argument and the one in Birdsall et al. on how inequality shapes human capital accumulation outcomes and hence growth prospects?
 - b. How would you fit the Sokoloff and Engerman argument up against this one? Is it a variant on their argument?
 - c. Do you see their argument as adding anything to the Origins of American Industrial Success paper by Gavin Wright which tried to describe the technological developments and congruence that led to America's worldwide technological leadership in the late 19th and first half of the 20th centuries?
2. How do you think institutional quality could help with a pro-integration (trade) policy approach?
 - a. Is your argument here shaped by the capacity of the country to deal with income distribution changes and adjustments that might occur with shifting comparative advantage?
 - b. How about the connection between institutional quality, human capital, and staying competitive?
3. Can you think of country cases where you think geography is essentially fate? Can you think of others where that "fate" was overcome?