

EDUCATION, ECONOMIC GROWTH,
INCOME DIFFERENCES

6-16-09

EASTERLY, BILL

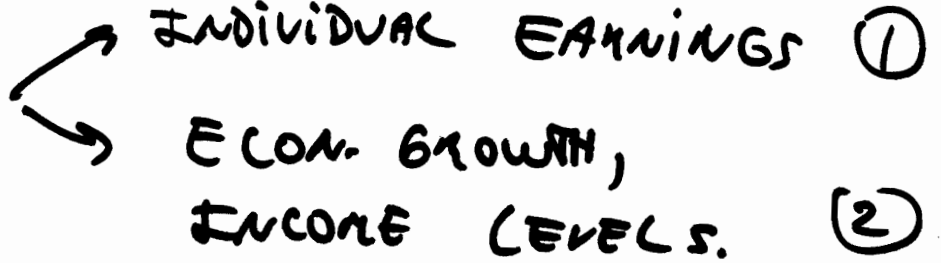
2 MAIN POINTS:

- 1 - INCENTIVES TO INVEST IN EDUCATION
CRUCIAL
- 2 - ISSUE OF COMPLEMENTARY INPUTS:
TECHNOLOGY, PHYSICAL K, INFRASTRUCTURE

OTHER TRUTHS:

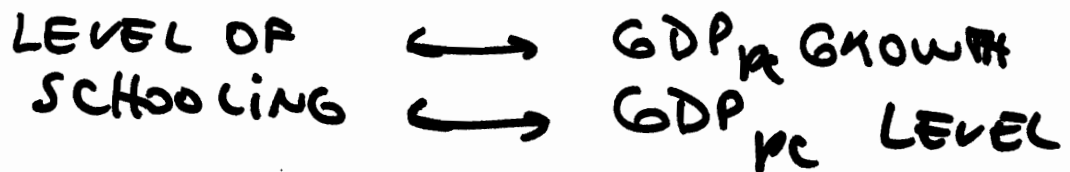
- NO COUNTRY HAS BECOME RICH WITH A
UNIVERSALLY UNSKILLED POPULATION
- ENROLLMENT IN FORMAL SCHOOLING
MAY BE A POOR MEASURE OF
CREATION OF SKILLS
- ADMINISTRATIVE ENROLLMENT TARGETS
DO NOT THEMSELVES CREATE THE
INCENTIVE TO GROW

EDUCATION
AND
RELATION
TO



① MICRO-LABOR LITERATURE:
ESTIMATES OF MONETARY RETURNS
TO INDIVIDUALS FROM SCHOOLING

② MACRO-GROWTH LITERATURE:



OR



① MICRO-LABOR : MINKER EQUATION

H-K EARNINGS FUNCTION

V.G. FIT : IN US :

EACH ADDITIONAL YEAR
OF SCHOOLING ↑ "EARNINGS"
BY 10%

THIS RATE VARIES ACROSS
COUNTRIES & TIME

ISSUES : ABILITY BIAS (UPWARD)
MEASUREMENT ERROR IN (DOWN)
ED. ATTAINMENT

Mincer Equation:

(3)

DERIVED FROM INDIV. OPTIMIZATION ASSUMPTIONS:

- COST OF ATTENDING ADDITIONAL YEAR OF SCHOOL IS JUST STUDENT TIME -
- % ↑ IN EARNINGS CAUSED BY ADDITIONAL SCHOOLING IS CONSTANT OVER LIFETIME.

$$\log w_i = \beta_0 + \beta_1 s_i + \beta_2 x_i + \beta_3 x_i^2 + \epsilon_i$$

WAGE OF AGENT i YEARS OF SCHOOLING EXPERIENCE

EXPERIENCE SQUARED

" β_1 " = RATE OF RETURN TO EDUCATION

$$\frac{\partial \log w_i}{\partial s_i} = \beta_1$$

O.C.S. ESTIMATION OF β_1

RESULTS: MANY COUNTRIES: 0.05 - 0.15 LARGER FOR WOMEN THAN FOR MEN.

② MACRO-GROWTH LITERATURE

MICRO \Rightarrow SCHOOLING DETERMINES WAGES

\Rightarrow MACRO HYPOTHESIS
 Δ LEVEL SCHOOLING AFFECTS $\widehat{GDP_{pc}}$ GROWTH
 $\widehat{GDP_{pc}} = f(\Delta SDC)$

BUT ALSO USED

~~$\widehat{GDP_{pc}}$~~
 $\widehat{GDP_{pc}} = f(\text{INITIAL LEVEL OF EDUCATION})$

BIG ISSUE:

AVERAGE SCHOOLING LEVEL POORLY MEASURED SINCE THEY COME FROM ENROLLMENT DATA.

CONCLUSION:

Δ & INITIAL LEVEL OF EDUCATION ARE POSITIVELY CORRELATED TO $\widehat{GDP_{pc}}$

BUT
CORRELATION IS SMALL
• APPLIES MAINLY TO COUNTRIES WITH LOW ED. LEVELS & NOT TO OED COUNTRIES

LAST REMARKS

(5)

- INCENTIVES → HARD TO MEASURE
- EDUCATIONAL INPUTS → QUALITY

MODELS & SCHOOLING

SOLOW H-k

$$y_{BGP}^*(t) = f[\dots h(t)]$$

↓
LEVEL OF
H-k

LUCAS

$$\hat{y}_{BGP} = \hat{h} = f[\text{SCHOOLING}]$$

(6)

ROLE OF ECONOMIC INSTITUTIONS ON GROWTH

AJR : STRONG CONNECTION
BETWEEN QUALITY OF
INSTITUTIONS & ECONOMIC
PERFORMANCE
BUT ISSUE OF CAUSALITY

REMARKS :

- RICH COUNTRIES CAN AFFORD
BETTER INSTITUTIONS
- OMITTED VARIABLES THAT
INFLUENCE INCOME THAT
CAN BE NATURALLY
CORRELATED WITH INSTITUTIONS.
- MEASURES OF INSTITUTIONS
CONSTRUCTED EX POST
⇒ BIAS IN SEEING BETTER
INSTITUTIONS IN RICHER
PLACES

ECONOMETRIC PROBLEMS:
CAN'T USED OLS

(7)

ECONOMETRIC PROBLEM
CAN BE FIXED
BY USING A TECHNIQUE
CALLED INSTRUMENTAL
VARIABLES.

OLS: DOES NOT WORK

$Y = \alpha + \beta X + \epsilon$

log of GDP per capita. \downarrow

\downarrow INSTITUTE QUALITY
= EXPROPRIATION RISK

WHY? ϵ IS NOT INDEPENDENT OF X .

Fix: INSTRUMENTAL VARIABLES

NEED TO FIND AN
"INSTRUMENT" (VARIABLE Z)
SUCH THAT:

- INSTRUMENT CORRELATED TO X
i.e. CORRELATION BETWEEN X
AND Z DIFFERENT THAN
ZERO
- INSTRUMENT UNCORRELATED

WITH ERKON TEAM -

THIS PROCEDURE YIELDS A
GOOD ESTIMATION OF THE EFFECT
OF X ON Y.

AIR:

INSTITUTIONS CORRELATED TO
CURRENT INCOME BUT
ECONOMETRIC ISSUES -

NEED TO FIND
INSTRUMENT CORRELATED TO
CURRENT INSTITUTIONS BUT
INDEPENDENT OF CURRENT
INCOME -

PREMISES

①

① DIFFERENT TYPES OF
COCONIZATION POLICIES:

- EXTRACTIVE STATES (ONE EXTREME)
(NO INTENT TO
DEVELOP INSTITUTIONS)

- NEO-EUROPEAN:
ANOTHER
EXTREME { SETTLERS REPLICATED EUROPEAN
INSTITUTIONS (STRONG EMPHASIS
ON PRIVATE PROPERTY +
CHECKS AGAINST GOV. POWER)

② COCONIZATION POLICY WAS
INFLUENCED BY FEASIBILITY
OF SETTLEMENTS

i.e. LOCATIONS WHERE DISEASE
ENVIRONMENT WAS UNFAVORABLE
TO EUROPEANS THE PROBABILITY
OF SETTLEMENTS WAS LOW
⇒ FORMATION OF EXTRACTIVE
STATE MORE LIKELY

③ COLONIAL INSTITUTIONS
PERSISTED AFTER INDEPENDENCE.

RESULT :

(10)

INSTITUTIONS STRONG
EFFECT ON
ECON. PERFORMANCE

INST. VARIABLE : NORMALITY RATES OF
CLERGY, SOLDIERS,
SAILORS -

REMARK : - MISSING DATA ALLOCATION
- MILITARY "LOCATION"
ISSUE -

DAVID ALBOY :

DISCOVERS DATA ISSUE
AND QUESTIONS RESULTS

ACTION - HOWITT :

EDUCATION AS AN INSTITUTION

The Colonial Origins of Comparative Development: An Empirical Investigation

By Daron Acemoglu, Simon Johnson, and James A. Robinson*

We exploit differences in European mortality rates to estimate the effect of institutions on economic performance. Europeans adopted very different colonization policies in different colonies, with different associated institutions. In places where Europeans faced high mortality rates, they could not settle and were more likely to set up extractive institutions. These institutions persisted to the present. Exploiting differences in European mortality rates as an instrument for current institutions, we estimate large effects of institutions on income per capita. Once the effect of institutions is controlled for, countries in Africa or those closer to the equator do not have lower incomes. (JEL O11, P16, P51)

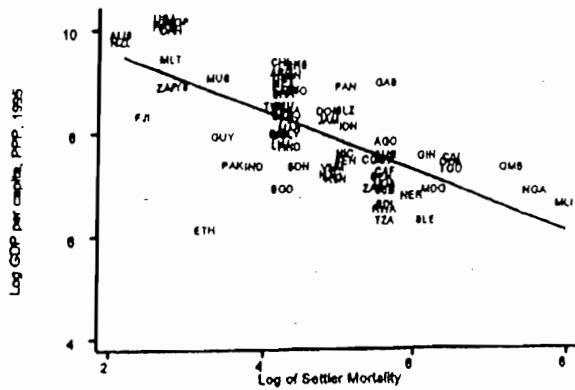
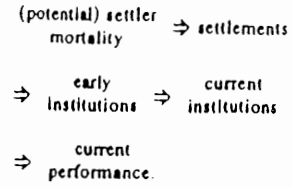


FIGURE 1. REDUCED-FORM RELATIONSHIP BETWEEN INCOME AND SETTLER MORTALITY

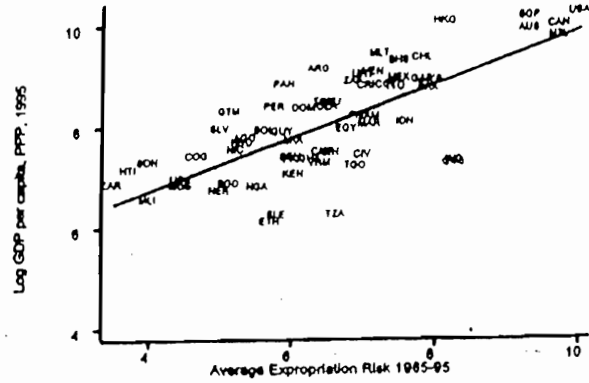


FIGURE 2. OLS RELATIONSHIP BETWEEN EXPROPRIATION RISK AND INCOME

TABLE 1—DESCRIPTIVE STATISTICS

	Whole world	Base sample	By quartiles of mortality			
			(1)	(2)	(3)	(4)
Log GDP per capita (PPP) in 1995	8.3 (1.1)	8.05 (1.1)	8.9	8.4	7.73	7.2
Log output per worker in 1988 (with level of United States normalized to 1)	-1.70 (1.1)	-1.93 (1.0)	-1.03	-1.46	-2.20	-3.03
Average protection against expropriation risk, 1985-1995	7 (1.8)	6.5 (1.5)	7.9	6.5	6	5.9
Constraint on executive in 1990	3.6 (2.3)	4 (2.3)	5.3	5.1	3.3	2.3
Constraint on executive in 1900	1.9 (1.8)	2.3 (2.1)	3.7	3.4	1.1	1
Constraint on executive in first year of independence	3.6 (2.4)	3.3 (2.4)	4.8	2.4	3.1	3.4
Democracy in 1900	1.1 (2.6)	1.6 (3.0)	3.9	2.8	0.19	0
European settlements in 1900	0.31 (0.4)	0.16 (0.3)	0.32	0.26	0.08	0.005
Log European settler mortality	n.a.	4.7 (1.1)	3.0	4.3	4.9	6.3
Number of observations	163	64	14	18	17	15

Notes: Standard deviations are in parentheses. Mortality is potential settler mortality, measured in terms of deaths per annum per 1,000 "mean strength" (raw mortality numbers are adjusted to what they would be if a force of 1,000 living people were kept in place for a whole year, e.g., it is possible for this number to exceed 1,000 in episodes of extreme mortality as those who die are replaced with new arrivals). Sources and methods for mortality are described in Section III, subsection B, and in the unpublished Appendix (available from the authors; or see Acemoglu et al., 2000). Quartiles of mortality are for our base sample of 64 observations. These are: (1) less than 65.4; (2) greater than or equal to 65.4 and less than 78.1; (3) greater than or equal to 78.1 and less than 280; (4) greater than or equal to 280. The number of observations differs by variable; see Appendix Table A1 for details.

TABLE 2—OLS REGRESSIONS

	Dependent variable is log GDP per capita in 1995		Dependent variable is log output per worker in 1988	
	Whole world (1)	Base sample (2)	Whole world (3)	Base sample (4)
Average protection against expropriation risk, 1985-1995	0.54 (0.04)	0.52 (0.06)	0.47 (0.06)	0.43 (0.05)
Latitude		0.89 (0.49)	0.37 (0.51)	1.60 (0.70)
Asia dummy			-0.62 (0.19)	0.92 (0.63)
Africa dummy			-1.00 (0.15)	-0.60 (0.23)
"Other" continent dummy			-0.90 (0.20)	-0.17 (0.32)
R ²	0.62	0.54	0.63	0.56
Number of observations	110	64	110	64

Notes: Dependent variable: columns (1)-(6), log GDP per capita (PPP basis) in 1995, current prices (from the World Bank's World Development Indicators 1999); columns (7)-(8), log output per worker in 1988 from Hall and Jones (1999). Average protection against expropriation risk is measured on a scale from 0 to 10, where a higher score means more protection against expropriation, averaged over 1985 to 1995, from Political Risk Services. Standard errors are in parentheses. In regressions with continent dummies, the dummy for America is omitted. See Appendix Table A1 for more detailed variable definitions.

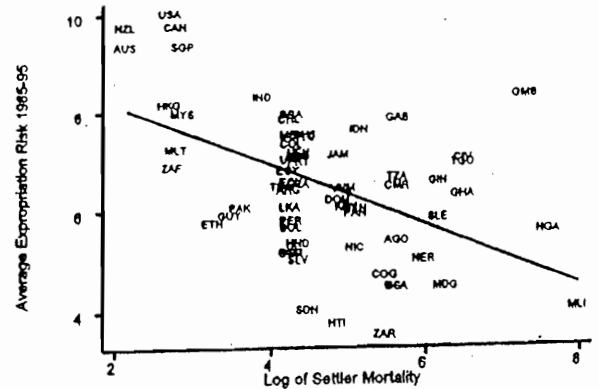


FIGURE 3. FIRST-STAGE RELATIONSHIP BETWEEN SETTLER MORTALITY AND EXPROPRIATION RISK

APPENDIX TABLE A1: DATA DESCRIPTIONS AND SOURCES

VI. Concluding Remarks

Many economists and social scientists believe that differences in institutions and state policies are at the root of large differences in income per capita across countries. There is little agreement, however, about what determines institutions and government attitudes towards economic progress, making it difficult to isolate exogenous sources of variation in institutions to estimate their effect on performance. In this paper we argued that differences in colonial experience could be a source of exogenous differences in institutions.

Our argument rests on the following premises: (1) Europeans adopted very different colonization strategies, with different associated institutions. In one extreme, as in the case of the United States, Australia, and New Zealand, they went and settled in the colonies and set up institutions that enforced the rule of law and encouraged investment. In the other extreme, as in the Congo or the Gold Coast, they set up extractive states with the intention of transferring resources rapidly to the metropole. These institutions were detrimental to investment and economic progress. (2) The colonization strategy was in part determined by the feasibility of European settlement. In places where Europeans faced very high mortality rates, they could not go and settle, and they were more likely to set up extractive states. (3) Finally, we argue that these early institutions persisted to the present. Determinants of whether Europeans could go and settle in the colonies, therefore, have an important effect on institutions today. We exploit these differences as a source of exogenous variation to estimate the impact of institutions on economic performance.

There is a high correlation between mortality rates faced by soldiers, bishops, and sailors in the colonies and European settlements; between European settlements and early measures of institutions; and between early institutions and institutions today. We estimate large effects of institutions on income per capita using this source of variation. We also document that this relationship is not driven by outliers, and is robust to controlling for latitude, climate, current disease environment, religion, natural resources, soil quality, ethnolinguistic fragmentation, and current racial composition.

It is useful to point out that our findings do not imply that institutions today are predetermined by colonial policies and cannot be changed. We emphasize colonial experience as one of the many factors affecting institutions. Since mortality rates faced by settlers are arguably exogenous, they are useful as an instrument to isolate the effect of institutions on performance. In fact, our reading is that these results suggest substantial economic gains from improving institutions, for example as in the case of Japan during the Meiji Restoration or South Korea during the 1960's.

There are many questions that our analysis does not address. Institutions are treated largely as a "black box": The results indicate that reducing expropriation risk (or improving other aspects of the "cluster of institutions") would result in significant gains in income per capita, but do not point out what concrete steps would lead to an improvement in these institutions. Institutional features, such as expropriation risk, property rights enforcement, or rule of law, should probably be interpreted as an equilibrium outcome, related to some more fundamental "institutions," e.g., presidential versus parliamentary system, which can be changed directly. A more detailed analysis of the effect of more fundamental institutions on property

Log GDP per capita, 1975 and 1995: Purchasing Power Parity Basis, from World Bank, World Development Indicators, CD-Rom, 1999.

Log output per worker, 1988: As used in Hall and Jones (1999), from www.stanford.edu/~chadj.

Average protection against expropriation risk, 1985–1995: Risk of expropriation of private foreign investment by government, from 0 to 10, where a higher score means less risk. Mean value for all years from 1985 to 1995. This data was previously used by Knack and Keefer (1995) and was organized in electronic form by the IRIS Center (University of Maryland); originally Political Risk Services.

Constraint on executive in 1900, 1970, 1990 and in first year of independence: Seven-category scale, from 1 to 7, with a higher score indicating more constraints. Score of 1 indicates unlimited authority; score of 3 indicates slight to moderate limitations; score of 5 indicates substantial limitations; score of 7 indicates executive parity or subordination. Equal to 1 if country was not independent at that date. Date of independence is the first year that the country appears in the Polity III data set. From the Polity III data set, downloaded from Inter-University Consortium for Political and Social Research. See Gurr (1997).

Democracy in 1900 and first year of independence: An 11-category scale, from 0 to 10, with a higher score indicating more democracy. Points from three dimensions: Competitiveness of Political Participation (from 1 to 3); Competitiveness of Executive Recruitment (from 1 to 2, with a bonus of 1 point if there is an election); and Constraints on Chief Executive (from 1 to 4). Equal to 1 if country not independent at that date. From the Polity III data set. See Gurr (1997).

European settlements in 1900 and percent of European descent 1975: Percent of population European or of European descent in 1900 and 1975. From McEvedy and Jones (1975) and other sources listed in Appendix Table A6 (available from the authors).

Ethnolinguistic fragmentation: Average of five different indices of ethnolinguistic fragmentation. Easterly and Levine (1997), as used in La Porta et al. (1999).

Religion variables: Percent of population that belonged to the three most widely spread religions of the world in 1980 (or for 1990–1995 for countries formed more recently). The four classifications are: Roman Catholic, Protestant, Muslim, and "other." From La Porta et al. (1999).

French legal origin dummy: Legal origin of the company law or commercial code of each country. Our base sample is all French Commercial Code or English Common Law Origin. From La Porta et al. (1999).

Colonial dummies: Dummy indicating whether country was a British, French, German, Spanish, Italian, Belgian, Dutch, or Portuguese colony. From La Porta et al. (1999).

Temperature variables: Average temperature, minimum monthly high, maximum monthly high, minimum monthly low, and maximum monthly low, all in centigrade. From Parker (1997).

Mean temperature: 1987 mean annual temperature in degrees Celsius. From McArthur and Sachs (2001).

Humidity variables: Morning minimum, morning maximum, afternoon minimum, and afternoon maximum, all in percent. From Parker (1997).

Soil quality: Dummies for steppe (low latitude), desert (low latitude), steppe (middle latitude), desert (middle latitude), dry steppe wasteland, desert dry winter, and highland. From Parker (1997).

Natural resources: Percent of world gold reserves today, percent of world iron reserves today, percent of world zinc reserves today, number of minerals present in country, and oil resources (thousands of barrels per capita.) From Parker (1997).

Dummy for landlocked: Equal to 1 if country does not adjoin the sea. From Parker (1997).

Malaria in 1994: Population living where falciparum malaria is endemic (percent). Gallup and Sachs (1998).

Latitude: Absolute value of the latitude of the country (i.e., a measure of distance from the equator), scaled to take values between 0 and 1, where 0 is the equator. From La Porta et al. (1999).

Log European settler mortality: See Appendix Table A2, reproduced below, and Appendix B (available from the authors).

Yellow fever: Dummy equal to 1 if yellow fever epidemics before 1900 and 0 otherwise. Oldstone (1998 p. 69) shows current habitat of the mosquito vector; these countries are coded equal to 1. In addition, countries in which there were epidemics in the nineteenth century, according to Curtin (1989, 1998) are also coded equal to 1.

Infant mortality: Infant mortality rate (deaths per 1,000 live births). From McArthur and Sachs (2001).

Life expectancy: Life expectancy at birth in 1995. From McArthur and Sachs (2001).

Distance from the coast: Proportion of land area within 100 km of the seacoast. From McArthur and Sachs (2001).
