# 9 Fundamental Causes of Income Differences

From proximate to fundamental causes of income differences. Why do some countries invest more, have better technologies and choose better policies? Three broad hypotheses:

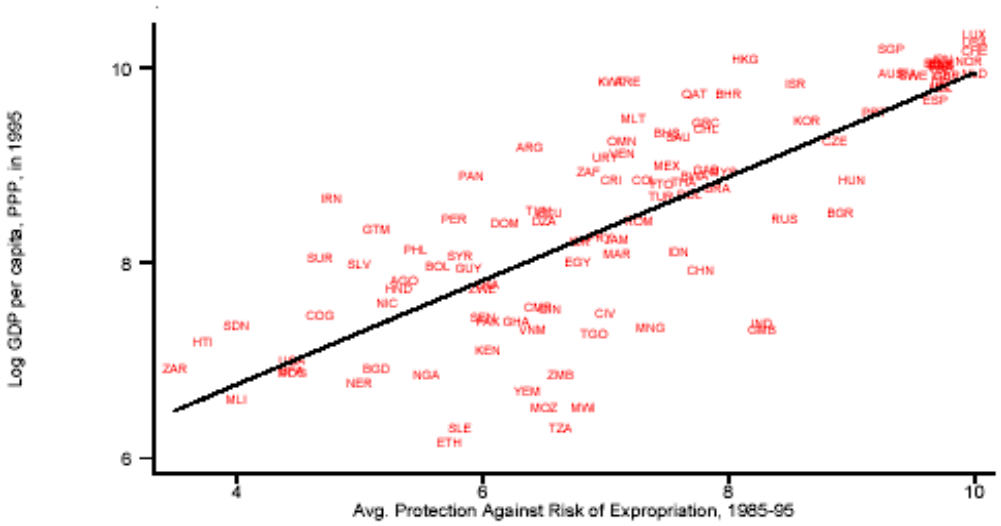
1. Geography. Differences in income may reflect differences in geographic, climatic and ecological characteristics. Promoters of this view are many, including Alfred Marshall, Gunnar Myrdal, Jared Diamond and Jeff Sachs. The climate may affect work effort; availability of crops and domesticated animals may affect food production that might be a pre-requisite for development; tropical agriculture might be more problematic and infectious diseases more aggressive in tropical areas.

2. Institutions. Prosperity depends on how the society is organized. Fundamental factors for development might be: protection of property rights, rule of law, limited government, equal opportunity...

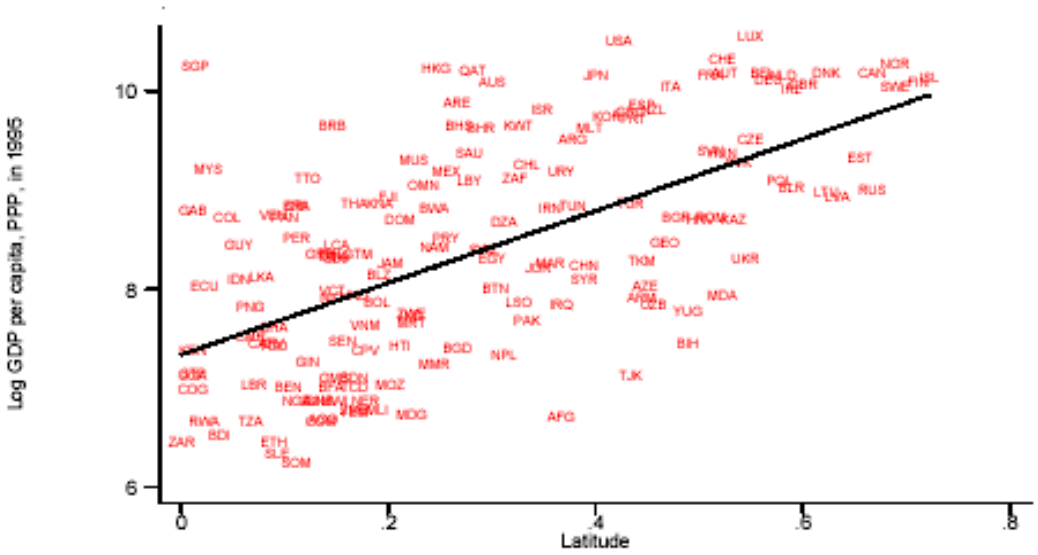
3. Culture. Having the right social capital might be fundamental to promote investment and cooperation. As opposed to institutions, social capital is harder to change.

Can we say anything about the relative importance of these different factors? At a first sight, they all predict income difference relatively well. The figure shows that countries with more secure property rights (better institutions) have higher average income. However, from this evidence we cannot conclude that institutions cause high income. There might be reverse causality or omitted variables: a third factor, like geography, may explain both low income and bad institutions. That is, we have an endogeneity problem.

Average Protection Against Risk of Expropriation 1985-95
and log GDP per capita 1995



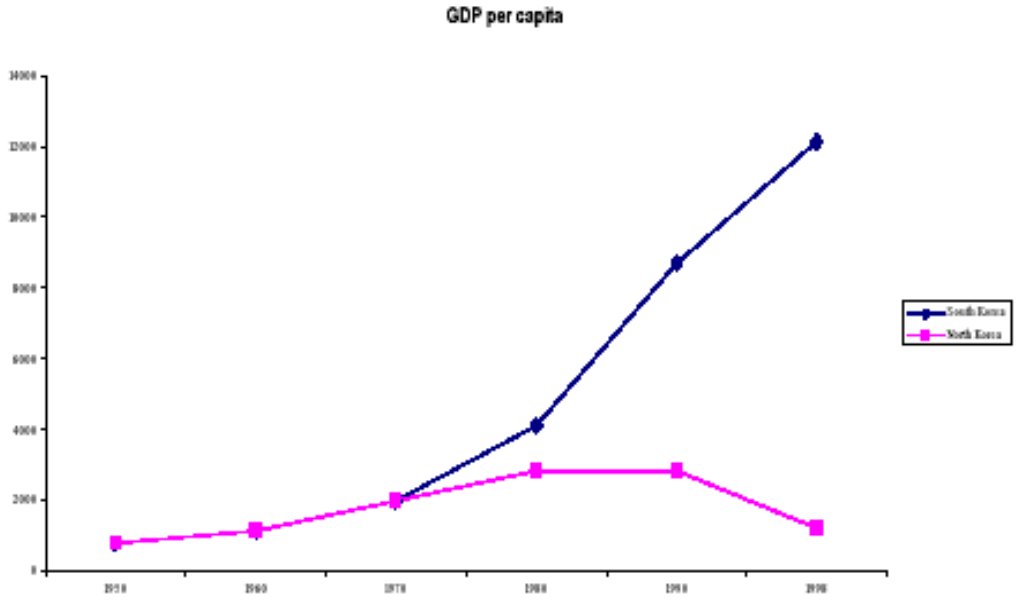

Latitude and log GDP per capita 1995




Indeed, latitude (absolute distance from the equator) is correlated with GDP. If latitude is also correlated with expropriation risk, the relationship in the previous figure might be spurious. How can we get around these problems? Finding a truly **exoge-**

**nous** source of variation in economic institutions that should have no direct effect on economic performance and use it to identify the impact of institutions on income. In other words, we need a good instrument.

GDP per capita in North and South Korea, 1950-98



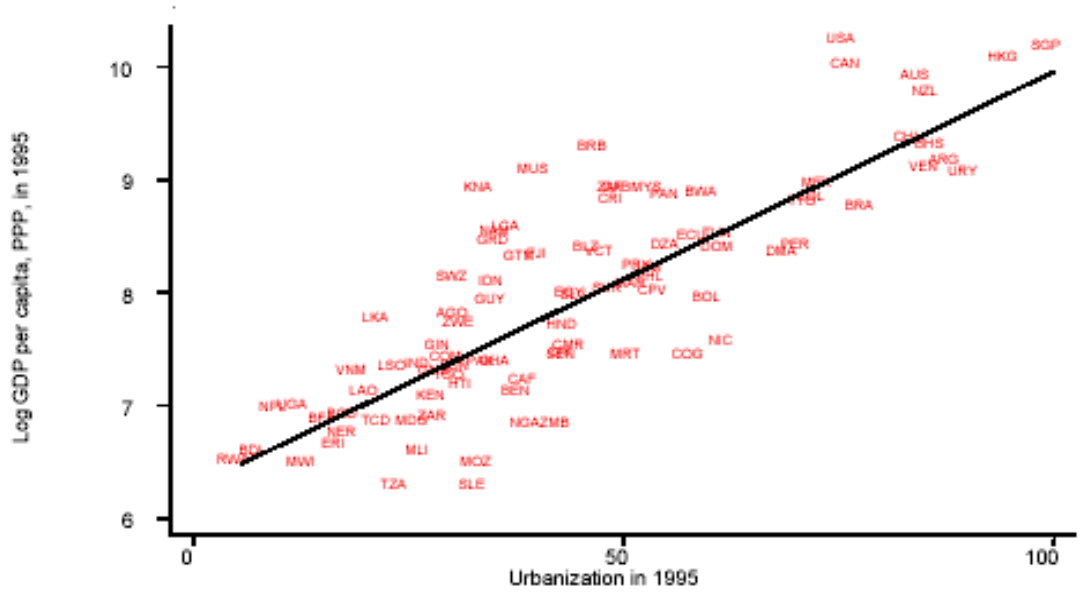

To this end, we first look for a natural experiment. The separation Korea in two (North and South) after WW II seems a good one: before separation, North and South Korea shared the same history, culture, economic and geographic conditions. After separation, they adopted very different sets of institutions: private property was abolishment in the North, while markets and private incentives where protected in the South. The Figure shows that South Korea had a much better economic performance, suggesting that the different institutions adopted translated into very different economic outcomes. This evidence is suggestive of causality; yet, with one observation only, the result might be just by chance.

A large scale experiment is represented by the colonization of the world by Europeans. The colonization experience represented a unique institutional shock. Europeans imposed new institutions across the globe and imposed different institutions in different parts of the world (e.g. North America colonies vs plantation societies). Of course, over the colonization period, geography did not change.

A first indication that economic success depends on man-made factors (as opposed to geography) and that institutional shocks seem to matter is the reversal of fortune within former European colonies: Aztecs and Incas were very rich, while now the regions they occupied are very poor; on the contrary, North America, New Zealand and Australia were very underdeveloped at the time of colonization, but became rich afterward. Acemoglu, Johnson and Robinson (2002) - AJR - look at this systematically.

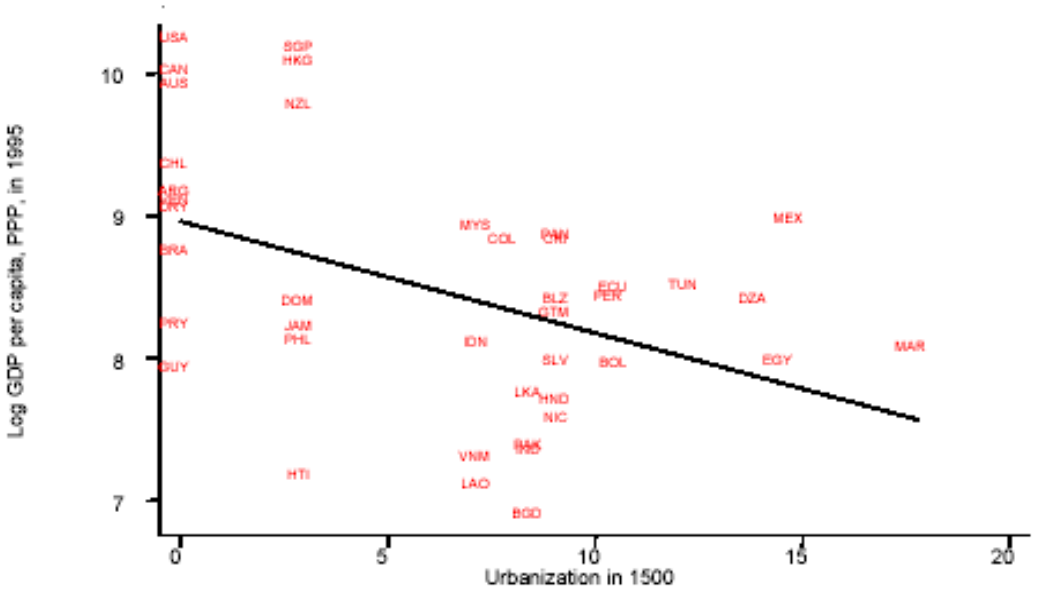
To this end, a measure of prosperity is needed. Given that we do not have good data on GDP for pre-industrial societies, AJR use urbanization rates as a proxy. The Figure shows that urbanization is indeed a good proxy for average income, at least today.

Urbanization in 1995 and log GDP per capita in 1995



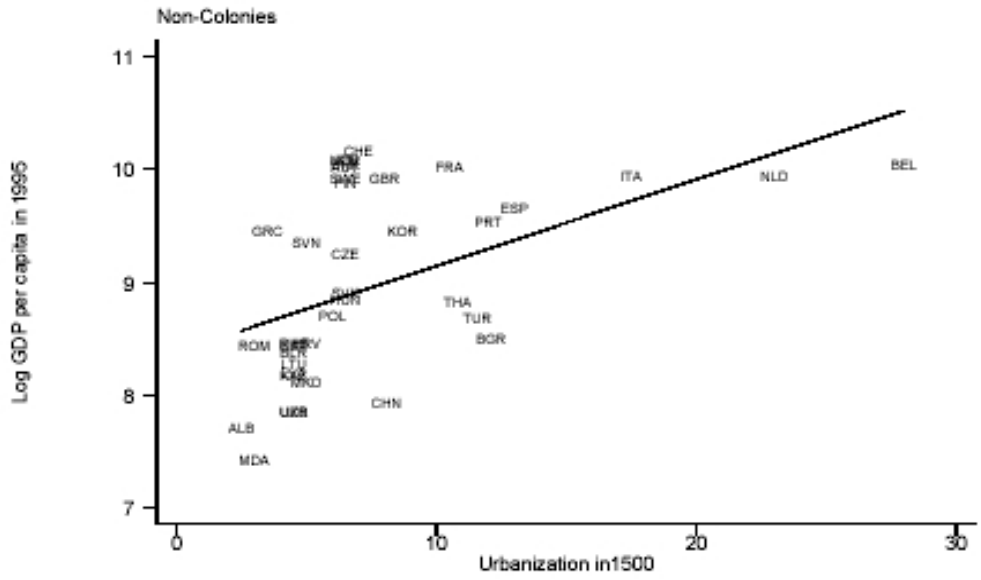

Next, we can look at the relationship between income today and urbanization in 1500 for European colonies. The next Figure shows a negative correlation, that is, the reversal of fortune.

Urbanization in 1500 and log GDP per capita in 1995, among former European colonies

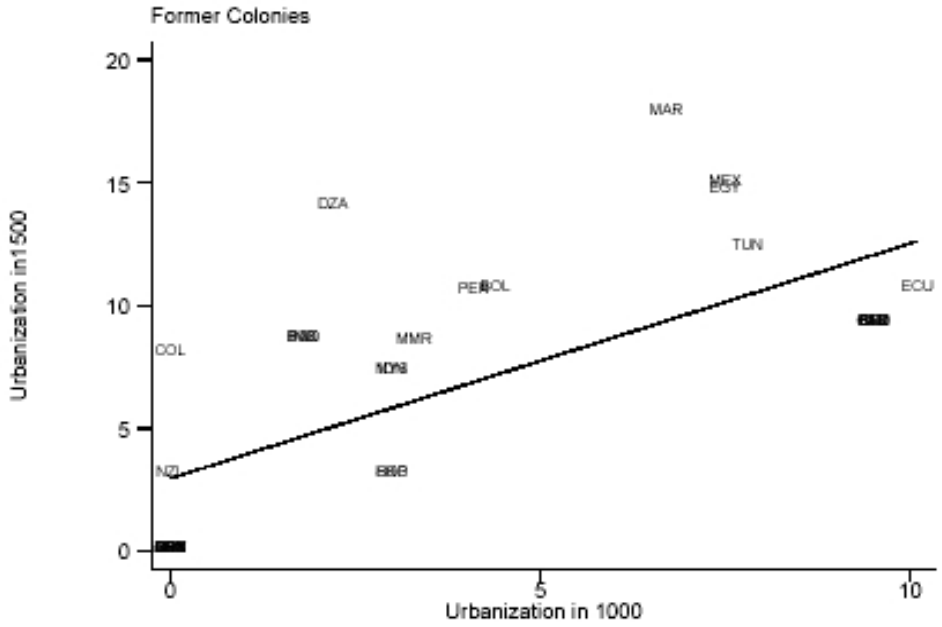



This reversal is not true for non-colonies.

Urbanization in 1500 and log GDP per capita in 1995, among non-colonies

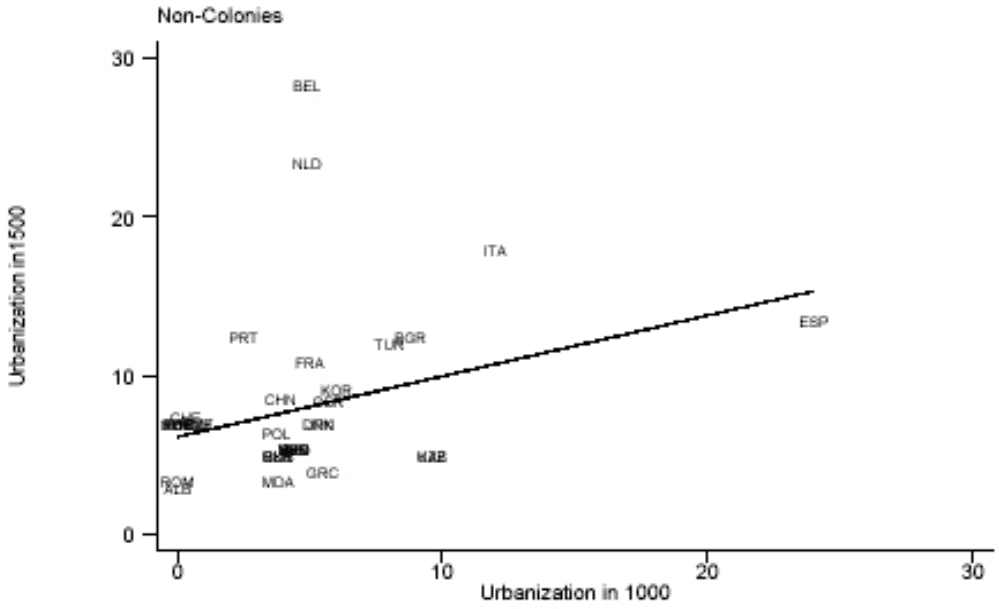


Urbanization in 1000 and 1500, among former European colonies




Also, there is no reversal for ex-colonies and non-colonies before colonization.

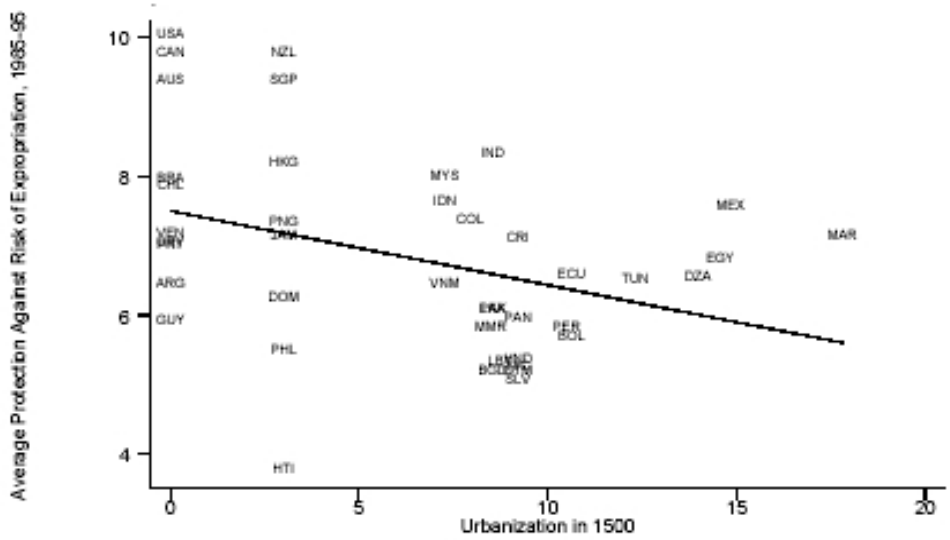
Urbanization in 1000 and 1500, among non-colonies



So, the colonial experience seems to have mattered a great deal.

A possible explanation for the reversal is that the higher the initial urbanization rate, the worse were subsequent institutions. Indeed, urbanization in 1500 is negative correlated to risk of expropriation in 1990s.

Urbanization in 1500 and average protection against risk of expropriation 1985-95




This might be because relatively urbanized colonies ended up with "extractive" institutions (or did not improve existing institutions) while non-urbanized areas received an inflow of European migrants that brought institutions more protective of property rights. AJR (2001) explore this possibility further.

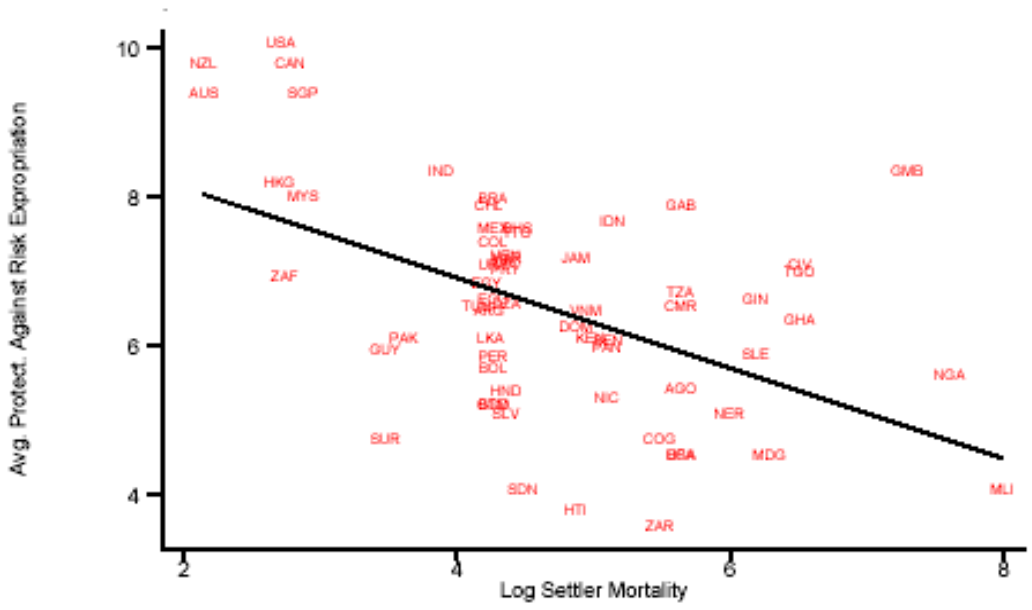
So, Europeans introduced better institutions in unsettled areas where they had to settle themselves. There it was in their own interest to introduce good institutions. In resource-rich and urbanized areas, only few European settled and imposed institutions that would allow them to exploit the local population. However, the decision to settle in an area (crucial to understand institutions) was also influenced by an important factor: the disease environment and thus the mortality risk for Europeans. This suggests the following chain:

settlers mortality → decision to settle → type of institution → prosperity today

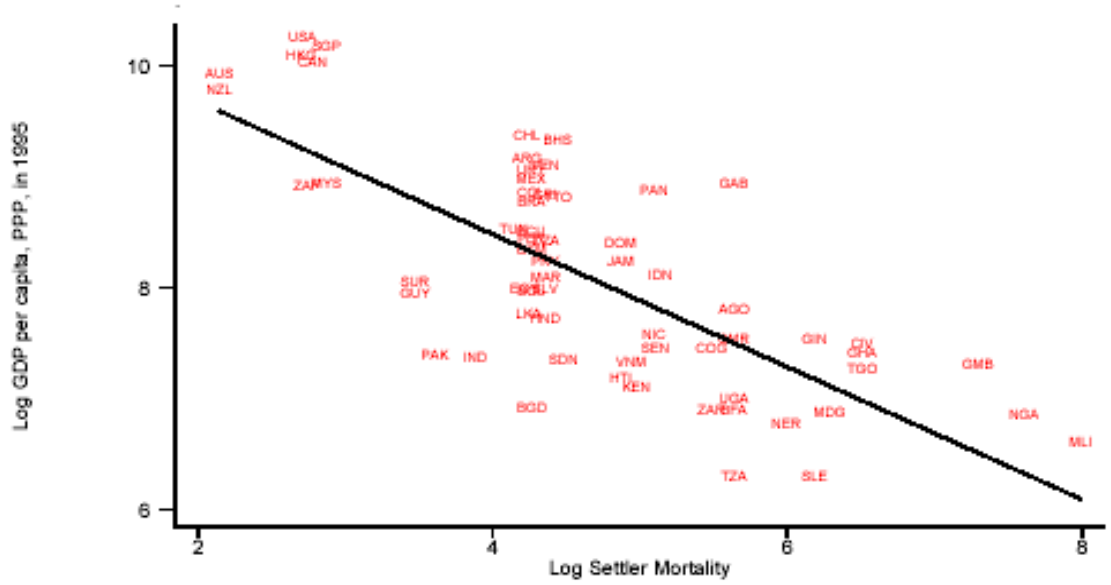
Where the last step implicitly assume persistence in institutions. Note that, if settlers mortality does not affect prosperity today other than through its effect on institutions, then it is a valid instrument, as it is a source of variation in institutional quality that is truly exogenous. AJR (2001) use mortality rates of Europeans (soldiers, sailors and bishops) as an instrument for current economic institutions.

Indeed, settlers mortality is correlated with current institutions (expropriation risk) and current prosperity.

Log mortality of potential European settlers
and average protection against risk of expropriation 1985-95



Log mortality of potential European settlers and log GDP per capita in 1995




This evidence may also suggest why geography is correlated to prosperity: as Europeans did not have immunity to tropical diseases, they tended to settle in temperate latitudes. So, geography may have had an influence on institutions. However it's institution quality what really matters, not geography per se.

Can we distinguish between the role of culture and institutions? After all, European settlers also brought their culture. However, AJR (2001) shows that, controlling for institutions, neither the identity of the colonial power, nor the contemporary fraction of Europeans in the population, nor the proportion of various religions, are significant determinants of income.

Table 2
OLS Regressions

| | Whole World (1) | Base Sample (2) | Whole World (3) | Whole World (4) | Base Sample (5) | Base Sample (6) | Whole World (7) | Base Sample (8) |
|---|---|---|---|---|---|---|---|---|
| | Dependent Variable is log GDP per capita in 1995 | | | | | | Dep. Var. is log output per worker in 1988 | |
| Average Protection Against | 0.54 | 0.52 | 0.47 | 0.43 | 0.47 | 0.41 | 0.45 | 0.46 |
| Expropriation Risk, 1985-1995 | (0.04) | (0.06) | (0.06) | (0.05) | (0.06) | (0.06) | (0.04) | (0.06) |
| Latitude | | | 0.89 | 0.37 | 1.60 | 0.92 | | |
| | | | (0.49) | (0.51) | (0.70) | (0.63) | | |
| Asia Dummy | | | | -0.62 | | -0.60 | | |
| | | | | (0.19) | | (0.23) | | |
| Africa Dummy | | | | -1.00 | | -0.90 | | |
| | | | | (0.15) | | (0.17) | | |
| "Other" Continent Dummy | | | | -0.25 | | -0.04 | | |
| | | | | (0.20) | | (0.32) | | |
| R-Squared | 0.62 | 0.54 | 0.63 | 0.73 | 0.56 | 0.69 | 0.55 | 0.49 |
| N | 110 | 64 | 110 | 110 | 64 | 64 | 108 | 61 |

Dependent Variable: columns 1-8, log GDP per capita (PPP basis) in 1995, current prices, (from the World Bank's World Development Indicators 1999); columns 9-10, 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 including dummies for the anti-expropriation index, the dummy for the first quartile --i.e., with highest risk of expropriation-- is the omitted category. In regressions with continent dummies, the dummy for America is omitted. See Appendix Table A1 for more detailed variable definitions and sources.
Of the countries in our base sample, Hall and Jones do not report output per worker in the Bahamas, Ethiopia, and Vietnam.

Table 4
IV Regressions of log GDP per capita

| | Base Sample (1) | Base Sample (2) | Base Sample without neo-Europes (3) | Base Sample without neo-Europes (4) | Base Sample without Africa (5) | Base Sample without Africa (6) | Base Sample with Continent Dummies (7) | Base Sample with Continent Dummies (8) | Base Sample, dep. var. is log output per worker (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Panel A: Two Stage Least Squares* | | | | | | | | | |
| Average Protection Against Expropriation Risk 1985-1995 | 0.94 | 1.00 | 1.28 | 1.21 | 0.58 | 0.58 | 0.98 | 1.10 | 0.98 |
| | (0.16) | (0.22) | (0.36) | (0.35) | (0.10) | (0.12) | (0.30) | (0.46) | (0.17) |
| Latitude | | -0.65 | | 0.94 | | 0.04 | | -1.20 | |
| | | (1.34) | | (1.46) | | (0.84) | | (1.8) | |
| Asia Dummy | | | | | | | -0.92 | -1.10 | |
| | | | | | | | (0.40) | (0.52) | |
| Africa Dummy | | | | | | | -0.46 | -0.44 | |
| | | | | | | | (0.36) | (0.42) | |
| "Other" Continent Dummy | | | | | | | -0.94 | -0.99 | |
| | | | | | | | (0.85) | (1.0) | |
| *Panel B: First-Stage for Average Protection against Expropriation Risk in 1985-95* | | | | | | | | | |
| Log European Settler Mortality | -0.61 | -0.51 | -0.39 | -0.39 | -1.20 | -1.10 | -0.43 | -0.34 | -0.63 |
| | (0.13) | (0.14) | (0.13) | (0.14) | (0.22) | (0.24) | (0.17) | (0.18) | (0.13) |
| Latitude | | 2.00 | | -0.11 | | 0.99 | | 2.00 | |
| | | (1.34) | | (1.50) | | (1.43) | | (1.40) | |
| Asia Dummy | | | | | | | 0.33 | 0.47 | |
| | | | | | | | (0.49) | (0.50) | |
| Africa Dummy | | | | | | | -0.27 | -0.26 | |
| | | | | | | | (0.41) | (0.41) | |
| "Other" Continent Dummy | | | | | | | 1.24 | 1.1 | |
| | | | | | | | (0.84) | (0.84) | |
| R-Squared | 0.27 | 0.30 | 0.13 | 0.13 | 0.47 | 0.47 | 0.30 | 0.33 | 0.28 |
| *Panel C: Ordinary Least Squares* | | | | | | | | | |
| Average Protection Against Expropriation Risk 1985-1995 | 0.52 | 0.47 | 0.49 | 0.47 | 0.48 | 0.47 | 0.42 | 0.40 | 0.46 |
| | (0.06) | (0.06) | (0.08) | (0.07) | (0.07) | (0.07) | (0.06) | (0.06) | (0.06) |
| Number of Observations | 64 | 64 | 60 | 60 | 37 | 37 | 64 | 64 | 61 |

The dependent variable in columns 1-8 is log GDP per capita in 1995, PPP basis. The dependent variable in column 9 is log output per worker, from Hall and Jones (1999). "Average Protection Against Expropriation Risk 1985-95" is measured on a scale from 0 to 10, where a higher score means more protection against risk of expropriation of investment by the government, from Political Risk Services. Panel A reports the two stage least squares estimates, instrumenting for protection against expropriation risk using log settler mortality; Panel B reports the corresponding first stage. Panel C reports the coefficient from an OLS regression of the dependent variable against average protection against expropriation risk. Standard errors are in parentheses. In regressions with continent dummies, the dummy for America is omitted. See Appendix Table A1 for more detailed variable descriptions and sources.

Table 5
IV Regressions of log GDP per capita with Additional Controls

| | Base Sample (1) | Base Sample (2) | British colonies only (3) | British colonies only (4) | Base Sample (5) | Base Sample (6) | Base Sample (7) | Base Sample (8) | Base Sample (9) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Panel A: Two Stage Least Squares* | | | | |
| Average Protection Against Expropriation Risk, 1985-1995 | 1.10 (0.22) | 1.16 (0.34) | 1.07 (0.24) | 1.00 (0.22) | 1.10 (0.19) | 1.20 (0.29) | 0.92 (0.15) | 1.00 (0.25) | 1.10 (0.29) |
| Latitude | | -0.75 (1.70) | | | | -1.10 (1.56) | | -0.94 (1.50) | -1.70 (1.6) |
| British Colonial Dummy | -0.78 (0.35) | -0.80 (0.39) | | | | | | | |
| French Colonial Dummy | -0.12 (0.35) | -0.06 (0.42) | | | | | | | 0.02 (0.69) |
| French legal origin dummy | | | | | 0.89 (0.32) | 0.96 (0.39) | | | 0.51 (0.69) |
| p-value for Religion Variables | | | | | | | [0.001] | [0.004] | [0.42] |
| | | | | | *Panel B: First-Stage for Average Protection against Expropriation Risk in 1985-95* | | | | |
| Log European Settler Mortality | -0.53 (0.14) | -0.43 (0.16) | -0.59 (0.19) | -0.51 (0.14) | -0.54 (0.13) | -0.44 (0.14) | -0.58 (0.13) | -0.44 (0.15) | -0.48 (0.18) |
| Latitude | | 1.97 (1.40) | | | | 2.10 (1.30) | | 2.50 (1.50) | 2.30 (1.60) |
| British Colonial Dummy | 0.63 (0.37) | 0.55 (0.37) | | | | | | | |
| French Colonial Dummy | 0.05 (0.43) | -0.12 (0.44) | | | | | | | -0.25 (0.89) |
| French legal origin | | | | | -0.67 (0.33) | -0.7 (0.32) | | | -0.05 (0.91) |
| R-Squared | 0.31 | 0.33 | 0.30 | 0.30 | 0.32 | 0.35 | 0.32 | 0.35 | 0.45 |
| | | | | | *Panel C: Ordinary Least Squares* | | | | |
| Average Protection Against Expropriation Risk, 1985-1995 | 0.53 (0.19) | 0.47 (0.07) | 0.61 (0.09) | 0.47 (0.06) | 0.56 (0.06) | 0.56 (0.06) | 0.53 (0.06) | 0.47 (0.06) | 0.47 (0.06) |
| Number of Observations | 64 | 64 | 25 | 25 | 64 | 64 | 64 | 64 | 64 |

Panel A reports the two stage least squares estimates with log GDP per capita (PPP basis) in 1995 as dependent variable, and Panel B reports the corresponding first stage. The base case in columns 1 and 2 is all colonies that were neither French nor British. The religion variables are included in the first stage of columns 7 and 8 but not reported here (to save space). Panel C reports the OLS coefficient from regressing log GDP per capita on average protection against expropriation risk, with the other control variables indicated in that column (full results not reported to save space). Standard errors are in parentheses. The religion variables are percentage of population that are Catholics, Muslims, and "other" religions; Protestant is the base case. Our sample is all either French or British legal origin (as defined by La Porta et al 1999.)

Table 6
Robustness Checks for IV Regressions of Log GDP per capita

| | Base Sample (1) | Base Sample (2) | Base Sample (3) | Base Sample (4) | Base Sample (5) | Base Sample (6) | Base Sample (7) | Base Sample (8) | Base Sample (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Panel A: Two Stage Least Squares* | | | | | | | | | |
| Average Protection Against | 0.84 | 0.83 | 0.96 | 0.99 | 1.10 | 1.30 | 0.74 | 0.79 | 0.71 |
| Expropriation Risk, 1985-1995 | (0.19) | (0.21) | (0.28) | (0.30) | (0.33) | (0.51) | (0.13) | (0.17) | (0.20) |
| Latitude | | 0.07 | | -0.67 | | -1.30 | | -0.89 | -2.5 |
| | | (1.60) | | (1.30) | | (2.30) | | (1.00) | (1.60) |
| p-value for Temperature Variables | [0.96] | [0.97] | | | | | | | [0.77] |
| p-value for Humidity Variables | [0.54] | [0.54] | | | | | | | [0.62] |
| Percent of European descent in 1975 | | | -0.08 | 0.03 | | | | | 0.3 |
| | | | (0.82) | (0.84) | | | | | (0.7) |
| P-Value for Soil Quality | | | | | [0.79] | [0.85] | | | [0.46] |
| P-Value for Natural Resources | | | | | [0.82] | [0.87] | | | [0.82] |
| Dummy for being landlocked | | | | | 0.64 | 0.79 | | | 0.75 |
| | | | | | (0.63) | (0.83) | | | (0.47) |
| Ethnolinguistic fragmentation | | | | | | | -1.00 | -1.10 | -1.60 |
| | | | | | | | (0.32) | (0.34) | (0.47) |
| *Panel B: First-Stage for Average Protection against Expropriation Risk in 1985-95* | | | | | | | | | |
| Log European Settler Mortality | -0.64 | -0.59 | -0.41 | -0.4 | -0.44 | -0.34 | -0.64 | -0.56 | -0.59 |
| | (0.17) | (0.17) | (0.14) | (0.15) | (0.16) | (0.17) | (0.15) | (0.15) | (0.21) |
| Latitude | | 2.70 | | 0.48 | | 2.20 | | 2.30 | 4.20 |
| | | (2.00) | | (1.50) | | (1.50) | | (1.40) | (2.60) |
| R-Squared | 0.39 | 0.41 | 0.34 | 0.34 | 0.41 | 0.43 | 0.27 | 0.30 | 0.59 |
| *Panel C: Ordinary Least Squares* | | | | | | | | | |
| Average Protection Against | 0.41 | 0.38 | 0.39 | 0.38 | 0.46 | 0.42 | 0.46 | 0.45 | 0.38 |
| Expropriation Risk, 1985-1995 | (0.06) | (0.06) | (0.06) | (0.06) | (0.07) | (0.07) | (0.05) | (0.06) | (0.06) |

Panel A reports the two stage least squares estimates with log GDP per capita (PPP basis) in 1995, and Panel B reports the corresponding first stages. Panel C reports the OLS coefficient from regressing log GDP per capita on average protection against expropriation risk, with the other control variables indicated in that column (full results not reported to save space). Standard errors are in parentheses. All regressions have 64 observations, except those including natural resources, which have 63 observations. The temperature and humidity variables are: average, minimum and maximum monthly high temperatures, and minimum and maximum monthly low temperatures, and morning minimum and maximum humidity, and afternoon minimum and maximum humidity. In the table we report joint significance levels for these variables (from Philip Parker, 1997).

Measures of natural resources are: 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.) Measures of soil quality/climate are steppe (low latitude), desert (low latitude), steppe (middle latitude), desert (middle latitude), dry steppe wasteland, desert dry winter, and highland. See Appendix Table A1 for more detailed variable definitions and sources.

Alternative approaches:

- Hall and Jones (1999) use expropriation risk as a measure of institutional quality, but instrument it with distance from the equator and the extent to which the primary language of Western Europe are spoken today (measuring "Western influence"). They find that institutions are a strong determinant of TFP.
- La Porta et al. in a number of papers argue that Europeans brought their legal systems into the countries they colonized, so that legal origin can be used as an instrument for the structure of various law ("contractual protection"). They show that this in turn affects financial development, and in some cases income.

**A Skeptic View: Glaeser, La Porta, Lopez-de-Silanes & Shleifer (2004)**

What are institutions? Are we really capturing institutions? North's (1981) definition: institutions as rules, moral and ethical norms that constrain the behavior of individuals in the interest of the principals

Common measures of institutions are:

1. expropriation risk, from the International Country Risk Guide
2. surveys of government effectiveness
3. limits of executive power from the Polity IV dataset

All these measures have problems: (1) and (2) are outcome variables (reflect choices, not rules of the game) and do not discriminate dictatorships; none of them is correlated with available constitutional measures of constraints on governments (like judicial independence) and all of them are very volatile. Furthermore, constitutional measures of constraints are not strongly correlated to income.

Gleaser et al. propose also a different interpretation for the IV results of AJR. They argue that settles mortality may be capturing something else: Europeans brought with them their know-how and their human capital, and maybe this is all the matters, not institutions per se. Indeed, settler mortality has a strong negative correlation with

human capital today. The table summarize the effects of human capital and political institutions in IV-regressions. It shows that while settler mortality is an important determinant of both executive constraints and years of schooling (first stage results), human capital is a significant determinant of income in the second stage and not executive constraints.

*Table 11.* Economic development, instrumental variable regressions.

*Panel A: Second-stage regressions*

| | Dependent variable is log GDP per capita in 2000 | |
|---|---|---|
| | (1) | (2) |
| Years of schooling (1960–2000) | 0.7894[a] | 0.4836[b] |
| | (0.2753) | (0.1875) |
| Executive constraints (1960–2000) | −0.3432 | −0.2965 |
| | (0.2577) | (0.2410) |
| Share of population living in temperate zone (1995) | −1.6969 | −0.0863 |
| | (1.2053) | (0.7714) |
| Observations | 47 | 55 |
| $R^2$ | 0.31 | 0.5 |

*Panel B: First-stage regressions*

| | Dependent variables | | | |
|---|---|---|---|---|
| | Executive Constraints (1960–2000) | Years of Schooling (1960–2000) | Executive Constraints (1960–2000) | Years of Schooling (1960–2000) |
| Share of population living in temperate zone (1995) | −0.1195 | 3.4975[a] | −0.0353 | 2.8397[a] |
| | (0.7202) | (0.8044) | (0.8359) | (0.8933) |
| Log settler mortality | −0.8212[a] | −1.0183[a] | | |
| | (0.2053) | (0.2293) | | |
| Log population density in 1,500 | | | −0.3737[b] | −0.6140[a] |
| | | | (0.1582) | (0.1691) |
| French legal origin | −1.4124[a] | −0.3770 | −1.1988[b] | −0.5329 |
| | (0.4258) | (0.4757) | (0.4538) | (0.4850) |
| Observations | 47 | 47 | 55 | 55 |
| $R^2$ | 0.53 | 0.70 | 0.25 | 0.55 |
| $F$-Test for excluded instruments | 17.23 | | 4.70 | |
| Correlation of predicted values of executive constraints and years of schooling | 0.8182 | | 0.8163 | |

Notes: The table shows instrumental variables regressions for the cross-section of countries. Panel A reports the second-stage estimates from instrumental variables regressions with first-stage estimates shown in Panel B. The dependent variable in both second-stage specifications is the log of GDP per capita in 2000. Panel B reports the first-stage estimates for two sets of instruments. The first specification instruments executive constraints and years of schooling using the log of settler mortality and French legal origin. The second specification instruments executive constraints and years of schooling using the log of population density in 1500 and French legal origin. The specifications in both stages include a constant but we do not report the estimates in the table. Robust standard errors are reported in parentheses. All variables are defined in the appendix.

[a]Significant at 1 percent.

[b]Significant at 5 percent.

[c]Significant at 10 percent.