# The deep roots of economic development: Geography, Institutions or Culture

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# Introduction

In the field of economic growth and development, the question we are called to answer is: Why are some countries much poorer than others? In other words, how can we explain differences in income per capita between nations?

If we decided to follow Solow (1956), Cass (1965) and Koopmans (1965) or any other traditional neoclassical growth model, we would explain differences in income per capita in terms of different paths of factor accumulation. Even in more recent incarnations of growth theory, such as Romer (1986) and Lucas (1988), differences in growth rates would be explained in terms of preferences, endowments and resource allocations.

Though these theories have provided many insights about the mechanics of economic growth, they seem unable to provide a fundamental explanation for economic growth. As North and Thomas (1973, p. 2) put it: "the factors we have listed (innovation, economies of scale, education, capital accumulation, etc.) are not causes of growth; they are growth". Factor accumulation and innovation are only proximate causes of growth.

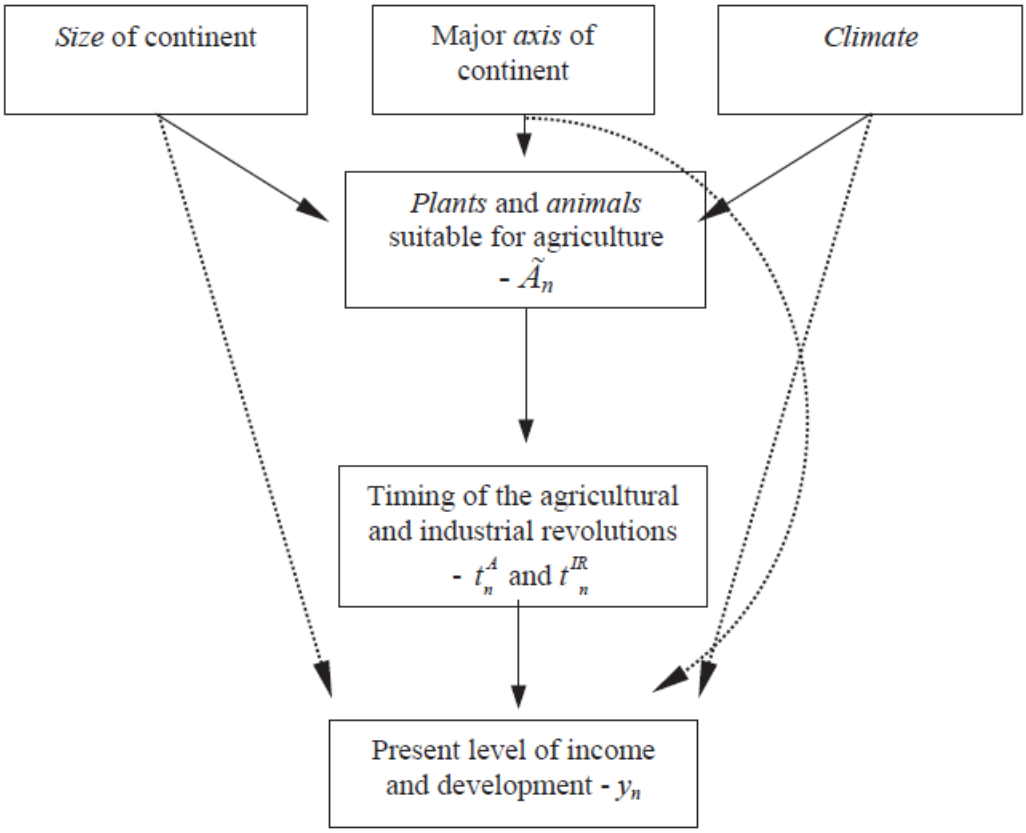
If these economic models can only provide proximate explanations of comparative growth, what would constitute a fundamental explanation? Though there is no universal answer on this, three theories can be distinguished: the first set of theories emphasizes on geography, the second on culture, and the third on the importance of economic institutions.

# Geography

Diamond (1997) argues that the inhabitants of Eurasia enjoyed some environmental advantages (the availability of animals and plants, the East-West orientation and size) that enabled an earlier transition from hunter-gatherer to agriculture economy. Those advantages resulted in a population explosion and an earlier technological innovation. Testing on these hypotheses Olsson and Hibbs (2005) provide an empirical analysis of the relation between initial biogeographic endowments and contemporary levels of development. Starting roughly from 11.000 BC, they establish two main arguments.

Firstly, regions with favorable initial biogeographic conditions and in particular the prevalence of plants and animals suited for domestication made the transition from hunter-gatherer to sedentary agriculture earlier than other regions. The surplus generated by the superior agricultural mode of production led to the emergence of a non-producing class whose members were responsible for the creation and organization of knowledge. Therefore, economies enter a path of endogenous technological progress and increased population growth and thus, all else equal, regions that made the transition to agriculture earlier will also be the first to develop industrial production. This leads us to their second central hypothesis, that present levels of per capita income still register the effects of initial biogeographic conditions.

Fig. 1 Biography and long-run economic development




**Empirical evidence/Regressions**
In order to test their hypotheses, they use several geographic and biological variables.

For the geographic conditions four variables are used: **Climate** ranging from 3 (denoting the best climate for agriculture) to 0 (denoting the worst climate for agriculture). **Latitude** is the distance from the equator in absolute latitude degrees (lower latitude associated with poor soil quality, rainfalls and diseases). **Axis** measure the East-West orientation of the major landmasses which measures barriers to the transmission of goods, people and ideas. **Size** is the number of square kilometers of the landmass. **Geo Conditions** is the first principal component of the four geographic variables just described.

Initial biogeographic endowments are measured by two variables: **Plants** is the number of annual or perennial wild grasses with a mean kernel weight exceeding 10 mg known to exist in prehistory in various parts of the world. **Animals** is the number of domesticable mammals weighing more than 45 kg known to exist in prehistory in various parts of the world. Both Plants and Animals are based on the information in Table 1. **Bio Conditions** is the first principal component of these variables.

Table 1

Distribution of species suitable for domestication

| Area[a] | Number of plants[b] | Number of animals[c] |
|---|---|---|
| Near East, Europe, North Africa | 33 | 9 |
| East Asia | 6 | 7 |
| Southeast Asia | 6 | 2 |
| Sub-Saharan Africa | 4 | 0 |
| North America | 4 | 0 |
| Central America | 5 | 0 |
| South America | 2 | 1 |
| Australia | 2 | 0 |
| Pacific Islands and Iceland | 0 | 0 |

Political Environment and Social Infrastructure are "institutional" variables that geography and biogeography are conditioned on in some of the log output per capita regression experiments. The former is the average of Knack and Keefer's (1995) coding over 1986–95 of five political-institutional characteristics of each country: (i) quality of bureaucracy, (ii) rule of law, (iii) government corruption, (iv) risk of expropriation and (v) risk of government repudiation of contracts. The later variable was developed by Hall and Jones (1999) to quantify the wedge between social and private returns to productive activity; it is the average of Knack and Keefer's political codings and Sachs and Warner's (1995) index of the openness of each country to free trade during 1950–1994. Finally, 1997 GDP per capita is expressed in constant US dollars at base year 1985 international prices (World Bank, 1999).

Table 2

Regressions for initial bio conditions, $\tilde{A}_n$, and years since transition to sedentary agriculture, $(T - t_n^A)$

| | *Plants* (1) | *Animals* (2) | *Bio Conditions* (3) | *Bio Conditions* (4) | *Years since transition to agriculture* (5) |
|---|---|---|---|---|---|
| *Climate* | 0.50 (7.2 \| 0.00) | 0.42 (6.1 \| 0.00) | 0.47 (7.8 \| 0.00) | | |
| *Latitude* | 0.31 (4.3 \| 0.00) | 0.21 (2.9 \| 0.00) | 0.26 (4.2 \| 0.00) | | |
| *Axis* | 0.08 (1.1 \| 0.26) | 0.37 (5.36 \| 0.00) | 0.23 (3.8 \| 0.00) | | |
| *Size* | 0.17 (2.8 \| 0.00) | 0.04 (0.65 \| 0.50) | 0.11 (2.0 \| 0.05) | | |
| *Geo Conditions* | | | | 0.83 (19.8 \| 0.00) | |
| *Bio Conditions* | | | | | 7982 (6.2 \| 0.01) |
| *Bio Conditions* squared | | | | | −1.283 (−2.7 \| 0.07) |
| Adjusted $R^2$ | 0.77 | 0.76 | 0.81 | 0.78 | 0.94 |
| St. error | 0.48 | 0.49 | 0.42 | 0.46 | 2196 |
| *N* | 112 | 112 | 112 | 112 | 6 (regions) |

Regressions 1–4 in Table 2 pertain to the first link of the long-run causal scheme featured in our historical analysis and illustrated by Fig. 1. These regression experiments show that exogenous geographic conditions explain around 80% of the variance of the international distribution of heavy seeded plants and large domesticable animals that are known to have existed in prehistory. Regression 5 pertains to the second link in the long-run causal chain: The influence of initial biogeographic endowments on the timing of the transition to sedentary agriculture. The results seem to support the thesis that the richer was a region's initial biogeographic endowment, the earlier was the transition out of hunter–gatherer production to agriculture.

Table 3

Regressions for 1997 log GDP per capita

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Climate* | 0.35<br>(3.1\|0.00) | | | | | | | | |
| *Axis* | 0.17<br>(1.8\|0.07) | | | | | | | | |
| *Latitude* | 0.40<br>(3.4\|0.00) | | | | | | | | |
| *Geo Conditions* | | | 0.42<br>(2.5\|0.01) | | 0.27<br>(3.1\|0.00) | | | 0.33<br>(4.8\|0.00) | |
| *Bio Conditions* | | 0.88<br>(6.3\|0.00) | 0.48<br>(2.2\|0.02) | | | 0.28<br>(3.4\|0.00) | | | 0.32<br>(4.4\|0.00) |
| *Bio Conditions* squared | | −0.32<br>(−1.6\|0.11) | −0.31<br>(−1.6\|0.11) | | | | | | |
| *Political Environment* | | | | 0.95<br>(14.1\|0.00) | 0.77<br>(8.7\|0.00) | 0.78<br>(9.6\|0.00) | | | |
| *Social Infrastructure* | | | | | | | 0.99<br>(15.8\|0.00) | 0.80<br>(11.3\|0.00) | 0.82<br>(11.8\|0.00) |
| Adjusted $R^2$ | 0.49 | 0.38 | 0.41 | 0.66 | 0.69 | 0.69 | 0.71 | 0.77 | 0.76 |
| St. error | 0.80 | 0.88 | 0.86 | 0.68 | 0.65 | 0.65 | 0.63 | 0.57 | 0.58 |
| *N* | 112 | 112 | 112 | 102 | 102 | 102 | 100 | 100 | 100 |

*Notes*: In parentheses are *t*-ratios|significance levels (*p*-values). Regression constants are omitted.

Table 3 reports regressions for log 1997 GDP per capita, the final point in the long run sequence depicted in Fig.1.

The first three regressions indicate that geography and biogeography can account for 40% and 50% of variance in 1997 log incomes per capita. These regressions imply that a change in bio&geo conditions would explain a shift in 1997 GDP per capita from 1000$ to 8600$ while the full range of international variation in incomes per person runs from 400$ to 20.000$ per capita. Hence, we need more explanatory variables with leading candidates being the political and institutional arrangements. So, Regressions 4–9 report the effects of the Political Environment and the Social Infrastructure variables introduced earlier and featured in the studies by Acemoglu et al. (2001) and Hall and Jones (1999), respectively. Although political and institutional arrangements clearly have proximate, statistically powerful effect on economic performance, regressions 5, 6, 8 and 9 demonstrate that Bio and Geo Conditions retain significance and importance in the presence of the former variables.

If there is one thing we should keep from this analysis is that current variations in economic prosperity to a significant degree still embody the effects of the prehistoric productive potentials of various environments. Moreover, the geographic and biogeographic signals detected in current levels of income per person were robust to controls for political and institutional variables that are known to exert powerful, proximate statistical influence on international variations in economic prosperity

# Culture

To better understand the mechanism linking geography and economic development we have to take into account the central role of historical population movements. An important contribution within this line of research comes from Putterman and Weil (2010) where they examine whether the historical legacy of the populations or the historical legacy of geographic locations play a more important role for contemporary outcomes. To do so, they assemble a matrix showing the share of the contemporary population of each country descended from people in different source countries in the year 1500. This matrix has 165 rows, each for a present-day country, and 172 columns (the same 165 countries plus seven other source countries with current populations of less than one half million). As an example, the row for Malaysia has five nonzero entries, corresponding to the five source countries for the current Malaysian population: Malaysia (0.60), China (0.26), India (0.075), Indonesia (0.04) and the Philippines (0.025). Thus, matrix entries measure the fraction of a country's ancestry attributable to different source countries, without distinguishing between whether descendants from those source countries have mixed together or remained ethnically pure (although we did use this information in constructing the matrix). The principal diagonal of the matrix provides a quick indication of differences in the degree to which countries are now populated by the ancestors of their historical populations. The diagonal entries for China and Ethiopia (with shares below one-half percent being ignored) are 1.0, whereas the corresponding entries for Jamaica, Haiti, and Mauritius are 0.0 and that of Fiji is close to 0.5.

Earlier studies have shown strong correlations between measures of early agricultural or political development and current levels of economic development. In that spirit, two measures of early development are used. The first is an index of state history called **statehist**. This index measures whether what is now a country had a supratribal government, the geographic scope of that government, and whether that government was indigenous or by an outside power. In other words, state history measures a stock of experience with state-level organization that takes into account, for example setbacks such as the disappearance, break up, or annexation of an existing state by a neighboring empire. The state history variable in country I for the fifty-year period t is $s_{it}$ which ranges between 0 and 50. When $s_{i,t}$ is equal zero there is no supratribal state, when $s_{i,t}$ is equal 50 there is a home-based supratribal state and when $s_{i,t}$ there is a supratribal rule over that territory by a foreign power. Values from values ranging from 15 (7.5) to 37.5 (18.75) for home- (foreign-) based states covering between 10% and 50% of the present-day territory or for several small states coexisting on that territory. *Statehist* is computed by taking the discounted sum of the state history variables over the thirty half-centuries and normalizing it to be between 0 and 1.

$$\text{Statehist}=\frac{\Sigma_{t=0}^{29}(1{,}05)^{-t}s_{i,t}}{\Sigma_{t=0}^{29}50*(1{,}05)^{-t}}$$

The second variable is called **Agyears.** It measures the number of millennia since a country transitioned from hunting and gathering to agriculture. The variable *agyears* is simply the number of years prior to 2000, in thousands, since a significant number of people in an area within the country's present borders are believed to have met most of their food needs from cultivated foods. The highest value, 10.5, occurs for four Fertile Crescent countries (Israel, Jordan, Lebanon, and Syria), followed closely by Iraq and

Turkey (10), Iran (9.5), China (9), and India (8.5). Near the middle of the pack are countries such as Belarus (4.5), Ecuador (4), the Cote d'Ivoire (3.5), and Congo (3).

They then construct a second set of historical variables, weighted using the migration matrix, representing the same variables as they pertain not to the location but the contemporaneous population inhabiting this location. For example, ancestry-adjusted statehist for Botswana is 0.312 times the statehist value for Botswana plus 0.673 times statehist for South Africa, plus weights of 0.005 each times the statehist values of France, Germany, and the Netherlands.
In this work the New World plays a big role in identifying the difference in the coefficients between historical factors and their ancestry adjusted counterparts, because outside the New World, everyone's ancestry is largely from their own location.
Their key finding is that it is not as much the past history of locations that matters as it is the history of the ancestor populations.

Table 4

HISTORICAL DETERMINANTS OF CURRENT INCOME

| | ln(GDP per capita 2000) | | | | | |
|---|---|---|---|---|---|---|
| Dependent var. | (1) | (2) | (3) | (4) | (5) | (6) |
| *statehist* | 0.892*** | | −1.43*** | | | |
| | (0.330) | | (0.32) | | | |
| Ancestry-adjusted *statehist* | | 2.01*** | 3.37*** | | | |
| | | (0.38) | (0.41) | | | |
| *agyears* | | | | 0.134*** | | −0.198*** |
| | | | | (0.035) | | (0.044) |
| Ancestry-adjusted *agyears* | | | | | 0.269*** | 0.461*** |
| | | | | | (0.040) | (0.054) |
| Constant | 8.17*** | 7.61*** | 7.51*** | 7.87*** | 7.05*** | 6.96*** |
| | (0.14) | (0.17) | (0.16) | (0.21) | (0.23) | (0.22) |
| No. obs. | 136 | 136 | 136 | 147 | 147 | 147 |
| $R^2$ | .060 | .219 | .271 | .080 | .240 | .293 |

*Note.* Robust standard errors in parentheses.
***$p < .01$, **$p < .05$, *$p < .1$.

Table 4 shows the results of regressing the log of year 2000 per capita income on our early development measures. Each regression includes the unadjusted form of one early development measure, the adjusted form, or both. Not surprisingly, given previous work, the tests suggest significant predictive power for the unadjusted variables. However, for both measures of early development, adjusting for migration produces a very large increase in explanatory power. In the case of *statehist*, *R*2 goes from 0.06 to 0.22, whereas in the case of *agyears* it goes from 0.08 to 0.24. The coefficients on the measures of early development are also much larger using the adjusted than the unadjusted values. In the third and sixth columns of the table they run "horse race" regressions including both the adjusted and unadjusted measures of early development. The coefficients on the adjusted measures retain their significance and become larger, whereas the coefficients on the unadjusted measures become negative and significant.

Table 5

HISTORICAL AND GEOGRAPHICAL DETERMINANTS OF CURRENT INCOME

| Dependent var. | ln(GDP per capita 2000) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | Panel A | | | |
| Ancestry-adjusted *statehist* | 2.38*** | 1.32*** | 2.21*** | 1.75*** | 1.31*** | 1.24*** |
| | (0.40) | (0.43) | (0.41) | (0.55) | (0.42) | (0.42) |
| Absolute latitude | | 0.0386*** | | | | 0.0337*** |
| | | (0.0062) | | | | (0.0084) |
| Landlocked | | | −0.628** | | | −0.558*** |
| | | | (0.272) | | | (0.172) |
| Eurasia | | | | 0.594** | | −0.327 |
| | | | | (0.286) | | (0.247) |
| Climate | | | | | 0.609*** | 0.235* |
| | | | | | (0.096) | (0.121) |
| Constant | 7.44*** | 6.94*** | 7.65*** | 7.44*** | 6.92*** | 6.99*** |
| | (0.17) | (0.15) | (0.21) | (0.16) | (0.17) | (0.20) |
| No. obs. | 111 | 111 | 111 | 111 | 111 | 111 |
| $R^2$ | .294 | .527 | .339 | .334 | .494 | .593 |
| | | | Panel B | | | |
| Ancestry-adjusted *agyears* | 0.313*** | 0.172*** | 0.289*** | 0.219*** | 0.178*** | 0.153*** |
| | (0.048) | (0.053) | (0.051) | (0.062) | (0.060) | (0.054) |
| Absolute latitude | | 0.0393*** | | | | 0.0404*** |
| | | (0.0058) | | | | (0.0087) |
| Landlocked | | | −0.500** | | | −0.577*** |
| | | | (0.236) | | | (0.160) |
| Eurasia | | | | 0.631** | | −0.172 |
| | | | | (0.250) | | (0.237) |
| Climate | | | | | 0.516*** | 0.053 |
| | | | | | (0.101) | (0.133) |
| Constant | 6.85*** | 6.61*** | 7.07*** | 7.04*** | 6.74*** | 6.80*** |
| | (0.25) | (0.21) | (0.28) | (0.26) | (0.25) | (0.25) |
| No. obs. | 116 | 116 | 116 | 116 | 116 | 116 |
| $R^2$ | .293 | .523 | .320 | .334 | .426 | .563 |

*Note.* Robust standard errors in parentheses.
***$p < .01$, ** $p < .05$, * $p < .1$.

In Table 5, we consider the effect of a series of measures of geography on the statistical significance of our adjusted statehist and agyears variables, in order to make sure that our measures of early development are not somehow proxying for physical characteristics of the countries to which people moved. Specifically, we control for latitude, for being landlocked, for being in Eurasia, and a measure of the suitability of a country for agriculture. However, none of them individually, or even all four taken together, eliminates the statistical significance of matrix-adjusted *statehist* or *agyears*.

Overall, adjusting for migration improves the predictive power of measures of early development, and once migration is taken into account, the ability of these historical measures to predict income today is surprisingly high. This finding is consistent with the hypothesis that especially Europeans and to some extent East and South Asians carried something with them—human capital, culture, institutions, or something else—that raised the level of income in the Americas, Australia, Malaysia, and elsewhere. A population's long familiarity with certain types of institutions, human capital,

norms of behavior or more broadly culture seems important to account for comparative development.

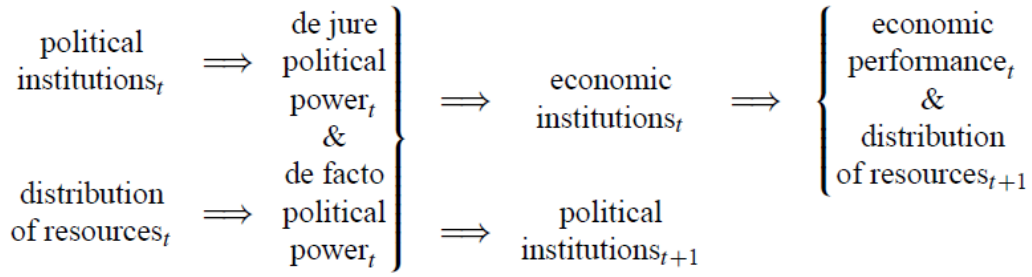
# Institutions

North (1990, p. 3) defines institutions as the rules of the game in a society which structure incentives in human exchange, whether political, social, or economic. Economic institutions in a society are very important in the structure of economic outcomes such as the structure of property rights and the presence and perfection of markets. Economic institutions are also important because they help to allocate resources to their most efficient uses, they determine who gets profits, revenues and residual rights of control. Consequently, the question of why some societies are much poorer than others is closely related to the question of why some societies have much "worse economic institutions" than others.

Economic institutions matter for economic growth because they shape the incentives of key economic actors in society, in particular, they influence investments in physical and human capital and technology, and the organization of production.

- Economic institutions not only determine the aggregate economic growth potential of the economy but also an array of economic outcomes, including the distribution of resources in the future (i.e., the distribution of wealth, of physical capital or human capital). In other words, they influence not only the size of the aggregate pie, but how this pie is divided among different groups and individuals in society.
- Economic institutions are determined as collective choices of the society, in large part for their economic consequences. Different economic institutions lead to different distributions of resources. The economic institutions set through conflict of interest among various groups. The group with the more political power sets its economic institutions it prefers.
- The distribution of political power in society is also endogenous and distinguish between two components. De jure (institutional) power refers to power that originates from the political institutions (i.e. democracy or dictatorship) in society. De facto political power has two sources. The ability of a group to solve its collective action problem and the de facto power of a group depends on its economic resources, which determine both their ability to use existing political institutions and also their option to hire and use force against different groups (our focus is primary on the second source). We have two main state variables in our framework, political institutions and the distribution of resources. Political institutions allocate de jure political power, and those who hold political power influence the evolution of political institutions, and they will generally opt to maintain the political institutions that give them political power. However, de facto political power occasionally creates changes in political institutions. The distribution of resources influences the distribution of de facto political power at time t. These two sources of political power, in turn, affect the choice of economic institutions and influence the future evolution of political institutions. Economic institutions determine economic outcomes, including the aggregate growth rate of the economy and the distribution of resources at time $t$ +1.

Putting all these pieces together, a simple representation of this framework is as follows:




Acemoglu et al. argue with convincing empirical support that differences in income per-capita can be explained through economic institutions rather than geography and culture. We use the colonial and Korean natural experiments to illustrate this point.

## The Korean experiment

After World War II, Korea became an independent state (1945). Three years later (1948) Korea separated into two countries. South Korea established a Republic and maintained a system of private property while attempting to use markets and private incentives in order to develop its economy. On the other hand, North Korea adopted communism, abolishing private property and economic decisions were not mediated by the market.

Korea exhibited an unparalleled degree of ethnic, linguistic, cultural, geographic and economic homogeneity. North Korea is better endowed with significant reserves of coal, lead, tungsten, zinc, graphite, magnesite, iron ore, copper, gold, pyrites, salt, fluorspar, hydropower. South Korea's natural resources are "coal, tungsten, graphite, molybdenum, lead, hydropower potential". Before Korea's independence industrialization concentrated more in the North than the South. Income per capita was approximately the same in both North and South Korea.

We can therefore think of the splitting on Korea 50 years ago as a natural experiment that we can use to identify the causal influence of a particular dimension of institutions on prosperity. The results are stunning. South Korea became one of the most rapid surges of economic prosperity in history while North Korea stagnated. By 2000 the level of income in South Korea was $16,100 while in North Korea it was only $1,000. By 2000 the South had become a member of the Organization of Economic Cooperation and Development, the rich nations club, while the North had a level of per-capita income about the same as a typical sub-Saharan African country. There is only one plausible explanation for the radically different economic experiences on the two Koreas after 1950: their very different institutions led to divergent economic outcomes. Bad institutions are therefore kept in place, clearly not for the benefit of society as a whole, but for the benefit of the ruling elite.

## The colonial experience

Among countries colonized by European powers during the past 500 years, those that were relatively rich in 1500 are now relatively poor. There is plenty of historical evidence showing this Reversal of Fortune in economic prosperity within former European colonies. For example, the Mughals in India and the Aztecs and Incas in the Americas were among the richest civilizations in 1500, while the civilizations in North America, New Zealand, and Australia were less developed. Today the United States, Canada, New Zealand, and Australia are an order of magnitude richer than the countries now occupying the territories of the Mughal, Aztec, and Inca Empires.

In order to measure prosperity in pre-industrial societies, urbanization rates and population density are the two proxies for income per capita used in this analysis. Only societies with a certain level of productivity in agriculture and a relatively developed system of transport and commerce can sustain large urban centers and a dense population. Figure 2 shows the relationship between income per capita and urbanization (fraction of the population living in urban centers with greater than 5000 inhabitants) today and demonstrates that in the current era there is a significant relationship between urbanization and prosperity. Figures 3 and 4 show the relationship between income per capita today and urbanization rates and population density in 1500 for the sample of European colonies.

Fig. 2 Urbanization in 1995 and log GDP per capita in 1995

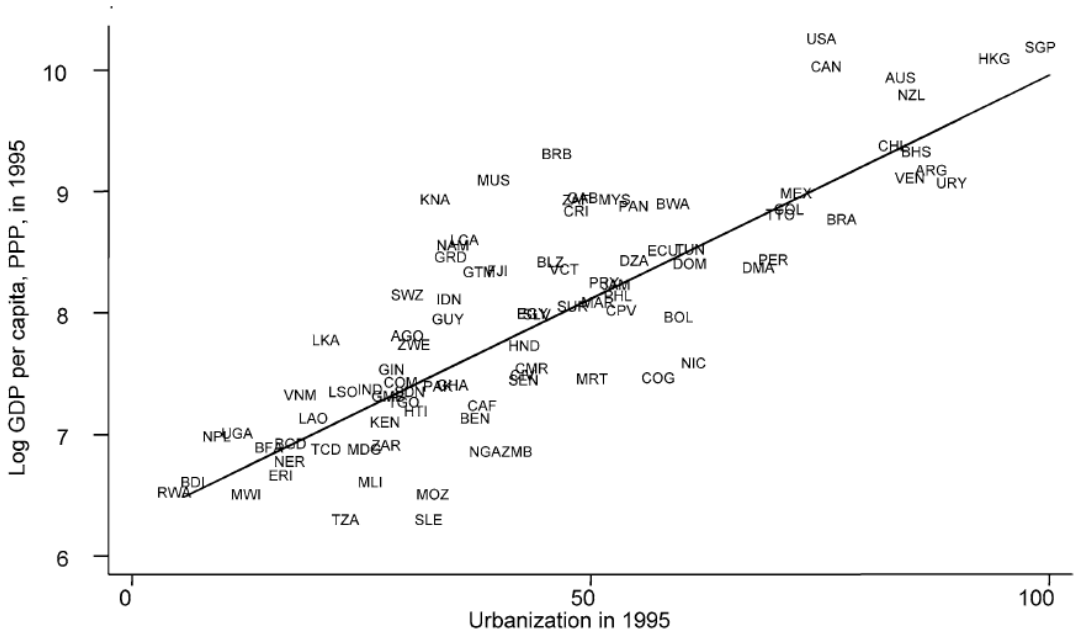


Fig. 3 Urbanization in 1500 and log GDP per capita in 1995, among former European colonies

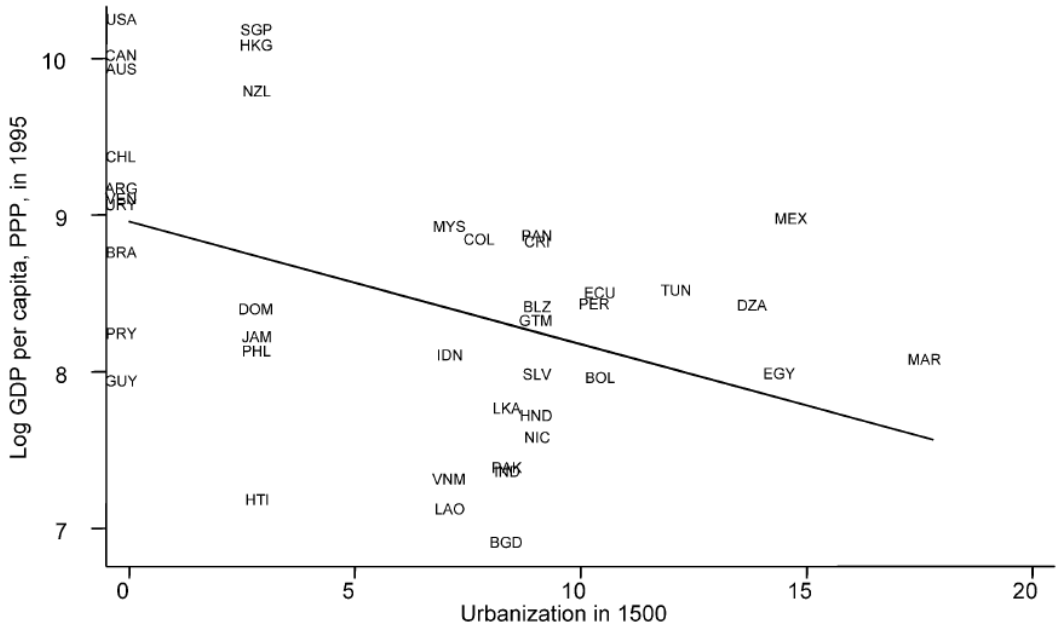
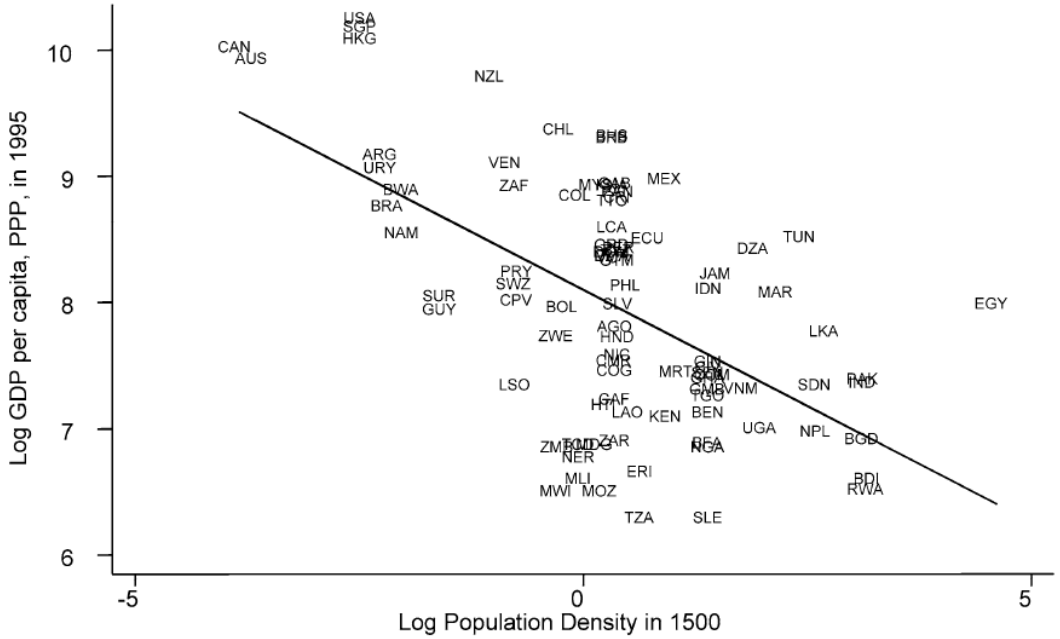
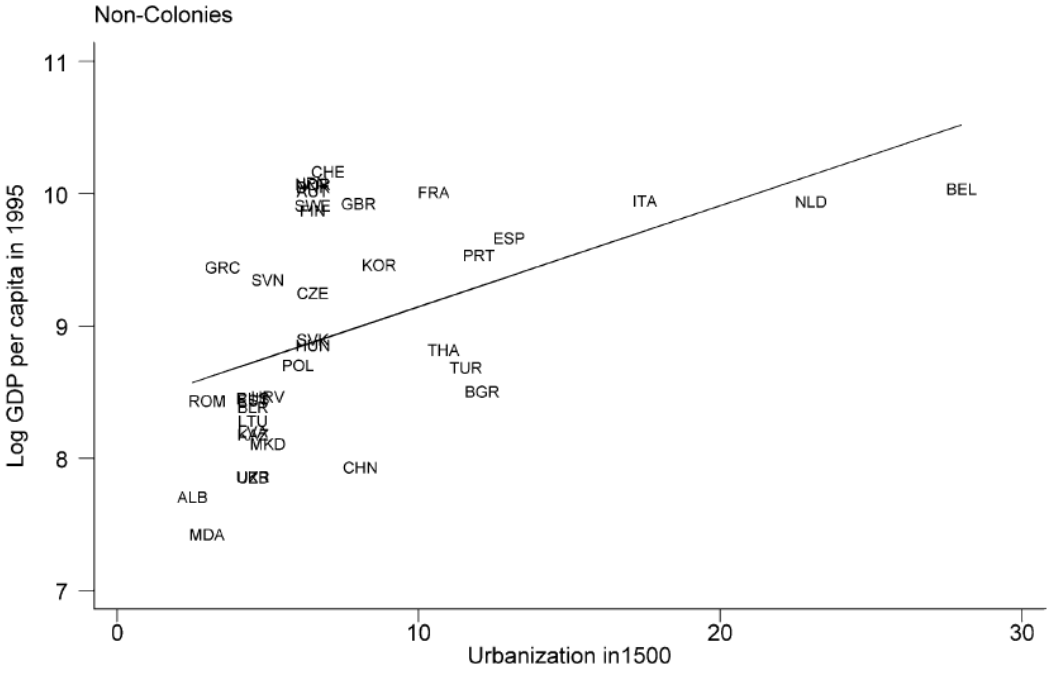



Fig. 4 Log population density in 1500 and log GDP per capita in 1995, among former European colonies




Moreover, reversal was not the general pattern in the world after 1500. Figure 5 shows that within countries not colonized by Europeans in the early modern and modern period, there was no reversal between 1500 and 1995.

Fig. 5 Urbanization in 1500 and log GDP per capita in 1995, among non-colonies




The best explanation for the patterns presented is the institution hypothesis, relating economic performance to the organization of society. Societies that provide incentives and opportunities for investment will be richer than those who fail to do so. A central hypothesis of our analysis is that a cluster of institutions ensuring secure property rights for a broad cross section of society, referred to as institutions of private property, are essential for investment incentives and successful economic performance. In contrast, extractive institutions, which concentrate power in the hands of a small elite and create a high risk of expropriation for the majority of the population, are likely to discourage investment and economic development.

How does the institution hypothesis help us explain the Reversal of Fortune? The basic idea is that the expansion of Europeans caused major changes in the organization of the societies that they settled in, and consequently caused an "institutional reversal", not in the sense that societies with good institutions ended up with extractive ones but that European colonialism led to the development of institutions of private property in poor areas and introduced or maintained extractive institutions in relatively rich areas. This happened mainly for two reasons: (a) The economic profitability of alternative policies. When extractive institutions were more profitable, Europeans were more likely to opt for them. High population density, by providing a supply of labor that could be forced to work in agriculture or mining, made extractive institutions more profitable for the Europeans. Furthermore, in these densely settled areas there was often an existing system of tax administration or tribute; the large population made it profitable for the Europeans to take control of these systems and to continue to levy high taxes. (b) Whether Europeans could settle or not. Europeans were more likely to develop institutions of private property when they settled in large numbers, for the natural reason that they themselves were affected by these institutions (i.e., their objectives coincided with encouraging good economic performance).Moreover, when a large

number of Europeans settled, the lower strata of the settlers demanded rights and protection similar to, or even better than, those in the home country. This made the development of effective property rights for a broad cross section of the society more likely. European settlements, in turn, were affected by population density both directly and indirectly. Population density had a direct effect on settlements, since Europeans could easily settle in large numbers in sparsely inhabited areas. The indirect effect worked through the disease environment, since malaria and yellow fever, to which Europeans lacked immunity, were endemic in many of the densely settled areas. To illustrate more on this point, we provide further evidence.

Fig. 6 Log mortality of potential European settlers and average protection against risk of expropriation 1985–95.

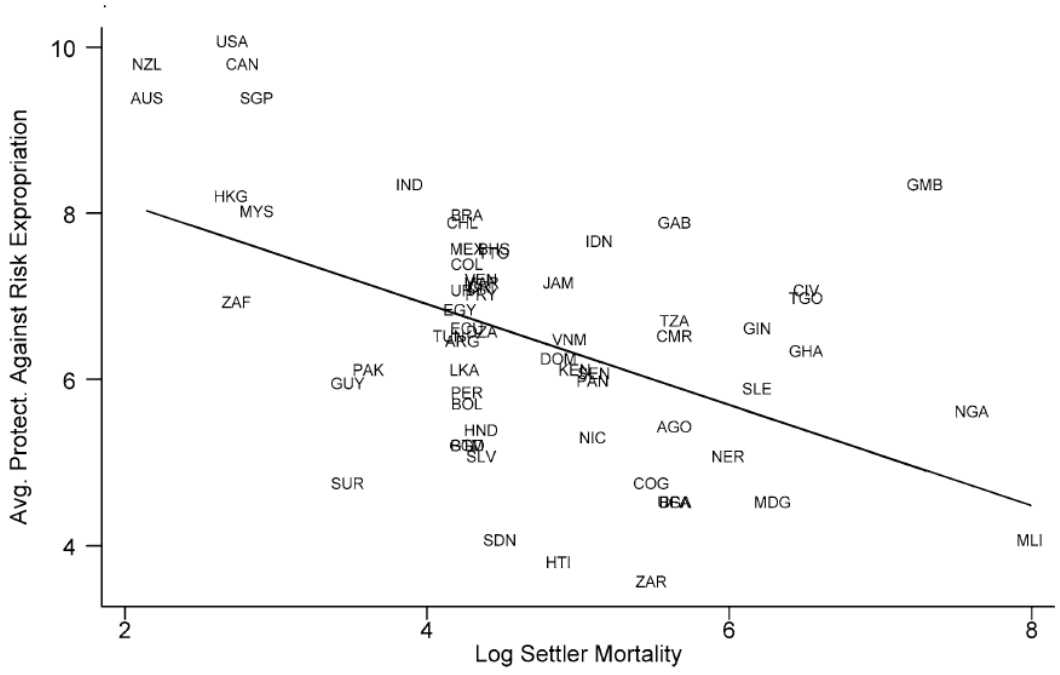


Table 6 Determinants of institutions

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Panel A | Dependent Variable Is Average Protection Against Expropriation Risk in 1985–1995 | | | | | | | | | |
| Constraint on executive in 1900 | 0.32 | 0.26 | | | | | | | | |
| | (0.08) | (0.09) | | | | | | | | |
| Democracy in 1900 | | | 0.24 | 0.21 | | | | | | |
| | | | (0.06) | (0.07) | | | | | | |
| Constraint on executive in first year of independence | | | | | 0.25 | 0.22 | | | | |
| | | | | | (0.08) | (0.08) | | | | |
| European settlements in 1900 | | | | | | | 3.20 | 3.00 | | |
| | | | | | | | (0.61) | (0.78) | | |
| Log European settler mortality | | | | | | | | | −0.61 | −0.51 |
| | | | | | | | | | (0.13) | (0.14) |
| Latitude | | 2.20 | | 1.60 | | 2.70 | | 0.58 | | 2.00 |
| | | (1.40) | | (1.50) | | (1.40) | | (1.51) | | (1.34) |
| $R^2$ | 0.2 | 0.23 | 0.24 | 0.25 | 0.19 | 0.24 | 0.3 | 0.3 | 0.27 | 0.3 |
| Number of observations | 63 | 63 | 62 | 62 | 63 | 63 | 66 | 66 | 64 | 64 |

| Panel B | Dependent Variable Is Constraint on Executive in 1900 | | | | Dependent Variable Is Democracy in 1900 | | | | Dependent Variable Is European Settlements in 1900 | |
|---|---|---|---|---|---|---|---|---|---|---|
| European settlements in 1900 | 5.50 | 5.40 | | | 8.60 | 8.10 | | | | |
| | (0.73) | (0.93) | | | (0.90) | (1.20) | | | | |
| Log European settler mortality | | | −0.82 | −0.65 | | | −1.22 | −0.88 | −0.11 | −0.07 |
| | | | (0.17) | (0.18) | | | (0.24) | (0.25) | (0.02) | (0.02) |
| Latitude | | 0.33 | | 3.60 | | 1.60 | | 7.60 | | 0.87 |
| | | (1.80) | | (1.70) | | (2.30) | | (2.40) | | (0.19) |
| $R^2$ | 0.46 | 0.46 | 0.25 | 0.29 | 0.57 | 0.57 | 0.28 | 0.37 | 0.31 | 0.47 |
| Number of observations | 70 | 70 | 75 | 75 | 67 | 67 | 68 | 68 | 73 | 73 |

Figure 6 shows very strong relationship between the historical mortality risk faced by Europeans and the current extent to which property rights are enforced. Columns 9-10 of table 6 show the relationship between the protection against expropriation variable and the mortality rates faced by settlers. It shows that the settler mortality alone explains 27 percent of the differences in institutions observed today.

Table 7 Urbanization, Population and Institutions

| | Dependent variable is: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Average protection against expropriation risk, 1985–1995 | | | Constraint on executive in 1990 | | | Constraint on executive in first year of independence | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| *Panel A: Without additional controls* | | | | | | | | | |
| Urbanization in 1500 | −0.107 | | −0.001 | −0.154 | | −0.037 | −0.132 | | 0.018 |
| | (0.043) | | (0.059) | (0.066) | | (0.098) | (0.069) | | (0.103) |
| Log population density in 1500 | | −0.37 | −0.37 | | −0.49 | −0.40 | | −0.33 | −0.54 |
| | | (0.10) | (0.15) | | (0.15) | (0.25) | | (0.15) | (0.28) |
| $R^2$ | 0.14 | 0.16 | 0.25 | 0.12 | 0.12 | 0.18 | 0.31 | 0.16 | 0.37 |
| Number of observations | 42 | 75 | 42 | 41 | 84 | 41 | 42 | 85 | 42 |
| *Panel B: Controlling for latitude* | | | | | | | | | |
| Urbanization in 1500 | −0.097 | | −0.001 | −0.159 | | −0.038 | −0.128 | | 0.022 |
| | (0.042) | | (0.059) | (0.067) | | (0.099) | (0.070) | | (0.104) |
| Log population density in 1500 | | −0.31 | −0.34 | | −0.45 | −0.41 | | −0.30 | −0.54 |
| | | (0.10) | (0.15) | | (0.16) | (0.25) | | (0.16) | (0.28) |
| Latitude | 2.87 | 3.53 | 2.57 | −1.49 | 2.63 | −1.86 | 1.52 | 2.68 | 1.48 |
| | (1.48) | (1.25) | (1.41) | (2.38) | (2.01) | (2.34) | (2.54) | (2.17) | (2.46) |
| $R^2$ | 0.21 | 0.24 | 0.31 | 0.13 | 0.13 | 0.19 | 0.32 | 0.17 | 0.38 |
| Number of observations | 42 | 75 | 42 | 41 | 84 | 41 | 42 | 84 | 42 |

Table 7 provides econometric evidence on the institutional reversal mentioned above. It shows the relationship between urbanization or population density in 1500 and subsequent institutions using three different measures of institutions. The first two measures refer to current institutions: protection against expropriation risk between 1985 and 1995 from Political Risk Services, which approximates how secure property rights are, and "constraints on the executive" in 1990 from Gurr's Polity III data set, which can he thought of as a proxy for how concentrated political power is in the hands of ruling groups. Columns (l)-(6) of Table 7 show a negative relationship between our measures of prosperity in 1500 and current institutions.

The institution hypothesis should matter more when new technologies were introduced that required investment from a broad section of the society. It becomes clearer that societies with good institutions benefited from industrializing while societies with extractive institutions didn’t. For further illustration, we present the following figures:

Fig. 7a Urbanization Rate in India, the United States, and New World Countries with Low and High Urbanization, 800-1920

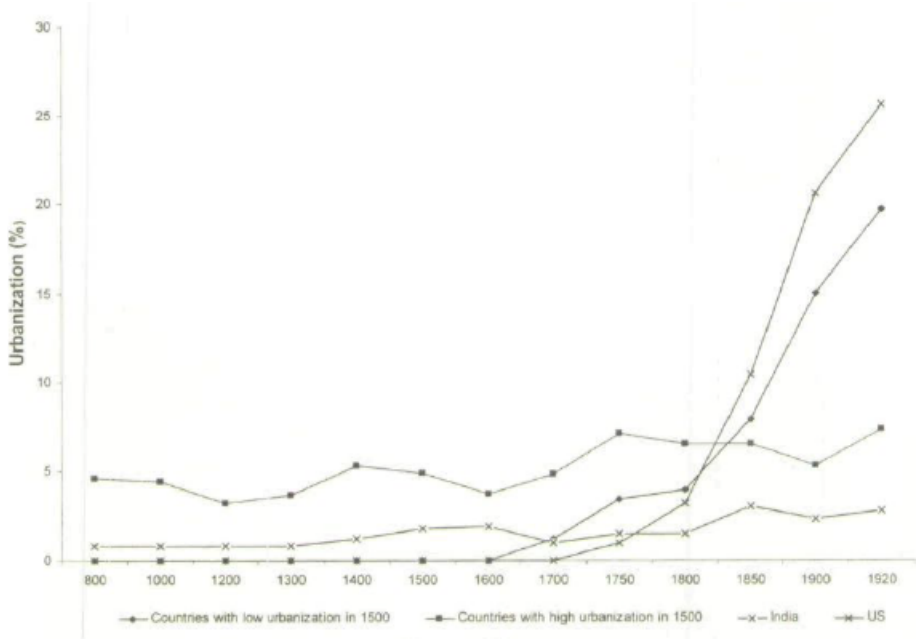



Fig. 7b Industrial Production per Capita, 1750-1953

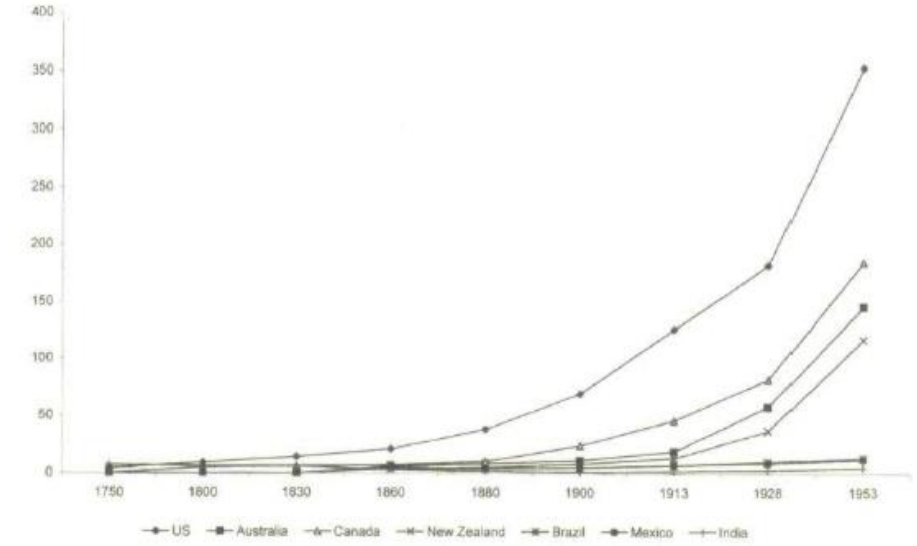



Figure 7a compares the evolution of urbanization among two groups of New World ex-colonies, those with low urbanization in 1500 versus those with high urbanization in 1500. The figure shows that the initially low urbanization group as a whole and the United States by itself overtake India and the initially high urbanization countries sometime between 1750 and 1850.

Figure 7b depicts per capita industrial production for the United. States, Canada, New Zealand, Australia, Brazil, Mexico, and India. This figure shows the takeoff in industrial production in the United States, Australia, Canada, and New Zealand relative to Brazil, Mexico, and India. Although the scale makes it difficult to see in the figure,

per capita industrial production in 1750 was in fact higher in India, 7, than in the United States, 4 (with U. K. industrial production per capita in 1900 normalized to 100).

The general interpretation is that the reversal in relative incomes took place during the late eighteenth and early nineteenth centuries and was closely linked to industrialization.

Finally, and perhaps most importantly, this reversal, in fact divergence, was related to institutions. It was the interaction between industrialization opportunities and institutions these countries developed during colonization that determined whether they took advantage of the industrialization opportunities. Those with institutions that protected property rights and enabled new entrepreneurs and businessmen to enter did so, those with extractive institutions failed. The next table provides evidence in line with this hypothesis, looking at the effect of the interaction between institutions and frontier industrialization on development in a panel of former colonies.

Table 8 The interaction of U.K. Industrialization and Institutions

| | Former colonies, using only pre-1950 data (1) | Former colonies, using data through 1980 (all data) (2) | Former colonies, using only pre-1950 data (3) | Former colonies, using only data pre-1950 and for independent countries (4) | Former colonies, with average institutions for each country, using only pre-1950 data (5) | Former colonies, with average institutions for each country, using only pre-1590 data (6) | Former colonies, with average institutions for each country, instrumenting using settler mortality, only pre-1950 data (7) | Former colonies, with average institutions for each country, instrumenting using settler mortality, only pre-1950 data (8) | Former colonies, with average institutions for each country, instrumenting using settler mortality, only pre-1950 data (9) | Former colonies, with average institutions for each country, instrumenting using settler mortality, only pre-1950 data (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Panel A: Dependent variable is industrial production per capita* | | | | | | | | | | |
| U. K. industrialization | 0.132 | 0.132 | 0.145 | 0.160 | 0.202 | 0.206 | 0.168 | 0.169 | 0.156 | 0.158 |
| *institutions | (0.026) | (0.027) | (0.035) | (0.048) | (0.019) | (0.022) | (0.030) | (0.032) | (0.065) | (0.065) |
| Institutions | 8.97 | −3.36 | 10.51 | 7.48 | | | | | | |
| | (2.30) | (4.46) | (3.50) | (9.51) | | | | | | |
| Independence | | | −14.3 | | | −6.4 | | 1.1 | | 2.0 |
| | | | (22.9) | | | (11.4) | | (12.6) | | (14.2) |
| U. K. industrialization | | | −0.12 | | | −0.042 | | 0.046 | | 0.06 |
| *independence | | | (0.21) | | | (0.12) | | (0.13) | | (0.17) |
| U. K. industrialization | | | | | | | | | 0.13 | 0.12 |
| *latitude | | | | | | | | | (0.50) | (0.48) |
| $R^2$ | 0.75 | 0.74 | 0.75 | 0.84 | 0.89 | 0.89 | 0.88 | 0.88 | 0.87 | 0.87 |
| Number of observations | 59 | 75 | 59 | 32 | 59 | 59 | 59 | 59 | 59 | 59 |

*Panel B: Dependent variable is log GDP per capita*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Log U. K. industrialization | 0.078 | 0.060 | 0.073 | 0.079 | 0.135 | 0.130 | 0.159 | 0.150 | 0.116 | 0.111 |
| *institutions | (0.022) | (0.017) | (0.027) | (0.025) | (0.021) | (0.026) | (0.032) | (0.038) | (0.067) | (0.073) |
| Institutions | −0.027 | −0.084 | −0.10 | −0.11 | | | | | | |
| | (0.025) | (0.028) | (0.04) | (0.04) | | | | | | |
| Independence | | | 0.67 | | | 0.12 | | 0.10 | | 0.019 |
| | | | (0.27) | | | (0.13) | | (0.13) | | (0.16) |
| Log U. K. industrialization | | | 0.035 | | | −0.008 | | −0.042 | | 0.016 |
| *independence | | | (0.12) | | | (0.093) | | (0.11) | | (0.14) |
| Log U. K. industrialization | | | | | | | | | 0.42 | 0.42 |
| *latitude | | | | | | | | | (0.49) | (0.54) |
| $R^2$ | 0.95 | 0.92 | 0.95 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Number of observations | 79 | 131 | 79 | 46 | 79 | 79 | 79 | 79 | 79 | 79 |

Using Acemoglu, Johnson, Robinson's notation, a panel data regression of the following form is run:

$$y_{it} = \mu_t + \delta_t + \pi * X_{it} + \varphi * X_{it} * UKIND_t + \varepsilon_{it},$$

where y is the outcome variable of interest in country i at date t. In addition, **μ** is a set of time effects, and **δ** denotes a set of country effects, $\mathbf{UKIND_t}$ is industrial output in the United Kingdom at date t, and $\mathbf{X_{it}}$ denotes the measure of institutions in country i at date t. Our institutions variable is constraint on the executive from the Gurr Polity III data set. The coefficient of interest is **φ**, which reflects whether there is an interaction between good institutions and the opportunity to industrialize. A positive and significant φ is interpreted as evidence in favor of the view that countries with institutions of private property took better advantage of the opportunity to industrialize. The parameter π measures the direct effect of institutions on industrialization and is evaluated at the mean value of $UKIND_t$.

The top panel of table 8 reports regressions of the above equation with industrial output per capita as the left-hand-side variable. Column 1 reports a regression using only pre-1950 data. The term φ is estimated to be 0.132, and is highly significant. In column 2 the data is extended through 1980, with no effect on the coefficient. In columns 3 and 4, a dummy is included for whether the country is independent. Again φ is unchanged and the variables added are insignificant. In columns (9) and (10) the interaction between latitude and industrialization is checked. This is useful because, if the reason why the United States surged ahead relative to India or South America during the nineteenth century is its geographic advantage, these measures of institutions might be proxying for this, incorrectly assigning the role of geography to institutions. The results give no support to this view: the estimates of φ are affected little and remain significant, while the interaction between industrialization and latitude is insignificant. Panel B repeats the same regressions using log GDP as the left-hand-side variable giving similar results to those in Panel A.

Overall, these results provide support for the view that institutions played an important role in the process of economic growth and in the surge of industrialization among the formerly poor colonies, and via this channel, account for a significant fraction of current income differences.

# Conclusions

In this article we have reviewed recent literature on economic growth and development, focusing on the long-run effects of geography, culture and economic institutions on productivity and income per capita, as well as present empirical evidence documenting these effects. In conclusion, what have we learned?

An important finding is the indirect and persistent effect of prehistorical biogeographic conditions. According to Olsson and Hibbs (2005), Neolithic advantages continue to have effects on contemporary income per capita, consistently with Diamond's hypothesis.

The importance of controlling for populations' ancestry highlights the second message from this literature. A focus on populations rather than locations helps us understand reversal of fortune, and sheds light on the spread of economic development. The need to adjust for population ancestry is at the core of Putterman and Weil's (2010) contribution, showing that current economic development is correlated with historical characteristics of a population's ancestors, including ancestors' years of experience with agriculture, going back, again, to the Neolithic transition.

Finally, through the Korean and colonial natural experiments, it was shown that different economic institutions form different economic outcomes and through that, institutional differences between nations are the major source of differences in income per capita today.

# References


Acemoglu, D., Johnson, S., Robinson, J., (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review* 91, 1369-1401.

Acemoglu, D., Johnson, S., Robinson, J., (2002). Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. *Quarterly Journal of Economics* 117, 1231-94.

Acemoglu, D., Johnson, S., Robinson, J., (2005). Institutions as a Fundamental Cause of Long-Run Growth. *In Handbook of Economic Growth, Volume 1A*, edited by Philippe Aghion and Steven N. Durlauf, 385-472. Amsterdam and Boston : Elsevier North-Holland

Spolaore, E., and R. Wacziarg (2013). How Deep Are the Roots of Economic Development? *Journal of Economic Literature* 51, 325-369.

Olsson, O., Douglas, A., Hibbs, Jr., (2005). Biogeography and Long-Run Economic Development. *European Economic Review* 49, 909-38.

Putterman, L., Weil, D., (2010). Post-1500 Population Flows and the Long-Run Determinants of Economic Growth and Inequality. *Quarterly Journal of Economics* 125, 1627-82.