# Persistence of Fortune: Accounting for Population Movements, There was No Post-Columbian Reversal

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**Abstract**. Using data on place of origin of today's country populations and the indicators of level of development in 1500 used by Acemoglu *et al*. (2002), we confirm a reversal of fortune for colonized countries as territories but find persistence of fortune for people and their descendants. Persistence results are at least as strong for three alternative measures of early development, for which reversal for territories, however, fails to hold. Additional exercises lend support to Glaeser *et al*.'s (2004) view that human capital is a more fundamental channel of influence of pre-colonial conditions on modern development than is quality of institutions. (*JEL*: O40, O10, N10)

In a much-cited paper, Acemoglu, Johnson and Robinson (2002, hereafter AJR) found that among the countries that emerged out of lands colonized by Europeans beginning in the late 15th century, there appeared to have occurred a "reversal of fortune" wherein countries that were more urbanized, densely populated, and thus richer or at least more technologically advanced in 1500 had become poorer by 1995. The finding closely paralleled the demonstration in Acemoglu, Johnson

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and Robinson (2001) that incomes were higher in 1995 in countries whose colonization had involved more European settlement than in ones where colonial rule focused on extraction of natural resource wealth and exploiting the labor of the local population. The authors used both findings to argue that it is the presence or absence of institutions promoting effort and investment, not geography, that determines the relative wealth and poverty of nations. The evidence of a reversal of fortune in the Americas and Australia is also a centerpiece of the argument for the primacy of institutions over geography as the ultimate determinant of comparative economic development in the recent book *Why Nations Fail* by Acemoglu and Robinson.

In the present paper, we revisit the question of whether there was a reversal of fortune—a phenomenon whereby rich countries became poor and poor ones rich—during the colonial era and its aftermath. We are able to reproduce the AJR reversal in terms of the territorial entities that constitute present-day countries. But we show that with respect to the people who live in countries and their descendants, there was no reversal. AJR (2002) demonstrated their reversal on the basis of two main indicators of development in 1500: the rate of urbanization, and population density. We find that in the large fraction of AJR's once-colonized countries sample for which we can estimate year 1500 ancestry, the descendants of people from societies that were more urbanized and more densely populated in 1500 have higher, not lower, incomes today.

Our method of studying the influence of the past in terms of descent and ancestry rather than territory parallels that of Putterman and Weil (2010, hereafter PW), who found evidence of the persistence of economic advantage between 1500 and 2000 when accounting for migration between countries, including that between world macro-regions following Europe's "discovery" of the Americas and Oceania. They provided no investigation of the relationship of their findings to the "reversal of fortune" identified by AJR, however. Our paper makes use of both the 1500 – 2000 migration data of PW and an adaptation of their data set that excludes migration in the post-colonial era (after 1960).

After obtaining our core result using AJR's urbanization and population density measures, we consider three alternative proxies for pre-colonial era development, some of which are less limited in terms of sample size and, perhaps, data quality. These indicators—time since transition to agriculture, history of state-level polities, and the year 1500 technology index of Comin, Easterly and Gong (2010)—are all significantly correlated with one another and with urbanization and population density in 1500, and all have been featured in studies of the effects of early development on modern growth. To the extent that the AJR hypothesis is correct, one would therefore expect them to show a negative effect on the recent per capita incomes of formerly colonized countries. We find that such a negative effect emerges in statistically significant form for two of the new variables when we use an earlier end year (1960) or impose some restrictions on the AJR colonies sample. For the terminal year and country sample on which AJR focus, however, the relevant coefficients are negative but entirely insignificant, casting some doubt on the robustness of the reversal idea in its original form. More importantly, when we make the relevant adjustment for origins of country populations, we find that all three variables reiterate our main finding of persistence of fortune for people and their descendants, with high degrees of significance and with and without sample or end year changes.

After presenting these results, we conduct robustness tests along several lines. We control for variables that reflect variations in geography, climate, religion, colonizing country, etc. We also report alternate estimates that extend the analysis from colonized to all non-European countries for which data are available, check the sensitivity of our results to the exclusion of four "neo-Europes" (U.S., Canada, Australia and New Zealand) and city states (Hong Kong and Singapore), check robustness to alternative end years, and consider estimates in which the sample is limited to only the Americas or to high immigration countries, as well as the complements of those samples. We find general robustness to controls and consistent indications of reversal for territories but persistence for people, regardless of year 1500 development indicator, end year, and sample.

Our paper contributes to the literature on long-run determinants of economic development that has recently been surveyed by Spolaore and Wacziarg (2013) and by Nunn (2014). The view that early economic development, including early adoption of agriculture, has had a persistent impact on economic development has been laid out in papers by Bockstette, Chanda and Putterman (2002), Hibbs and Olsson (2004, 2005), Chanda and Putterman (2007), Putterman (2008), Comin, Easterly and Gong (2010), and, in the literature of biology and geography, by Diamond (1998). Acemoglu and Robinson (2012) identify Diamond's view as one of two geography-centered competitors to their institutional explanation of comparative development, the other being a more traditional geographic approach epitomized by the work of Jeffrey Sachs and collaborators (e.g., Gallup, Sachs and Mellinger, 1999). Glaeser *et al*. (2004, hereafter GLLS) question the arguments of Acemoglu *et al*. (2001, 2002), pointing out that the human capital brought by people to lands they settled in may be more important than the institutions they adopted. Easterly and Levine (2012) find direct effects of presence of Europeans during the colonial era on economic outcomes of former colonies today.[1]

In an extension of our main analysis, we briefly investigate the channels through which differences in pre-colonial development levels may have

[1] Nunn (2008) argues that it was not colonization, but the slave trade preceding the colonial era, that is responsible for contemporary African development, while Gennaioli and Rainier (2007) and Michalopoulos and Papaioannou (forthcoming) find effects of the centralization of power in ethnic groups or existence of pre-colonial states in Africa on contemporary provision of public goods, and on income.

influenced recent comparative development. Like GLLS, we compare pathways of human capital to ones involving political and economic institutions emphasized by AJR. We go beyond the analysis of GLLS in that we apply to this question both (i) the more substantial set of early development indicators mentioned above, and (ii) the post-1500 migration data assembled by PW, as well as our own colonial-era-only variant (for 1500 – 1960 migration). We use both the ancestry-adjusted and the unadjusted measures of pre-colonial development as instruments for recent human capital levels, measured by literacy circa 1950, 1975 and 1990 and for years of schooling, and also as instruments for the measures of institutional quality studied by AJR and GLLS. Our results support the view that human capital is an earlier and more consistently supported channel of transmission of early developmental advantages.

## I. Empirical Strategy and Main Results

### **A**. *Urbanization and Population Density*

We begin by reproducing AJR's results in simple regressions showing that both ex-colonies that were more urbanized in 1500 and ex-colonies that had higher population densities in 1500 had lower incomes in 1995. We use AJR's data for all variables, including the estimated urban share of population in 1500, which is from Bairoch (1988) and Eggimann (1999), estimated population density in 1500 based on McEvedy and Jones (1978), and 1995 real GDP per capita, originally from the World Bank. We then repeat the exercises replacing the urbanization rate or population density of each country with the average urbanization rate or the average population density of the countries in which the year 1500 ancestors of each country's year 2000 population lived, according to the World Migration Matrix 1500 – 2000 constructed for PW.

**{Table 1 here}**

Results for the original AJR samples, corresponding to the "base sample" columns in tables III and V of AJR, are shown in columns (1) and (4) of Table 1. Each is an exact replication.[2] Our migration data covers a large number of countries – one hundred and sixty-five, to be exact. However, to construct average urbanization rates of the countries in which each country population's ancestors lived in 1500—what we'll be calling ancestry adjusted urbanization rates—we need urbanization data for not just the colonized countries in AJR's sample but also the origin countries of the migrants. Since urbanization data in 1500 is sparse, the sample size falls from the 41 countries in AJR's regression to 28. For population density, for which estimates are more widely available, the sample size falls only from 91 to 83. To make sure that any qualitative change in results is not due to peculiarities of the available subsamples, we first re-estimate the AJR regressions on the relevant smaller sample. The results displayed in columns (2) and (5) of Table 1 closely resemble those in the original regressions in magnitude, significance, and sign. In columns (3) and (6), we then show our regressions for the same samples of countries but replacing each country's territorial urbanization rate or population density in 1500 with the weighted average urbanization rate or population density of the countries in which the ancestors of the country's year 2000 population lived in 1500.[3] The resulting estimates are our first indication

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[2] To replicate AJR's result, we naturally follow their classification of which countries were colonized, which is in turn taken from LaPorta *et al*. (1999). Although classifications differ from those of some other studies, AJR and LaPorta *et al*. take the common approach of considering as colonized only countries colonized by Western European powers, so countries that emerged from the Russian empire and Soviet Union, and former colonies of Japan, are considered non-colonies.

[3] For a given country, an "ancestry adjusted" variable, say population density of 1500, is the weighted average of the year 1500 population densities of those countries in which the year 2000 population's ancestors were living in 1500, with the weights being ancestry shares. For Singapore, for example, ancestry adjusted population density of 1500 equals 0.03 times population density 1500 of Malaysia plus 0.77 times population density 1500 of China plus 0.11 times population density 1500 of Indonesia, etc. If data are missing for countries in which a combined total of more than 10% of the current population's ancestors lived, we treat the observation as missing (which explains why sample sizes frequently drop); if a smaller share of

that what is a reversal for countries as territories is not such for populations: the coefficients on both key variables change sign and, while losing significance, are nevertheless significant at the 10% level. Without correcting for migration, a one standard deviation increase in urbanization is associated with roughly a 30 percent decrease in GDP per capita; however, a one standard deviation increase in ancestry adjusted urbanization is associated with a 27 percent increase in 1995 income. The "reversal" in results can also be observed in Figure 1. Panel A of Figure 1 plots log of GDP per capita in 1500 against the unadjusted and ancestry adjusted measures of urbanization. The change in direction is readily apparent. In Panel B, we repeat the exercise for population density. Again the change in direction is obvious.

**{Figure 1 here}**

### **B.** *Alternative Proxies for Year 1500 Development*

While urbanization rates and population density are useful metrics for capturing pre-industrial levels of development, urbanization data for 1500 is only available for a small set of countries, and questions remain regarding the quality and conceptual appropriateness of the population density data.[4] It therefore makes sense to also look for evidence of reversal or persistence of fortune using other indicators or proxies for year 1500 level of development. The three alternative variables that we use have been shown elsewhere to be strongly correlated with

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the source population's values is missing, we re-weight each country by its share of ancestors from countries having data.

[4] Quality problems revolve around the age and conjectural nature of many of the population estimates and difficulties assigning shares of population to individual countries in cases in which the authors provide estimates for a larger region only. The major conceptual problem is that in most countries, the large majority of the people are found in a small subset of the territory, often including river valleys, coastlines, and fertile plains, and the ratio of largely uninhabited to inhabited territory varies among countries as defined by their modern borders in a fashion that may reflect less on the level of development of the society than on geographic happenstance (examples include the surrounding of the Nile River Valley by large deserts, or the proximity of the main population centers of Canada, Sweden and Norway to largely unpopulated expanses of subarctic terrain).

year 1500 living standards, and two can also be viewed as indicators of the organizational and technological know-how that populations may have brought with them to new lands during the large-scale migrations that redrew the world ethnic, linguistic, and cultural map in the years since 1500.

The first is the number of years since people living within what is now the country's territory began to rely on agriculture more than on foraging as their major source of food. The associations between agriculture, sedentary life, appearance of cities and large scale polities, and other technological advances are much discussed in the archeological and historical literature, and duration of practice of agriculture has also been shown to be a predictor of current level of development by Hibbs and Olsson (2005). While Hibbs and Olsson calculate transition dates for nine world regions, Putterman and Trainor (2006) improve on this by calculating country specific dates. Like PW, we use the latter data.

A second measure used is state history, or *statehist*. This measure indicates the proportion of time in which the territory within the borders of a present-day country had a supra-tribal polity, how much of the territory that polity covered, and whether it was home-based or imposed from without. Years from 1 to 1500 C.E. are covered, with diminishing weight on the more distant past. Anthropologists and historians associate the emergence of states with more advanced technologies, larger populations, and greater social complexity. Studies including PW and Chanda and Putterman (2007, henceforth CP) have found it to be a good predictor of modern development.[5] CP also demonstrate its statistical association with the development of agriculture, as is expected from numerous historical accounts, and show it to be significantly positively correlated with year 1500 income estimates.[6]

[5] See also Ang (2013a, 2013b), who finds evidence that state history predicts contemporary financial system features and quality of institutions.

[6] Year 1500 income, in this exercise of CP, is estimated by extrapolating from linear models based on the year 1500 income estimates for 32 countries by Maddison (2001).

A third proxy for year 1500 level of development employed by us is Comin *et al*.'s index based on use of 24 technologies in five sectors (agriculture, transportation, military, industry, and communications) around the year 1500 but prior to European contact. Comin *et al*. demonstrate the measure's ability to predict country incomes in year 2000 as well as the strengthening of that predictive power by accounting for migration using the data of PW. Ashraf and Galor (2011) show that level of technology prior to the industrial revolution is highly correlated with income but especially with population density, in line with expectations that technological advances result more in population than in income growth during the Malthusian era.

**{Table 2 here}**

Before putting our three additional proxies of year 1500 development to work in our additional checks for a reversal of fortune in the colonized or non-European worlds, we first check their correlations with each other as well as with urbanization rates and population densities. Table 2 shows that all of the three variables are strongly correlated with each other as well as with population density. With respect to urbanization, there is more variation with the state history variable exhibiting a strong positive association while millennia since agriculture exhibits a much weaker association.

**{Table 3 here}**

Table 3 shows OLS regressions each of which attempts to predict income in 1995, the main dependent variable in AJR, when the sample is restricted to colonized countries. As mentioned, the three variables have earlier been shown to be positively associated with long term economic development when samples were not restricted to colonized countries. For each of these variables, we show both a regression using their value based on the country defined as territory and one using their average value for the lands in which the current population's ancestors lived in year 1500 adjusted by estimated ancestry shares. Columns (1), (3), and (5) indicate that none of the three variables have any positive effects on contemporary incomes, findings reminiscent of AJR's "reversal of fortune" although statistically insignificant. The ancestry adjusted variable, on the other hand, is positive and statistically significant at the one percent level for each of the three variables.[7] While the pattern of results resembles Table 1 with regard to sign, in Table 3 the coefficients of each of the variables become significant once adjusted for ancestry, and R-square values also exhibit sizeable jumps.

**{Figure 2 here}**

Based on both AJR's and our alternative measures, fortunes appear to be persistent rather than reversed among the lineages of people who occupied ex-colonies in 1995. In Figure 2, panels A, B, and C replicate scatterplots for the three added variables in the same spirit as those for population density and urbanization in Figure 1. The change in the sign of the slope is readily apparent in all three cases.

## II. Robustness Checks: Controls, Samples, and End Years

### **A.** *Robustness to Additional Controls*

In Table 4, we perform robustness checks using five sets of controls for each of our proxies for year 1500 level of development. Results are displayed for each territorially based variable and for each ancestry adjusted counterpart using

[7] In Table 3 we allow the sample to change with each proxy of development to allow as many observations as possible. However, these results also hold when we limit the sample to a restricted set of sixty common countries.

the same dependent variable, 1995 per capita income. The controls are latitude, climate, an absolute measure of resources (coal, oil, metals and geography), indicators for colonizing powers, and an indicator for the main religion in the country. These are the same controls as are used in tables III and IV of AJR (2002).

**{Table 4 here}**

In all cases, the estimates using the ancestry adjusted measures maintain their positive coefficients. These are uniformly significant at the 1% level for the agriculture measure, significant but at varying levels for the state history and technology measures, and significant with only about half of the sets of controls for the urbanization and population density measures. The unadjusted, territorially defined measures obtain negative coefficients, consistent with AJR and with our previous findings, except when the additional control captures differences in religion, or when the measure of development is the 1500 technology index. The negative coefficients, however, are usually significant only for urbanization and population density. In sum, there is strong evidence for persistence of ancestral populations' advantages surviving addition of the various sets of controls.[8]

### **B.** *Robustness to Alternative Samples*

In *Why Nations Fail*, Acemoglu and Robinson give considerable attention to the fact that in the Americas, the places that became Mexico and Peru were home to densely populated agrarian civilizations whereas those that became the U.S. and Canada were more sparsely populated and home to many smaller tribes,

[8] In addition to these controls, we also checked for robustness to ethnic fractionalization. This did not change our results.

some of them primarily reliant on foraging. The shaded map of the Western Hemisphere on the left side of Figure 3 displays the differences in estimated year 1500 population density in the territories of today's countries. Acemoglu and Robinson's attribution of a reversal of fortune, whereby the latter became the richer and the former the poorer countries, to a difference in institutions in and after the colonial era is one of the centerpieces of their argument for the primacy of institutions in determining economic growth. More broadly, intuition suggests that countries of the Western Hemisphere and Oceania (including Australia and New Zealand), where colonization led to the most dramatic changes in population origins, play a particularly important role in the reversal phenomenon identified by AJR. In columns 1 and 2 of Table 5, we revisit our regression exercises for the subset of countries in the Americas.

**{Figure 3 here}**

Only the estimates that use year 1500 population density as proxy for early development strongly support the idea of a reversal of fortune in the territorially based versions of these Americas-only regressions. In contrast, regressions for the same restricted sample using all five proxies for early development strongly indicate persistence of fortune for descendants of year 1500 ancestors. Moreover, the point estimate of the coefficient for ancestry adjusted population density is much higher within the Americas than in the larger sample in Table 2, as is the case also for the point estimates for ancestry adjusted state history and millennia of agriculture.

**{Table 5 here}**

Table 5's column (1) and (2) results for population density are particularly striking because coefficients are highly significant for both the territorial and the ancestry adjusted regressions, but with opposite signs. Contrasting the map on the right side of Figure 1, which shows the average year 1500 population density of those countries from which current residents' ancestors hail, to that on the left, referenced above, makes clear that for the New World, the historical characteristics of places of origin are almost a mirror image of the historical characteristics of the places themselves—which helps to explain the dramatic sign reversal in these regressions.

The Americas sample are only the most prominent subset of countries in which population origins changed substantially in the years following 1500, with other well-known examples including Australia and New Zealand, and some less prominent cases such as Fiji, Singapore and Taiwan. In columns (3) and (4), we broaden the sample from the Americas to all countries in which more than 20% of current populations were of foreign origin.[9] As column (3) indicates, evidence of a reversal for countries as territories is strengthened (relative to the Americas-only sample) for urbanization and population density, but weakened for the other three indicators, the coefficients on which were already insignificant and for two of which there is also a sign change. When we look at column (4), we see that the coefficients on the ancestry adjusted versions of the original variables are positive and in the same four of five cases significant, as in the Americas sample. So, in the broader high-migration countries sample as in the narrower subset of the Americas alone, there is generally weak evidence of a reversal of fortunes for territories but strong evidence of persistence of fortunes for the descendants of year 1500 populations. Who moved to a high migration country from where makes a large contribution to explaining its income level today, according to these estimates.[10]

[9] Of the 165 countries with populations above ½ million that are studied by PW, 64 had 20% or more of the current population's ancestors originating elsewhere in 1500.

[10] It might also be of interest to see whether reversal-supporting results for the unadjusted measures and/or persistence-supporting results for the ancestry adjusted ones hold in the complements of the Americas and

AJR consider concerns that their results might be driven by the four "neo-Europes"—the U.S., Canada, Australia, and New Zealand. These countries stand out as having been relatively lightly populated and technologically behind in 1500 and having become predominantly European-populated members of the club of advanced industrial societies by 1995. The city states of Hong Kong and Singapore share with the neo-Europes the fact of having been populated after 1500 by people from countries with high year 1500 development indicators (in these cases, China) and having achieved relatively high incomes in the 20th century. We investigate the reversal or persistence of early advantages for the global sample of colonized countries minus the neo-Europes and city states in columns (5) and (6). Column (5) shows significant evidence of reversal for two territory-defined indicators, population density and technology. When replaced by their ancestry adjusted counterparts (column 6), we see that four of the five variables show a positive and statistically significant effect. Thus, although compared to the benchmark regressions in Table 3 the point estimate of the coefficient declines in all cases, confirming suspicions about the possible importance of the neo-Europes and city states, the qualitative result of persistence nonetheless stands.[11] Finally, we also examine what happens when we add non-

High Migration samples of columns (1) – (4). Online appendix Table A.2 shows results for former colonies not in the Americas, former colonies with migrant-descended population shares of 20% or less, non-European countries (including non-colonies) not in the Americas, and non-European countries with migrant-descended population shares of 20% or less (The online appendix can be found at: http://www.brown.edu/Departments/Economics/Papers/2013/2013-4_appendix.pdf). Coefficients on the unadjusted early development measures vary in sign and significance level depending on measure and sample, with only one statistically significant negative coefficient (supporting reversal of fortune), that for population density in colonized countries excluding the Americas only. Coefficients on the adjusted measures are positive in all cases, are insignificant in all cases for urbanization, are significant for the non-European samples only for population density, and are significant in almost all samples for millennia of agriculture, state history, and technology of 1500, but always with smaller and less significant coefficients than in the complementary Americas only and high migration samples. Thus, there is considerable evidence of persistence of fortunes in the Old World and in low migration countries taken alone, but the Americas and the high migration countries appear to contribute disproportionately to the overall result.

[11] In columns (5) and (6), compared to the benchmark regressions, in principle we drop six countries. However, not all variables have observations for all of the six countries. For example, data on technology in 1500 are available for more than 90% of source countries, allowing construction of the ancestry adjusted measure, for only two of the six—Hong Kong and Singapore. Thus, only two observations are dropped in

European countries that were never colonized. As the results in column (7) indicate, we continue to see reversal in territories, when using urbanization and population density as indicators of early development. It is interesting to note that this happens despite a considerable increase in the sample size for population density, though the coefficient falls in value compared to the results in Table 3. When using the ancestry adjusted variables, we again see a positive significant effect, denoting persistence of fortune, for all except urbanization. This is in keeping with most of our robustness tests so far.

### **C**. *Alternative End Years*

To check whether there is anything unusual about the year 1995 as a representation of recent incomes, we also estimate and show, in Table 6, regressions with dependent variables income per capita in 1960 and income per capita in 2009 for country samples consistent with the exercises in tables 1 and 3. We chose 1960 to represent the end of the colonial era and 2009 as the most recent year with available data for purposes of "updating."[12] Because a few countries, including the U.S., experienced non-trivial changes in population origins between 1960 and 2000, we constructed new data paralleling the PW 1500 – 2000 migration matrix but for the 1500 – 1960 period. We use the new data to compute the ancestry adjusted variables for the estimates that take 1960 as end year.

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these columns, in the case of the technology measure, and this is also true for urbanization. Since dropping only two of 28 observations (see column (2) of Table 1) causes the negative coefficient on urbanization to become statistically insignificant in column (5) of Table 5, it may be of interest to see what would happen if all six neo-Europes and city states were dropped from the larger 41 country sample of column (1) of Table 1. We perform this exercise (not shown) and find that in the resulting 35 country sample, the coefficient on urbanization also becomes substantially smaller and loses its statistical significance. That is, AJR's original reversal of fortune for territories, using the urbanization measure, is not robust to dropping the neo-Europes and city states.

[12] As discussed in our Working Paper, CP use the same 1960 income data, which are from Maddison, to check for reversal of fortune during the colonial era proper.

**{Table 6 here}**

Columns (1) and (2) of Table 6 display regressions that predict GDP per capita in 1960 with each of our five proxies of year 1500 level of development taken individually on the largest subset of AJR's once-colonized country sample for which the ancestry adjusting can be calculated. As with the estimates for 1995, the regressions for 1960 income obtain negative coefficients on the territory-based measures, this time being highly significant for both population density and technology. Also as with those estimates, however, there is no indication of the reversal being robust to accounting for migration, with the coefficients on the ancestry adjusted versions of each measure being positive and with four of the five coefficients (those for all measures except population density) being significant at the 1 or 5% level. Among the changes of result due to replacing territory-based with population-based indicators is the change from a negative coefficient significant at the 1% level for year 1500 technology to a statistically significant coefficient of closely similar magnitude but opposite sign. Thus, a reversal of fortune between 1500 and 1960 is supported for territories in the samples for which the migration adjustment can be performed, but we again find persistence rather than reversal, using our 1500 to 1960 migration matrix.

Columns (3) and (4) of Table 6 show the results for 2009 as the end year. Compared to the results for 1995 in tables 1 and 3, we see that the results are largely unchanged. In the case of the indicators' ancestry adjusted counterparts, in contrast, point estimates are uniformly larger and in two cases more significant. The strengthening of "persistence" findings over time could in part reflect accelerating or persisting "catch-up" phenomena in countries with historically advanced civilizations including China, India, and S. Korea, and in countries populated by migrants therefrom, e.g. Singapore and Taiwan.

### **D**. *Final Robustness Checks*

As a final step in this section's analysis, we conducted additional robustness checks for the exercises in tables 5 and 6. Specifically, we repeated all the regressions in the two tables after controlling for the various geographic, political, and religious variables in Table 4. The results are presented in the online appendix tables A3 (for different country coverage) and A4 (for different end years). To conserve space we mention only the results for the ancestry adjusted measures of the five variables. Results for two of the variables, millennia of agriculture and 1500 technology, are particularly robust to this double test of alternative samples and additional control variables. Results for state history are robust for the samples in which only high immigration countries are included or when non-colonized countries are included. They are less robust to geographic controls when the sample is restricted to the Americas and when neo-Europes and city states are excluded. Results for population density are consistently robust to the additional variables when the sample is restricted to the Americas only or is expanded to include non-colonized countries. In online appendix Table A.4, where the control variables are included for regressions ending in alternative years, we see largely similar patterns. In particular, for the year 2009, results for millennia of agriculture, state history, and the 1500 technology index are robust to additional control variables. For 1960, results for state history are not as consistently robust while those for the other two measures continue to be significant. Population density and urbanization produce more varied results. Overall, these additional regressions continue to cement the evidence suggesting a persistence of fortunes for peoples.

### III. How early development affects recent income: a look at channels

While our paper thus far has provided much evidence that a reversal of fortune applies if at all to the territories, not the inhabitants, of ex-colonies, its direct bearing on the ongoing debate about the determinants of comparative development remains somewhat unclear. That our approach may in fact have more direct implications for that debate is suggested in the present section by a brief exploration of channels that directly engages the issues of contention between AJR and GLLS.

As mentioned in Section 1, AJR use urbanization and population density of 1500 as instrument for institutions circa 1990, thereby attempting to demonstrate that differences in institutions are the main determinant of differences in comparative development for former colonies. GLLS, in contrast, argue that AJR's institutional indicators do not reflect institutions in the deep sense of North (1990) and others. They show that relative levels of human capital are more persistent during recent decades than are institutional indicators, and find that when both human capital and institutions measures are instrumented by population density of 1500,[13] the former are more consistent and robust over time periods and across alternative measures, as predictors of levels of development.

As an exercise, we contrast human capital and institutions as possible channels through which pre-colonial conditions may have influenced differences in contemporary levels of development. For institutions, we focus on AJR's preferred indicator, risk of expropriation, and on that preferred by GLLS, constraints on the executive.[14] For human capital, we focus on adult literacy,

[13] GLLS also adopt AJR (2001)'s settler mortality measure as an instrument in some exercises. We stick with population density and our other measures of early development since the settler mortality measure has been much challenged and since it is not conceived of as an indicator of pre-modern economic development in the same sense as are state history, technology of 1500, etc.

[14] Tabellini (2010) makes prominent use of a constraints on the executive measure at the subnational level in the history of Western Europe.

which is available for more countries and years than the other measures that might also serve as overall gauges of human capital,[15] but in one specification we try average years of schooling.

The key differences between our exercises and those of GLLS and AJR are that (i) we use simultaneously several measures of early development that we view in the spirit of Bockstette *et al.*, Hibbs and Olsson, Comin *et al.*, and Diamond, as capturing differences in pre-modern development across the non-European world, measures that include but are not limited to population density in 1500, and (ii) we account for the major migrations that reshaped the Americas, Oceania, and other countries by using ancestry-adjusted versions of our measures in addition to the unadjusted versions used by AJR and GLLS.[16]

Panel A of Table 7 shows a set of illustrative regressions in which per capita income of 1995 is predicted by an instrumented institutions measure, an instrumented human capital measure, or both. In Panel B, we show for each column the corresponding first stage regression predicting the institutions measure of Panel A with four ancestry-adjusted and four unadjusted early development indicators, and in Panel C, the corresponding first stage regression predicting the education measure used in Panel A.

**{Table 7A here}**

Columns (1) – (3) of Panel A display second stage regressions for 53 once-colonized countries for which data on the variables of column (3), including adult literacy circa 1950 from UNESCO (1957), are available. Column (1) uses

[15] The availability of the literacy measure for a large number of countries as early as 1950 is particularly helpful. Literacy remains a useful indicator of population-level education even in recent years when primary schooling approaches universality and secondary enrollment ratios have frequently been found uncorrelated with growth.

[16] As noted in section 3, AJR provide many tests for robustness to additional controls, which is precluded by the exploratory nature of this short section.

only instrumented protection from expropriation (always for the same years as in AJR), column (2) only instrumented literacy of 1950, and column (3) both instrumented variables. Both instrumented variables obtain significant coefficients whether entered singly or together. A look at panels B and C shows that for these and other columns, more instruments are significant and the F statistic for the excluded instruments are usually much larger when predicting literacy than when predicting institutions. Most importantly, when both instrumented 1950 literacy and instrumented institutions circa 1990 are included, in column (3), literacy remains a highly significant predictor of average GDP per capita, contrary to AJR's contention that institutions are the only channel through which early conditions determined contemporary development.

We think using literacy of the mid-20$^{th}$ century appropriate because causality is so likely to run in both directions, in the relationship between contemporaneous income and human capital. Moreover, interpretation of the literacy variable's effect is relatively straightforward, whereas if equally early institutions measures were to be available, their use could be questionable since for some countries they would represent the characteristics of colonial rather than of locally-based administration. We note that in the first-stage regressions, as in our earlier tables, early development indicators such as technology of 1500 tend to predict 1950 literacy in a negative significant fashion (a reversal result) while ancestry-adjusted variants of the same indicators predict it positively and significantly (a persistence result). To check whether using an earlier value of the literacy than of the institutions variable gives the former an edge, column (8) shows a variant on specification (3) that uses a measure of literacy circa 1990 instead of 1950, obtaining a quite similar result. Column (9) parallels column (8) but uses years of schooling rather than literacy. It also obtains a similar result.

Rather than bring the education measure forward in time, one might also want to test column (3)'s robustness by using an institutions measure for an earlier year. Unfortunately, the protection from expropriation measure becomes available in 1985, only, so for a qualitatively similar exercise we must turn to our other institutions measure. Columns (4), (5) and (7) report specifications using (instrumented) constraint on the executive as measure of institutions and simultaneously using (instrumented) literacy of roughly the same year (circa 1950, 1975 or 1990, depending on the column).[17] The institutions variable is never statistically significant, whereas each literacy variable obtains a highly significant positive coefficient. Column (9) shows that instrumented literacy rate circa 1990 entered alone returns results similar to that of instrumented 1950 literacy alone in column (2). Finally, column (10) uses the alternative (instrumented) governance indicators measure for 1996 from World Bank (2013) alongside (instrumented) 1950 literacy. This can be estimated for a larger sample, and yields a qualitatively similar result to (3), except that the overall first stage F statistic is quite low, with the first stage for institutions having a particularly low F statistic.

**{Table 7B here}**

While many other first stage F statistics in the table are too low to inspire confidence, and while we do not investigate robustness to additional controls, we see these regressions as suggestive. It seems that as compared to institutions, human capital is at least as important if not a more important channel through which pre-colonial development levels affect current comparative development in formerly colonized countries. The regressions also suggest a stronger effect of early development on both mid- and late-20th century human capital than is the

[17] While constraints on the executive is available for some former colonies as early as 1950, we think it best not to mix measures of institutions while under colonial rule with those for independent countries, so for those sample countries that became independent after 1950 our earliest institutions measure is that for the earliest year of independence in which the measure exists.

case for the temporally earlier institutions measures, with strong positive coefficients consistent with persistence for the ancestry-adjusted instruments.

Problems with the argument that institutions were the ultimate determinants of comparative development and that the migrations accounting for our regression results are merely channels through which institutions worked can also be illustrated by specific examples. One of these is the fact that the considerable indigenous populations of Central America and the Andes, whose numerous descendants help account for the lower values of indicators like ancestry-adjusted technology of 1500 in comparison to Canada and the United States, predated rather than being brought into being by colonial institutions. For another example, consider the large African-descended populations in countries of the Caribbean and northeast Brazil, which similarly help to explain those countries' lower values of our indicators. True, those populations' presence was brought about by population movement (the slave trade) induced by an institution (slavery). However, climate and soil (Engermann and Sokoloff, 2000, Easterly and Levine, 2003) helped to determine what institutions were adopted and who ended up in those economies, and it is unclear why institutions should be accorded ultimate explanatory status without reference to what drove their adoption.

## IV. Conclusion

The reversal of fortune finding of AJR (2002) suggests that by adopting or having imposed upon them better institutions than once more advanced counterparts, some of the countries that Europe colonized between the 15$^{th}$ and 20$^{th}$ centuries were able to leapfrog ahead in their levels of economic development. We find that a reversal of fortune did occur among countries as territories—the chunks of real estate on which late 20$^{th}$ century countries are situated—but that for nations thought of as groups of people sharing linguistic and other features, and for their descendants, persistence rather than reversal is the rule. This is the case not only in the European-colonized world but also in the non-European world as a whole, in those non-European countries that experienced significant influxes of non-native migrants, considering the Americas only, and in the colonized world minus the extreme migration-and-development cases: the neo-Europes and the city states of Hong Kong and Singapore.

We find no evidence of an important subset of national groups converting themselves from relatively "backward" to relatively "advanced" by adopting better institutions. The AJR reversal is instead associated with people from places hosting societies that were relatively socially and technologically sophisticated in 1500 migrating to places that had been relatively backward and that accordingly had relatively low population densities (which were further diminished by absence of resistance to Old World diseases). The most straightforward explanation of the reversal of fortune for territories, then, would be that the connecting of "old" (Eurasia plus Africa) with "new" (Americas, Oceania and other islands) worlds that began in the $15^{th}$ century led to population transfers in which (inter alia) the technological and social advantages of peoples from the most advanced civilizations sank new roots in previously backward lands. To what extent establishment of institutions more inviting to settlement by such populations played a crucial role, in which case institutions can be said to have been an important determinant of reversal-for-territories in their own right, and to what extent those populations simply brought their social orientations with them, leading to the correlation between economic capability and facilitating institutions, remains a question for further research. Our preliminary analysis using both migration-adjusted and unadjusted indicators of pre-colonial development as instruments yields results consistent with the view that human capital has been at least as important a factor as institutions in determining long run comparative development.[18]

[18] Research such as that of Ashraf and Galor (2013) and Cook (2013) among others, has argued for the importance of genetic diversity and other genetic traits in long term development. While, we cannot rule out that the transmission mechanism of the effects we are observing is partly genetic, it seems to us that social transmission through family lines could be a sufficient transmission mechanism.

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## Data Appendix

**Ancestry Adjusted:** Ancestry adjusted (also called "migration weighted") measures have been created for urbanization, population density, millennia of agriculture, state history, and technology. Each measure for 1500 development has two migration weighted measures: 1500-2000 CE and 1500-1960 CE.

The 1500-2000 weighting is done with the Putterman and Weil (2010) migration matrix, which estimates the fraction of the year 1500 ancestors of each country's 2000 CE population that lived within the contemporary borders of each country. Migration weighting simply assigns weights to the 1500 measures of development of the source countries proportionate to their ancestry shares. For example, if 50% of the ancestors of Country X's year 2000 population lived in Country Z in 1500 and if there were no other sources of migrants to Country X between 1500 and 2000, then Country X's migration weighted measure of historical development will give equal weights to the (unweighted) measures of countries X and Z.

Adjusting ancestry for 1500-1960 uses migration data for 1960-2000 from Özden et al. (2011) to adjust the migration matrix of Putterman and Weil (2010). Özden *et al*. (2011) list the numbers of migrants between each pair of countries between 1960 and 2000. Using these numbers and population estimates for 1960 and 2000 and assuming the ancestry shares for 2000 in Putterman and Weil (2010) to be accurate, we work out corresponding year 1500 ancestry shares for each country's population as of 1960. For example, a non-trivial fraction of the US's population is derived from Mexican immigrants since 1960. In order to remove this portion of the population to create population compositions for 1960 based on historic origins, it is incorrect to simply allocate less of the US's population to Mexico. This is due to the fact that the Mexican population is derived from a number of source populations, most importantly: Spain, Mexico, and a number of African countries. Therefore, when removing Mexican immigrants from the 2000 population, we assign these immigrants to the 1500 source countries with the use of Putterman and Weil migration matrix.

For both weighting measures, we have incomplete country data for our historic measures of development. If a country's weighting is incomplete due to a lack of data for source countries, we perform one of two actions: 1) If less than 10% of a country's population's ancestors lived in source countries for which we lack the historic development measure in question, we reweight the country's composition based on the source countries for which we have data and calculate a weighted average accordingly. 2) If data are missing for countries accounting for more than 10% of a country's year 1500 ancestors, we exclude the country from the sample.

**Climate:** Climate variables include humidity, temperature, and soil quality measures. Humidity is the average percent of humidity recorded at differing times during the day. Temperature data are average temperature and monthly highs and lows in centigrade. Soil quality variables are climate classifications for differing ecological zones. All data are by way of Acemoglu *et al*. (2002).

**Colonizer:** Colonizer variables include indicator variables for the European colonizer country. These include British, French, German, Spanish, Italian, Belgian, Dutch, and Portuguese. The data are from La Porta *et al*. (1999) by way of Acemoglu *et al*. (2002).

**Constraint on Executive in 1950 or 1st Year of Independence:** An index for constraints on the executive branch in 1975, ranging from 1-7—i.e., unlimited authority to executive parity or subordination. For autonomous countries, data are from 1950; for colonies, data are from first year of independence. Data for year of independence are from Ertan, Fiszbein, and Putterman (2013). Data for constraints on the executive are from the Polity IV data set (Marshall et al., 2013).

**Constraint on Executive in 1975:** An index for constraints on the executive branch in 1975, ranging from 1-7—i.e., unlimited authority to executive parity or subordination. Data are from the Polity IV data set (Marshall et al., 2013).

**Constraint on Executive in 1990:** An index for constraints on the executive branch in 1990, ranging from 1-7—i.e., unlimited authority to executive parity or subordination. Data are from the Polity IV data set by way of Acemoglu et al. (2002).

**GDP per capita 1960:** Maddison estimates for PPP converted GDP per capita in constant 2007 dollars. Found in Avakov (2010).

**GDP per capita 1995:** PPP converted GDP per capita in 1995. Data are from the World Bank's World Development Indicators (1999) by way of Acemoglu *et al*. (2002).

**GDP per capita 2009:** PPP converted GDP per capita in 2005 chain dollars. Data are from the World Bank's World Development Indicators (2012).

**Latitude:** Absolute value of latitude scaled between 0 and 1. Data are from La Porta *et al.* (1999) by way of Acemoglu *et al*. (2002).

**Literacy Rate in 1950:** Fraction of the population above 15 years of age that is literate in 1950. Data are from UNESCO (1957).

**Literacy Rate in 1970:** The fraction of the population above 15 years of age that is literate in 1970. Data are from UNESCO etc.

**Literacy Rate, Average 1985-1995:** The fraction of the population above 15 years of age that is literate. The average is comprised of country-level literacy rates from 1985, 1990, and 1995. Data are from the UNDP Human Development Report for 1990, 1992, and 1998, respectively.

**Millennia of Agriculture:** The number of millennia a country has practiced agriculture until 2000 CE. These data are from Putterman and Trainor (2006).

**Population Density in 1500:** Total population relative to arable land. Data are from McEvedy and Jones (1978) by way of Acemoglu *et al*. (2002).

**Religion:** Religion variables include the percent of a country belonging to the following religions: Roman Catholic, Protestant, Muslim, and "Other". The data are from La Porta *et al*. (1999) by way of Acemoglu *et al*. (2002).

**Resources:** Resource variables include indicators for being landlocked, an island, or whether a country has produced coal since 1800. The percent of the world's gold deposits in 1995, the percent of the world's iron deposits in 1995, the percent of the world's zinc deposits in 1995, the percent of the world's silver deposits in 1995, and thousands of barrels of oil reserves in 1995 are also included in resources. All data are by way of Acemoglu *et al*. (2002).

**State History in 1500 CE:** An index of state antiquity for the period 1 CE to 1500 CE. Forms of institutional organization are assigned a hierarchical value between 0 and 1 for each 50 year period. These data are then aggregated to form the state history index. The data are from Putterman (2012).

**Technology in 1500 CE:** An index capturing state-level development in agriculture, transportation, military, industry, and communications in 1500 CE. The presence of a technology is typically assigned an ordinal value of either 0 or 1. The individual technology scores are then aggregated to form the index. Data are from Comin *et al*. (2010).

**Urbanization in 1500:** Fraction of the population in 1500 CE living in an urban area with a population minimum of 5,000. Data are from Bairoch (1988) and Eggimann (1999) by way of Acemoglu *et al*. (2002).

**World Governance Indicators, average 1996:** The average of all world governance indicators for 1996. World governance indicator are comprised of indices ranging from -10 to 10, with higher scores associated with better governance, and contain measures for voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. Data are from Kaufmann, Kraay, and Mastruzzi (2013).

**Years of Schooling, average 1985-1995:** The country-level average years of schooling for the population above 15 years of age. Data are in 5-year increments (i.e., 1985, 1990, and 1995) and averaged between 1985 and 1995. Data are from Barro and Lee (2010).

# Tables

Table 1. AJR's Reversal of Fortune

| Dependent Variable: Log of GDP per capita (PPP) in 1995 | | | | | | |
|---|---|---|---|---|---|---|
| | Reversal with Urbanization | | | Reversal with Population Density | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Urbanization in 1500 | -0.0783*** | -0.0643** | | | | |
| | (0.0234) | (0.0282) | | | | |
| Ancestry Adj. Urb. (1500-200) | | | 0.0901* | | | |
| | | | (0.0446) | | | |
| ln Population Density in 1500 | | | | -0.3767*** | -0.3804*** | |
| | | | | (0.0532) | (0.0557) | |
| Ancestry Adj. ln Pop. Den. | | | | | | 0.2138* |
| | | | | | | (0.1199) |
| Observations | 41 | 28 | 28 | 91 | 81 | 81 |
| R Sqr. | 0.1935 | 0.1379 | 0.1109 | 0.3413 | 0.3707 | 0.0478 |

**Notes:** (i) All regressions contain a constant. (ii) Ancestry adjusted variables use the 1500-2000 CE Putterman and Weil (2010) data and exlude countries for which greater than 10% of the ancestral population has no data. (iii) The sample consists of countries colonized by European states. (iv) OLS coefficients are reported in each column. *, **, and *** represent significance at the 10, 5, and 1% significance level, respectively. Robust standard errors are in parentheses.

Table 2. Correlates of Year 1500 Development

| Variable: | Urbanization | Population Density | Millennia of Agriculture | State History | Technology |
|---|---|---|---|---|---|
| Urbanization in 1500 | 1.0000 | | | | |
| | (n = 44) | | | | |
| ln Pop. Density in 1500 | 0.7293 | 1.0000 | | | |
| | (n = 44) | (n = 98) | | | |
| Millennia of Agriculture | 0.3312 | 0.5054 | 1.0000 | | |
| | (n = 44) | (n = 91) | (n = 91) | | |
| State History in 1500 | 0.6367 | 0.4570 | 0.6573 | 1.0000 | |
| | (n = 43) | (n = 87) | (n = 87) | (n = 87) | |
| Technology in 1500 | 0.3982 | 0.5235 | 0.6600 | 0.7218 | 1.0000 |
| | (n = 40) | (n = 73) | (n = 73) | (n = 70) | (n = 73) |

**Notes:** (i) The sample consists of countries colonized by European states. (ii) Urbanization and population density are from Acemoglu et al. (2002). Millennia of agriculture is from Putterman and Trainor (2006). State history is from Chanda and Putterman (2007). Technology is from Comin et al. (2010).

Table 3. Persistence of Fortune with Additional Determinants of 1500 Development

| | Dependent Variable: Log of GDP per capita in 1995 | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Millennia of Agriculture | -0.0531 | | | | | |
| | (0.0615) | | | | | |
| Ancestry Adj. Millennia of Agr. | | 0.3015*** | | | | |
| | | (0.0709) | | | | |
| State History in 1500 | | | -0.2671 | | | |
| | | | (0.4015) | | | |
| Ancestry Adj. State Hist. | | | | 1.5054*** | | |
| | | | | (0.4900) | | |
| Technology in 1500 | | | | | -0.2933 | |
| | | | | | (0.5996) | |
| Ancestry Adj. Tech. 1500 | | | | | | 1.8787*** |
| | | | | | | (0.5145) |
| Observations | 80 | 80 | 77 | 77 | 62 | 62 |
| R Sqr. | 0.0070 | 0.2762 | 0.0064 | 0.1685 | 0.0058 | 0.2033 |

**Notes:** (i) All regressions contain a constant. (ii) Ancestry adjusted variables use the 1500-2000 CE Putterman and Weil (2010) data and exlude countries for which greater than 10% of the ancestral population has no data. (iii) The sample consists of countries colonized by European states. (iv) OLS coefficients are reported in each column. *, **, and *** represent significance at the 10, 5, and 1% significance level, respectively. Robust standard errors are in parentheses.

## Table 4. Robustness to Omitted Variables

| Dependent Variable: Log of GDP per capita (PPP) in 1995 | | | | | | |
|---|---|---|---|---|---|---|
| Controlling for: | Latitude | | Climate | | Resources | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | *Panel A: Urbanization* | | | |
| Urbanization in 1500 | -0.0643** | | -0.0997** | | -0.1000** | |
| | (0.0291) | | (0.0396) | | (0.0425) | |
| Urbanization | | 0.1083* | | 0.0705 | | 0.0791 |
| (Ancestry Adj.) | | (0.0569) | | (0.1138) | | (0.0617) |
| Observations | 28 | 28 | 28 | 28 | 28 | 28 |
| R Sqr. | 0.1385 | 0.1377 | 0.6106 | 0.4779 | 0.5122 | 0.3314 |
| | | | *Panel B: Population Density* | | | |
| ln Pop. Den. 1500 | -0.3356*** | | -0.3305*** | | -0.3112*** | |
| | (0.0559) | | (0.0611) | | (0.0523) | |
| ln Pop. Den. | | 0.1370 | | 0.1941 | | 0.0657 |
| (Ancestry Adj.) | | (0.1122) | | (0.1238) | | (0.1039) |
| Observations | 81 | 81 | 81 | 81 | 81 | 81 |
| R Sqr. | 0.4276 | 0.1819 | 0.6001 | 0.4276 | 0.5786 | 0.3882 |
| | | | *Panel C: Millennia of Agriculture* | | | |
| Millennia of Agriculture | -0.0489 | | -0.0334 | | -0.0019 | |
| | (0.0600) | | (0.0659) | | (0.0671) | |
| Millennia of Agr. | | 0.2574*** | | 0.2762*** | | 0.2236*** |
| (Ancestry Adj.) | | (0.0750) | | (0.0630) | | (0.0669) |
| Observations | 80 | 80 | 80 | 80 | 80 | 80 |
| R Sqr. | 0.1681 | 0.3482 | 0.4071 | 0.5637 | 0.3949 | 0.5184 |
| | | | *Panel D: State History* | | | |
| State History in 1500 | -0.4621 | | -0.3677 | | -0.2502 | |
| | (0.3786) | | (0.3968) | | (0.3783) | |
| State Hist. | | 1.1292** | | 1.1143* | | 0.8462* |
| (Ancestry Adj.) | | (0.5503) | | (0.6104) | | (0.4756) |
| Observations | 77 | 77 | 77 | 77 | 77 | 77 |
| R Sqr. | 0.1709 | 0.2337 | 0.4188 | 0.4725 | 0.4212 | 0.4599 |
| | | | *Panel E: Technology* | | | |
| Technology in 1500 | -0.3840 | | 0.3177 | | -0.6239 | |
| | (0.6270) | | (0.7735) | | (0.5829) | |
| Technology | | 1.8264*** | | 1.9244*** | | 1.6699*** |
| (Ancestry Adj.) | | (0.5673) | | (0.5841) | | (0.5741) |
| Observations | 62 | 62 | 62 | 62 | 62 | 62 |
| R Sqr. | 0.0370 | 0.2053 | 0.3759 | 0.5264 | 0.2867 | 0.3931 |

Table 4 (Cont'd). Robustness to Omitted Variables

| Dependent Variable: Log of GDP per capita (PPP) in 1995 | | | | |
|---|---|---|---|---|
| Controlling for: | Colonizer | | Religion | |
| | (7) | (8) | (9) | (10) |
| | *Panel A: Urbanization* | | | |
| Urbanization in 1500 | -0.0605 | | -0.0596 | |
| | (0.0366) | | (0.0391) | |
| Urbanization | | 0.1296** | | 0.1130** |
| (Ancestry Adj.) | | (0.0582) | | (0.0408) |
| Observations | 28 | 28 | 28 | 28 |
| R Sqr. | 0.1727 | 0.2264 | 0.2269 | 0.2927 |
| | *Panel B: Population Density* | | | |
| ln Pop. Den. 1500 | -0.3223*** | | -0.3921*** | |
| | (0.0602) | | (0.0709) | |
| ln Pop. Den. | | 0.1921* | | 0.3334** |
| (Ancestry Adj.) | | (0.1108) | | (0.1301) |
| Observations | 81 | 81 | 81 | 81 |
| R Sqr. | 0.5008 | 0.3040 | 0.3927 | 0.2104 |
| | *Panel C: Millennia of Agriculture* | | | |
| Millennia of Agriculture | -0.0785 | | 0.0677 | |
| | (0.0599) | | (0.0784) | |
| Millennia of Agr. | | 0.2279*** | | 0.3802*** |
| (Ancestry Adj.) | | (0.0797) | | (0.0749) |
| Observations | 80 | 80 | 80 | 80 |
| R Sqr. | 0.2813 | 0.3949 | 0.1157 | 0.4706 |
| | *Panel D: State History* | | | |
| State History in 1500 | -0.0983 | | 0.5370 | |
| | (0.4262) | | (0.4874) | |
| State Hist. | | 1.5545*** | | 2.1817*** |
| (Ancestry Adj.) | | (0.4379) | | (0.4513) |
| Observations | 77 | 77 | 77 | 77 |
| R Sqr. | 0.2439 | 0.3898 | 0.1183 | 0.4047 |
| | *Panel E: Technology* | | | |
| Technology in 1500 | 0.7270 | | 1.1787 | |
| | (0.6873) | | (0.7440) | |
| Technology | | 1.3830** | | 2.3514*** |
| (Ancestry Adj.) | | (0.6164) | | (0.5328) |
| Observations | 62 | 62 | 62 | 62 |
| R Sqr. | 0.3460 | 0.4148 | 0.2178 | 0.3984 |

**Notes:** (i) Latitude is absolute value of latitude; climate controls include variables for humidity, temperature, and soil measures; resource controls include variables for coal, oil, metals, and geography; colonizer includes indicators for the colonizing power; and religion includes an indicator variable for the main religion of the country. (ii) Ancestry adjusted variables use the 1500-2000 CE Putterman and Weil (2010) data and exclude countries for which greater than 10% of the ancestral population has no data. (iii) The sample consists of countries colonized by European states. (iv) All regressions contain a constant. OLS coefficients are reported in each column. *, **, and *** represent significance at the 10, 5, and 1% significance level, respectively. Robust standard errors are in parentheses.

## Table 5. Persistence with Alternative Samples

| | Dependent Variable: Log of GDP per capita (PPP) in 1995 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample: | Americas Only | | High Immigration | | Excl. Neo-Europes and City-states | | Including Non-Colonies | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | | | | *Panel A: Urbanization* | | | | |
| Urbanization in 1500 | -0.0495 | | -0.0787* | | -0.0348 | | -0.0692** | |
| | (0.0333) | | (0.0376) | | (0.0263) | | (0.0267) | |
| Ancestry Adj. Urbanization | | 0.0634 | | 0.0749 | | 0.0712* | | 0.0540 |
| | | (0.0817) | | (0.0610) | | (0.0395) | | (0.0476) |
| Observations | 13 | 13 | 16 | 16 | 26 | 26 | 30 | 30 |
| R Sqr. | 0.1979 | 0.0563 | 0.2466 | 0.0404 | 0.0612 | 0.1136 | 0.1406 | 0.0367 |
| | | | | *Panel B: Population Density* | | | | |
| ln Pop. Den. in 1500 | -0.3175*** | | -0.4737*** | | -0.2545*** | | -0.2213*** | |
| | (0.0824) | | (0.0608) | | (0.0591) | | (0.0801) | |
| Ancestry Adj. ln Pop. Den. | | 0.7684*** | | 0.5419** | | 0.0490 | | 0.2462*** |
| | | (0.1992) | | (0.2103) | | (0.0976) | | (0.0912) |
| Observations | 25 | 25 | 44 | 44 | 75 | 75 | 105 | 105 |
| R Sqr. | 0.3466 | 0.3587 | 0.4727 | 0.2131 | 0.1761 | 0.0037 | 0.1228 | 0.0737 |
| | | | | *Panel C: Millennia of Agriculture* | | | | |
| Millennia of Agriculture | 0.1073 | | 0.0057 | | -0.0117 | | 0.0525 | |
| | (0.1695) | | (0.1350) | | (0.0460) | | (0.0405) | |
| Ancestry Adj. Millennia of Agr. | | 0.4506*** | | 0.3939*** | | 0.2048*** | | 0.2107*** |
| | | (0.1071) | | (0.0849) | | (0.0666) | | (0.0430) |
| Observations | 25 | 25 | 43 | 43 | 74 | 74 | 104 | 104 |
| R Sqr. | 0.0230 | 0.3825 | 0.0000 | 0.4069 | 0.0005 | 0.1630 | 0.0156 | 0.2000 |
| | | | | *Panel D: State History* | | | | |
| State History in 1500 | -0.5430 | | 0.6877 | | -0.1952 | | 0.1187 | |
| | (0.4569) | | (0.5965) | | (0.3242) | | (0.3512) | |
| Ancestry Adj. State Hist. | | 2.6065** | | 3.1888*** | | 0.8017* | | 1.5488*** |
| | | (1.1402) | | (0.5297) | | (0.4223) | | (0.3937) |
| Observations | 24 | 24 | 41 | 41 | 71 | 71 | 97 | 97 |
| R Sqr. | 0.0262 | 0.2611 | 0.0245 | 0.4965 | 0.0050 | 0.0663 | 0.0014 | 0.1832 |
| | | | | *Panel E: Technology* | | | | |
| Technology in 1500 | -2.1178 | | 1.1103 | | -1.0445** | | 0.3882 | |
| | (1.6464) | | (0.8843) | | (0.4720) | | (0.4554) | |
| Ancestry Adj. Tech. | | 1.7524*** | | 2.4628*** | | 1.4327*** | | 2.0668*** |
| | | (0.3557) | | (0.6846) | | (0.4749) | | (0.4418) |
| Observations | 18 | 18 | 32 | 32 | 60 | 60 | 72 | 72 |
| R Sqr. | 0.0852 | 0.2302 | 0.0584 | 0.3557 | 0.0798 | 0.1336 | 0.0117 | 0.2515 |

**Notes:** (i) All regressions contain a constant. (ii) Adjusting by ancestry in columns (2), (4), (6), and (8) is done with 1500-2000 CE migration data from Putterman and Weil (2010). Countries for which greater than 10% of the ancestral population has no data are excluded. (iii) The "Americas Only" sample consists of countries within the Americas that were colonized by European states. The "High Immigration" sample consists of countries with less than 80% of the 2000 CE population derived from the indigenous 1500 CE population. The"Excluding Neo-Europes and City-states" sample excludes USA, Canada, Australia, New Zealand, Singapore, and Hong Kong. The"Including Non-Colonies" sample consists of all non-European countries for which we have data. (iv) OLS coefficients are reported in each column. *, **, and *** represent significance at the 10, 5, and 1% significance level, respectively. Robust standard errors are in parentheses.

## Table 6. Persistence of Fortune in Alternative Years

| Dependent Variable: | 1960 GDP per capita | | 2009 GDP per capita | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | *Panel A: Urbanization* | | | |
| Urbanization in 1500 | -0.0408 | | -0.0517* | |
| | (0.0239) | | (0.0302) | |
| Ancestry Adj. Urb. in 1500 | | 0.0909** | | 0.1077** |
| | | (0.0424) | | (0.0440) |
| Observations | 28 | 28 | 28 | 28 |
| R Sqr. | 0.0944 | 0.1922 | 0.0868 | 0.1541 |
| | *Panel B: Population Density* | | | |
| ln Pop. Den. in 1500 | -0.2917*** | | -0.3932*** | |
| | (0.0504) | | (0.0688) | |
| Ancestry Adj. ln Pop. Den. 1500 | | 0.1541 | | 0.3040** |
| | | (0.1074) | | (0.1415) |
| Observations | 75 | 75 | 80 | 80 |
| R Sqr. | 0.3133 | 0.0353 | 0.2920 | 0.0689 |
| | *Panel C: Millennia of Agriculture* | | | |
| Millennia of Agriculture | -0.0783 | | -0.0378 | |
| | (0.0557) | | (0.0715) | |
| Ancestry Adj. Millennia of Agr. | | 0.1842*** | | 0.3724*** |
| | | (0.0579) | | (0.0789) |
| Observations | 74 | 74 | 79 | 79 |
| R Sqr. | 0.0226 | 0.1503 | 0.0026 | 0.3045 |
| | *Panel D: State History* | | | |
| State History in 1500 | -0.5048* | | 0.0490 | |
| | (0.2969) | | (0.4394) | |
| Ancestry Adj. State Hist. in 1500 | | 1.0458*** | | 2.0659*** |
| | | (0.3601) | | (0.5329) |
| Observations | 72 | 72 | 76 | 76 |
| R Sqr. | 0.0292 | 0.1084 | 0.0002 | 0.2260 |
| | *Panel E: Technology* | | | |
| Technology in 1500 | -0.8647** | | 0.0284 | |
| | (0.3958) | | (0.6443) | |
| Ancestry Adj. Tech. in 1500 | | 1.1301** | | 2.4872*** |
| | | (0.4302) | | (0.5836) |
| Observations | 55 | 55 | 61 | 61 |
| R Sqr. | 0.0882 | 0.1202 | 0.0000 | 0.2623 |

**Notes:** (i) All regressions contain a constant. (ii) Adjusting by ancestry in column (2 )is done with the 1500-1960 CE migration matrix constructed from data in Özden et al. (2011) and Putterman and Weil (2010) (see Appendix for details). Additional migration weighted estimations–i.e., column (4)–use the 1500-2000 CE Putterman and Weil (2010) data. Countries for which greater than 10% of the ancestral population has no data are excluded. (iii) The sample consists of countries colonized by European states. (iv) OLS coefficients are reported in each column. *, **, and *** represent significance at the 10, 5, and 1% significance level, respectively. Robust standard errors are in parentheses.

## Table 7A. Channels of Persistence: 2SLS Estimates

| Dependent Variable: Log of GDP per capita (PPP) in 1995 | | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Protection from Expropriation (1985-1995) | 0.8949*** | | 0.5767*** | | |
| | (0.1360) | | (0.1227) | | |
| Literacy Rate in 1950 | | 0.0275*** | 0.0175*** | 0.0263*** | |
| | | (0.0041) | (0.0039) | (0.0040) | |
| Cons. on the Exec. in 1950 or 1st Year of Ind. (if later than 1950) | | | | 0.0875 | |
| | | | | (0.1185) | |
| Cons. on the Exec. in 1975 | | | | | -0.0067 |
| | | | | | (0.1179) |
| Literacy Rate in 1970 | | | | | 0.0231*** |
| | | | | | (0.0038) |
| Avg. Literacy Rate (1985-1995) | | | | | |
| Cons. on the Exec. in 1990 | | | | | |
| Avg. Years of Schooling (1985-1995) | | | | | |
| Avg. of World Governance Indicators in 1996 | | | | | |
| Observations | 53 | 53 | 53 | 47 | 45 |
| First-stage F Stat. | 10.8378 | 29.5459 | 8.2846 | 3.6437 | 0.9029 |
| Overid. p-value | 0.0861 | 0.5090 | 0.4353 | 0.6377 | 0.0964 |

Table 7A (Cont'd). Channels of Persistence: 2SLS Estimates

| Dependent Variable: Log of GDP per capita (PPP) in 1995 | | | | | |
|---|---|---|---|---|---|
| | (6) | (7) | (8) | (9) | (10) |
| Protection from Expropriation (1985-1995) | | | 0.4541*** | 0.5686*** | |
| | | | (0.1518) | (0.1109) | |
| Literacy Rate in 1950 | | | | | 0.0105** |
| | | | | | (0.0051) |
| Cons. on the Exec. in 1950 or 1st Year of Ind. (if later than 1950) | | | | | |
| Cons. on the Exec. in 1975 | | | | | |
| Literacy Rate in 1970 | | | | | |
| Avg. Literacy Rate (1985-1995) | 0.0338*** | 0.0337*** | 0.0261*** | | |
| | (0.0044) | (0.0080) | (0.0063) | | |
| Cons. on the Exec. in 1990 | | 0.0016 | | | |
| | | (0.0871) | | | |
| Avg. Years of Schooling (1985-1995) | | | | 0.2635*** | |
| | | | | (0.0640) | |
| Avg. of World Governance Indicators in 1996 | | | | | 1.1335*** |
| | | | | | (0.1697) |
| Observations | 58 | 58 | 53 | 46 | 60 |
| First-stage F Stat. | 17.8342 | 1.2973 | 5.6702 | 3.6453 | 2.6846 |
| Overid. p-value | 0.7784 | 0.7057 | 0.7141 | 0.1717 | 0.8616 |

**Notes:** (i) All regressions contain a constant. (ii) The set of instruments used throughout Table 7A include both ancestry adjusted and unadjusted measures for the log of population density in 1500 CE, the years a country has practiced agriculture, the index for state history in 1500 CE, and the index of technology in 1500 CE. First stage estimates are given in Table 7B. (iii) The first stage, or Kleibergen-Paap, F-statistic and the p-value for the overidentifying restrictions test, corresponding with Hansen's J statistic, are reported. (iv) 2SLS coefficients are reported in each column. *, **, and *** represent significance at the 10, 5, and 1% significance level, respectively. Robust standard errors are in parentheses.

Table 7B. Channels of Persistence: First Stage Estimates

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Panel A. First Stage: Institutions | | | | |
| Ancestry Adj. Population Density | -0.2235 | – | -0.2235 | 1.8872** | 0.1212 |
| | (0.3424) | – | (0.3424) | (0.7866) | (0.8397) |
| Ancestry Adj. Millennia of Agr. | 0.3925 | – | 0.3925 | 1.6927* | 2.7538*** |
| | (0.3078) | – | (0.3078) | (0.8911) | (0.9684) |
| Ancestry Adj. State Hist. | 2.8844 | – | 2.8844 | -9.5801** | -1.2970 |
| | (1.7225) | – | (1.7225) | (4.7240) | (6.0803) |
| Ancestry Adj. Technology | -1.9695 | – | -1.9695 | -8.4021** | -11.7363* |
| | (1.5416) | – | (1.5416) | (3.7034) | (6.3986) |
| ln Populatin Density in 1500 CE | -0.0987 | – | -0.0987 | -0.8965 | -0.3502 |
| | (0.2429) | – | (0.2429) | (0.6401) | (0.7473) |
| Millennia of Agriculture | -0.1613 | – | -0.1613 | -1.5312* | -2.0411** |
| | (0.3101) | – | (0.3101) | (0.8406) | (0.9794) |
| State History in 1500 CE | -1.7758 | – | -1.7758 | 5.9261 | 0.7259 |
| | (1.3983) | – | (1.3983) | (3.7757) | (4.7836) |
| Technology Index for 1500 CE | 1.5827** | – | 1.5827** | 9.4852*** | 9.2305* |
| | (0.7367) | – | (0.7367) | (2.4581) | (4.9540) |
| Observations | 53 | – | 53 | 47 | 45 |
| F Stat. of Excluded Instruments | 10.8378 | – | 10.8378 | 3.7989 | 2.1197 |
| | Panel B. First Stage: Human Capital | | | | |
| Ancestry Adj. Population Density | – | -3.1494 | -3.1494 | 0.7628 | -5.3688 |
| | – | (4.5005) | (4.5005) | (5.4696) | (6.1042) |
| Ancestry Adj. Millennia of Agr. | – | 13.3068*** | 13.3068*** | 18.4431*** | 17.0041** |
| | – | (4.3891) | (4.3891) | (4.3900) | (6.7490) |
| Ancestry Adj. State Hist. | – | -55.7207** | -55.7207** | -97.7186** | -177.9103*** |
| | – | (22.8036) | (22.8036) | (38.1939) | (56.1710) |
| Ancestry Adj. Technology | – | 66.1229*** | 66.1229*** | 58.1150*** | 144.1490*** |
| | – | (18.5455) | (18.5455) | (18.4429) | (43.3791) |
| ln Populatin Density in 1500 CE | – | -0.0572 | -0.0572 | -3.1743 | 1.4980 |
| | – | (3.4714) | (3.4714) | (4.2962) | (4.2894) |
| Millennia of Agriculture | – | -8.3360* | -8.3360* | -13.0471*** | -12.8576* |
| | – | (4.5853) | (4.5853) | (4.5130) | (6.5773) |
| State History in 1500 CE | – | 29.2932* | 29.2932* | 65.4048** | 125.0944*** |
| | – | (16.7579) | (16.7579) | (29.3124) | (43.7349) |
| Technology Index for 1500 CE | – | -55.3609*** | -55.3609*** | -43.8847*** | -96.6026*** |
| | – | (9.4530) | (9.4530) | (9.9254) | (30.8299) |
| Observations | – | 53 | 53 | 47 | 45 |
| F Stat. of Excluded Instruments | – | 29.5459 | 29.5459 | 28.0853 | 29.5087 |

Table 7B (Cont'd). Channels of Persistence: First Stage Estimates

| | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|
| | | Panel A. First Stage: Institutions | | | |
| Ancestry Adj. Population Density | – | -0.9415 | -0.2235 | -0.0918 | 0.0156 |
| | – | (0.6306) | (0.3424) | (0.3686) | (0.1499) |
| Ancestry Adj. Millennia of Agr. | – | 2.4050*** | 0.3925 | 0.2555 | 0.4858*** |
| | – | (0.8460) | (0.3078) | (0.3350) | (0.1462) |
| Ancestry Adj. State Hist. | – | -8.3331* | 2.8844 | 2.2850 | -0.7609 |
| | – | (4.2145) | (1.7225) | (2.0179) | (1.1030) |
| Ancestry Adj. Technology | – | 1.0900 | -1.9695 | -1.8353 | -0.5579 |
| | – | (2.9195) | (1.5416) | (1.5715) | (0.7946) |
| ln Populatin Density in 1500 CE | – | 0.2180 | -0.0987 | -0.1880 | -0.0759 |
| | – | (0.5420) | (0.2429) | (0.2422) | (0.1180) |
| Millennia of Agriculture | – | -1.4744* | -0.1613 | -0.1218 | -0.4384*** |
| | – | (0.7838) | (0.3101) | (0.3286) | (0.1390) |
| State History in 1500 CE | – | 8.0949** | -1.7758 | -1.4838 | 0.6457 |
| | – | (3.4557) | (1.3983) | (1.3706) | (0.9307) |
| Technology Index for 1500 CE | – | -3.3693 | 1.5827** | 1.8464** | 0.8204 |
| | – | (2.1142) | (0.7367) | (0.7535) | (0.5718) |
| Observations | – | 58 | 53 | 46 | 60 |
| F Stat. of Excluded Instruments | – | 8.0803 | 10.8378 | 6.8807 | 5.0380 |
| | | Panel B. First Stage: Human Capital | | | |
| Ancestry Adj. Population Density | -5.8740 | -5.8740 | -9.2282 | -0.2238 | -2.8698 |
| | (6.2245) | (6.2245) | (5.7918) | (0.5307) | (4.4308) |
| Ancestry Adj. Millennia of Agr. | 19.0404*** | 19.0404*** | 13.6317*** | 1.5789*** | 12.9447*** |
| | (5.8063) | (5.8063) | (4.7353) | (0.5008) | (4.4410) |
| Ancestry Adj. State Hist. | -70.5412* | -70.5412* | -26.2249 | -7.3062** | -63.3291*** |
| | (40.3520) | (40.3520) | (29.7472) | (2.7525) | (21.1172) |
| Ancestry Adj. Technology | 41.1904* | 41.1904* | 39.1272 | 1.9825 | 72.7491*** |
| | (20.8276) | (20.8276) | (24.8794) | (1.9976) | (15.0991) |
| ln Populatin Density in 1500 CE | -1.8868 | -1.8868 | 0.5475 | -0.1805 | -0.6464 |
| | (3.4232) | (3.4232) | (2.6798) | (0.3150) | (3.5397) |
| Millennia of Agriculture | -16.0247*** | -16.0247*** | -9.8834* | -1.3248** | -8.6694* |
| | (5.8815) | (5.8815) | (5.1868) | (0.4889) | (4.5033) |
| State History in 1500 CE | 55.5516* | 55.5516* | 20.2920 | 5.4204*** | 35.7482** |
| | (30.5971) | (30.5971) | (20.7615) | (1.8918) | (16.1185) |
| Technology Index for 1500 CE | -17.7205 | -17.7205 | -29.4435*** | -1.2418 | -57.8602*** |
| | (11.3441) | (11.3441) | (9.7082) | (1.1246) | (10.3920) |
| Observations | 58 | 58 | 53 | 46 | 60 |
| F Stat. of Excluded Instruments | 17.8342 | 17.8342 | 15.9141 | 8.5875 | 30.5649 |

**Notes:** (i) All regressions contain a constant. (ii) Columns of Table 7B give first stage estimate for corresponding column of Table 7A. (iii) F-statistic for excluded instruments in explaining endogenous second-stage regressors are reported. (iv) OLS coefficients for the first stage of estimation given in Table 7A are reported in each column. *, **, and *** represent significance at the 10, 5, and 1% significance level, respectively. Robust standard errors are in parentheses.

# Figures


(A)

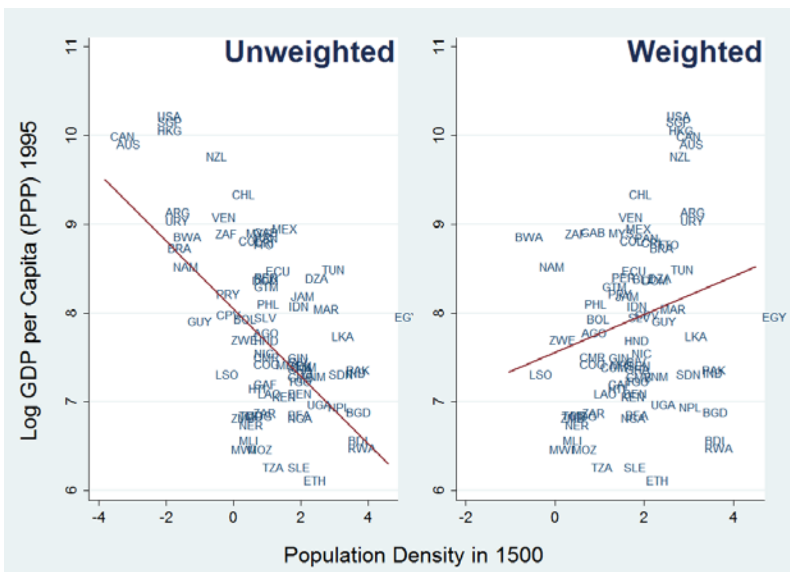
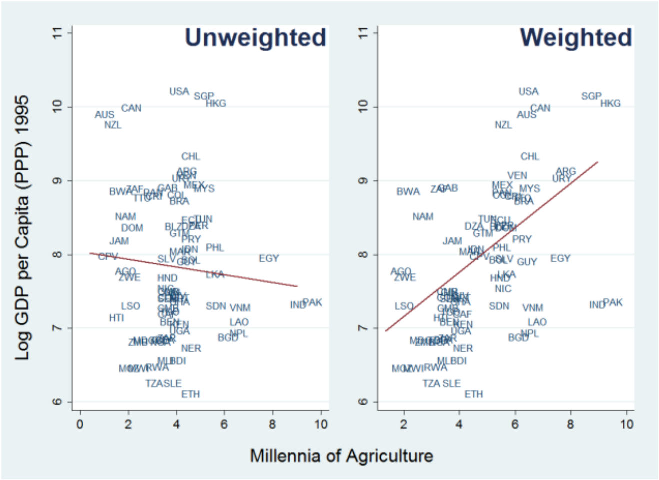
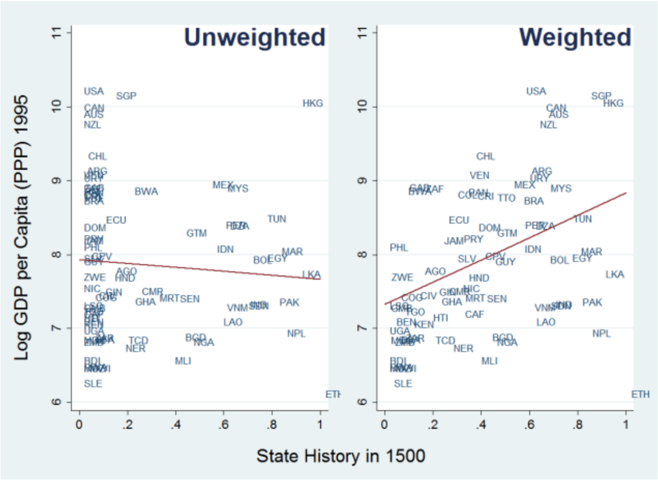


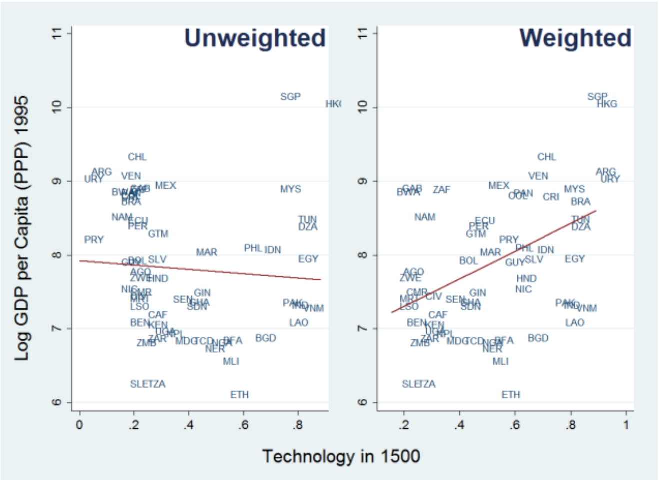

**Figure 1:**
Persistence with AJR's Measures of Year 1500 Development




(A)

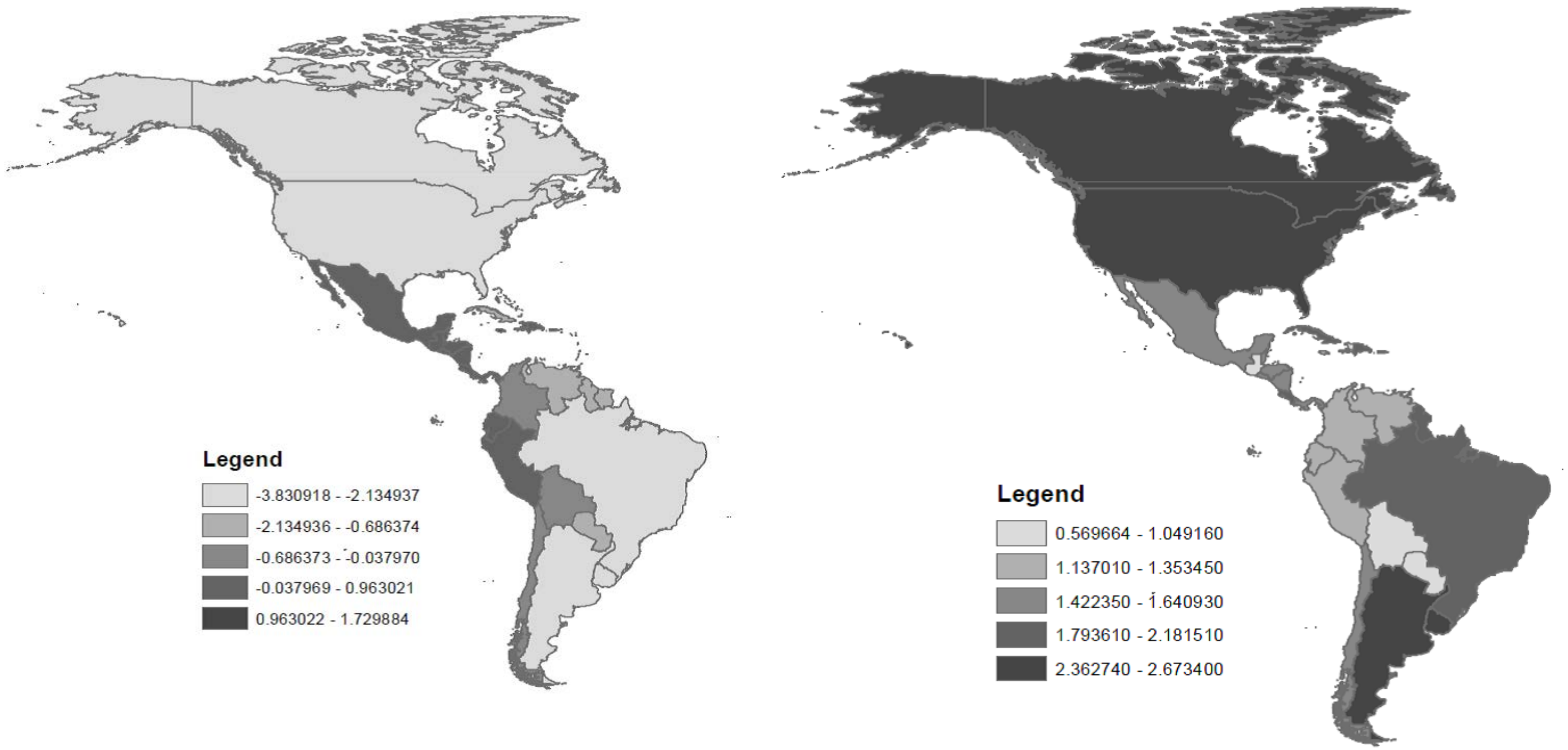



(B)




(C)

**Figure 2:**
Persistence with Alternative Measures of Year 1500 Development




**(A)**
**Unadjusted**

**(B)**
**Ancestry Adj.**

**Figure 3:**
Unadjusted and Ancestry Adjusted ln Population Density in 1500 CE for Americas