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Abstract

Early states like China, India, Italy and Greece have been experiencing more rapid economic growth in recent decades than have later-comers to agriculture and statehood like New Guinea, the Congo, and Uruguay. We show that more rapid growth by early starters has been the norm in economic history, and that the "reversal of fortune" associated with the European overseas expansion that began around 1500 was both exceptional and temporary. We demonstrate not only that the colonial era reversal was in the process of being reversed between 1960 and 1998, but also that the growth rate advantage conferred by early development in the latter period was several times greater than the growth rate disadvantage that it conferred during the colonial era, implying a rapid undoing of the first reversal.

Keywords: economic growth, economic development, economic history
JEL codes: O40, O10, N00

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1. Introduction

It has become clear, of late, that history will not allow itself to be ignored in the study of economic development. Hall and Jones (1999) demonstrate that countries in which European languages are widely spoken, in many cases as a result of their colonial experience, have better institutions, which explain a large part of the variance in countries' per capita output levels. Acemoglu, Johnson and Robinson (2001) show that countries in which European settlement was discouraged by high mortality rates experienced slower growth than others in the five millennia after 1500. Hibbs and Olsson (2004), who find institutions a strong predictor of income levels, show that cross-country differences in the dates of transition to agriculture, most of which occurred thousands of years ago, explain 53% of the variance in 1997 per capita income and 38% of the variance in the quality of institutions. Bockstette, Chanda and Putterman (hereafter BCP, 2002) show that an early and durable history of political organization above the tribal level is a powerful predictor of recent rates of economic growth.

In this paper, we begin with these observations that history has left its mark on levels and rates of economic development, and we focus on an important difference between the era of European expansion and colonization (roughly 1500 to 1960) and both the millennia which proceeded it and the shorter recent era of decolonization and increasing global trade. Up to about 1500, the rates of economic, technological, and political development of the world's societies are fairly well predicted by the factors emphasized by Hibbs and Olsson, Bockstette *et al.*, and Diamond (1998)—i.e., the presence or absence of early agricultural development and the associated growth of population densities and social complexity, including larger scale polities and more complex divisions of labor. By two thousand years ago, centuries of agricultural development had led to the presence of dense populations, tax collecting states, and cities in parts of China, India, West Asia, the Mediterranean basin, Mesoamerica and Peru; but

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large parts of sub-Saharan Africa, Australia, the Americas, and northernmost Eurasia continued to be occupied by peoples for whom agriculture was unimportant or unknown. Map 1 shows the distribution of states around the world during the years 1 – 50 C.E. according to the index of state history used in Chanda and Putterman (forthcoming) and using the borders of present-day countries rather than of ancient states and empires to define its observations.[1] In the agrarian states of the old world, metallurgy, coinage, animal drawn plows, the military use of the horse, and written language were well developed many centuries ago, while lands without agriculture (Australia, Southern Africa, eastern and southern South America, and the far north of both hemispheres) and those with less productive agricultures (New Guinea, Polynesia, what is now the eastern United States) lagged behind in population growth and technological development. The new world agrarian states of Mesoamerica and Peru, which were relative newcomers to agriculture, also lagged behind old world states in key technologies that, along with their lack of resistance to European diseases, would permit their easy conquest by old world states a millenium and a half later (Diamond, 1998).[2]

Despite the spread of both old and new world civilizations during the millennium prior to 1500, the world of that year still contained large areas with little or no agriculture, writing, metallurgy, or supra-tribal political organization, and levels of economic and technological development still largely followed the patterns set by early agriculture. Historian Angus Maddison points out the similarity in the levels of development of the old world core areas of Europe, the Ottoman Empire, India and the Far East around 1500. Map 2 shows the depth of indigenous state history associated as of

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[1] The data can be found in an Appendix, Putterman (2003). As described further, below, the index accords a higher score to a present-day country if, during the period in question, it was politically integrated above the tribal level, if the state that ruled it was indigenous, and if that state covered more of the present country's territory. Current borders are used because the variable was developed to explain differences in growth rates and levels of development among contemporary countries. Use of current borders means, for example, that what is now Italy is considered to have had state-level organization in 1 C.E. by virtue of the presence of the Roman Empire.

[2] According to Diamond and others, the differences in disease resistance were not unrelated to differences in agricultural development. In particular, he argues that diseases like smallpox had long ago jumped to densely-settled Eurasians from their sheep, goats, cattle and pigs, conferring a degree of resistance on the Eurasian populations of the age of exploration. Because the people of the Americas had passed out of the range of Eurasian disease transmission before the advent of Eurasian animal husbandry, and because the Americas did not have such animals on hand to domesticate, they lacked such resistance.

that year with most of what are now the world's countries, again delineated by present-day borders.[3]

It was only after Western Europe's outward expansion to colonize first the New World, then much of Asia, and eventually most of Africa, the Middle East, and still more of Asia, that the relationship between early agricultural development and level of income was dramatically changed. With Northwestern Europe, once a hinterland of the Mediterannean civilizations, outpacing and dominating the world's other regions including the core old world civilizations, it was the relatively underdeveloped and temperate lands of the U.S., Canada, Australia, New Zealand, and (to a lesser extent) Argentina, Chile and South Africa that progressed most rapidly. Hotter and/or more densely populated countries like Mexico and Brazil occupied a middle position, while countries that Europeans settled sparsely, late, or not at all, whether due to disease, climate, or high population density—examples include most of sub-Saharan Africa, India, China, Indonesia, and New Guinea—fell to the bottom of the world's income pyramid. This post-1500 pattern underlies the "reversal of fortune"—the slower growth after 1500 of colonized lands that were either more deadly to Europeans, in terms of disease, or more densely populated in 1500—pointed out by Acemoglu, Johnson and Robinson (hereafter AJR 2001, AJR 2002).

The central theme of this paper is that the pattern of slower growth by the previously more advanced colonized (or, more generally, non-European) areas after 1500 is exceptional, and that the reversal that AJR document is in fact limited to the era of colonialism, ending around 1960. Since the post-World War II era of decolonization and global trade has gotten into full swing, the *dis*advantage under which history's early starters labored in the era of colonialism has changed again into an apparent advantage. While late-starters like New Guinea and sub-Saharan Africa recorded limited economic

[3] The data are again those used in Chanda and Putterman (forthcoming) and available in full in Putterman (2003). Due to unavailability of other data used in that study and the present one, the state history variable was not calculated for most countries that belonged to the Soviet bloc during the 1950s to 1980s, and for some others.

growth in the late 20th Century and intermediate cases like Mexico and Brazil struggled, more and more of the early starters took off into rapid economic growth

Specifically, the aim of this paper is to demonstrate, statistically, three propositions: (1) up to 1500, economic change and technological progress followed more or less predictably upon early agricultural development; (2) from 1500 to 1960, there was a reversal of the fortunes of most non-European lands, as emptier countries were to a large extent developed by Europeans while other non-European regions felt the negative impact of a Europe-dominated world; and finally, (3) from 1960 to the present, there has been a relative resurgence of non-European earlier developers and a resurfacing of the disadvantages of those non-European societies (apart from the few "empty lands" settled overwhelmingly by Europeans) that were behind in 1500 and are catching up slowly if at all today.

The paper proceeds as follows. In section 2, we discuss our empirical strategy and the data to be used. In section 3, we present our derivation of new estimates of per capita GDP in 1500. Section 4 examines the influence of early agrarian and state development on incomes in 1500, while sections 5 and 6 examine the colonial era "reversal of fortune" and the post-War "reversal of the reversal," respectively. We summarize and discuss the implications of these findings, including those for the recent debate about institutions and growth (AJR, 2001, 2002; Glaeser *et al*., 2004), in section 7.

2. Empirical Strategy and Data

To show that early agrarian state development predicts level of development in 1500, we employ as measures of early development the number of years since the onset of agriculture in a region, and measures of state history as of 50, 500, and 1000 CE. We measure development in 1500 using per capita income in that year as provided by direct estimates, and as extrapolated based on the level of urbanization in 1500, and also on both the level of urbanization and population density in 1500. To confirm the reversal of fortune from 1500 to 1960, we use two alternative dependent variables, per capita income in 1960 and the growth rate of per capita income from 1500 to 1960, and we use as explanatory variables and measures of development in 1500 the estimates of per capita income in that year. To show that during 1960 to 2000 the colonial era reversal has itself been in the process of being reversed, we use growth rate of per capita income from 1960 to 2000 as our dependent variable, and again use the years since the onset of agriculture variable and the measures of early state history, as well as per capita income in 1500, as explanatory variables.

The data used come primarily from Maddison (2001), AJR (2002), McEvedy and Jones (1978), Putterman (2003), and Hibbs and Olsson (2004). Maddison (2001) provides estimates of GDP per capita in 1500 in 1990 international dollars for a sample of countries and regions that we use to obtain the estimated relationship between GDP per capita, population densities and average urbanization rates. The data for population densities are calculated by using population numbers from Maddison (2001) and land area numbers from FAO Statistics.[4] Urbanization numbers are taken from Bairoch (1988) and are further augmented by numbers from AJR (2002). GDP per capita numbers for a larger set of countries in 1500 are also taken from Maddison (2001), as are the numbers for 1960 and 1998. All these numbers are in 1990 international dollars (PPP adjusted). Further details for these variables are found in the appendix.

The state history variables, which summarize whether present-day countries had states, giving more weight to indigenous states covering more of a country's present territory, are taken from the "State Antiquity Appendix Version 2" used by Chanda and Putterman (forthcoming). This is an improved version of the original data used in BCP.[5]

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[4] In their original work AJR (2002) use arable land instead of actual area wherever possible. Although desirable in principle, the uneven availability of this information means that the approach can lead to substantial aberrations. For example, since McEvedy and Jones (1978), AJR's primary source, lists data on arable land for Egypt but not for many other countries, the population density for Egypt is recorded as 100, which is four times the population density of the next highest countries—Rwanda and Burundi—and more than four times that of India (for which McEvedy and Jones do not record arable land area). To rule out such random occurrences we stuck with total land area.

[5] Despite changes, the old and new series are highly correlated; for example, the old and new values for the full measure to 1950 using a 5% backward discounting rate have a correlation of .8957.

The data begin in the year 1 of the common era, and are organized by half centuries. As in both BCP and Chanda and Putterman, we continue to focus on versions of the variable that downweight for each additional half century in the past using a 5% depreciation rate. We use STATEHIST50, which considers the values for the first half century only, and STATEHIST500, STATEHIST1000 and STATEHIST1500, which use values for the first 500, 1000, and 1500 years, respectively.[6]

The variable AGYEARS is an estimate, in 2000 CE, of the number of years since a country's transition from a foraging to an agricultural society.[7] This variable is based on Hibbs and Olsson (2004), who estimated the number of years from 10,000 BCE onwards to the establishment of agricultural societies, using a calibrated model that attributes the transition to the "bio-geographic" endowments – that is, endowments of wild grain pre-cursors and large animals suitable to domestication – as discussed by Diamond (1998).

Table 1a summarizes the data for AGYEARS and the four state history measures. We summarize the data for the entire sample of countries for which such measures are available, for countries that were later colonized and were studied by AJR, and for the slightly larger sample of all non-OECD countries for which the data are available.[8] The AGYEARS variable in principle can have a highest possible value of 12,000, for 10,000 BCE. According to the estimates however, the earliest agricultural civilizations date back to approximately 7,846 BCE (the "Fertile Crescent", i.e. an AGYEAR value of 9846) and the most recent adopters of agriculture date back to 2,958 BCE (sub-Saharan Africa, Canada and the United States, with AGYEAR values of 4958 years). In our work in the

[6] When calculating STATEHIST500, STATEHIST1000, and STATEHIST1500, we give full weight to the most recent half century and discount earlier half centuries progressively (by $1/(1.05)$, $1/(1.05)^2$, etc.). We then sum the discounted values for each country and normalize the sums so that the highest possible country value is 1 and the lowest is 0.

[7] Actual agricultural transitions may have taken hundreds of years, so the transition year should be understood to approximate the year in which agriculture first surpassed foraging as a source of food supply.

[8] Mexico and South Korea are included in our non-OECD sample since they were usually considered developing countries and joined the OECD only toward the end of the post-War period covered by our data.

rest of the paper, we scaled this variable to millennia rather than actual years, to allow for easier interpretation of coefficients in regression estimates.[9]

STATEHIST is a scaled variable and therefore can take a maximum value of 1 irrespective of the terminal date. However the means indicate an expected upward trend. As one increases the terminal date, more countries begin to develop states. For example, we find that in 50 CE, only 34 of 107 countries covered had states. Moreover only eight countries recorded the full maximum value (for locally-run states covering the whole present-day territory) during that half century. Over the next 450 years only 5 more of today's countries became the sites of governments. From 500 to 1000 CE, 10 more countries began to show signs of governments. Between 1000 and 1500 CE, as many as 18 countries crossed the threshold. Map 2 shows the extent of state history in contemporary countries covered by the STATEHIST data as of 1500. As with many other measures of economic and social development, the subsequent 450 years of the second millennium was a period of acceleration with all of the remaining 40 countries covered also developing formal governments. As Table 1A suggests, the experience with states seems to be lowest within the sample of colonized countries (also with the lowest variance). Further, there was little or no advancement within these countries in the first 500 years. The colonized countries also were late, on average, in undergoing the Neolithic transition—hence their lower average AGYEARS value. Lateness in developing agriculture, urban civilization, and the state may have influenced not only the level of development, but also the likelihood of becoming colonized by a European country (Diamond, 1998).

Table 1b presents correlations between the same variables for the same samples. The very strong positive correlation between AGYEARS on one hand and the STATEHIST variables stand out. Clearly the onset of agriculture had strong implications for the appearance and existence of states, as historians have often remarked. Indeed, the correlation between having come early to agriculture and having a longstanding state

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[9] A drawback of the AGYEARS variable is that it takes on only six values—9846, 9262, 8194, 6151, 5881 and 4958—because the biogeographic endowment data are available only for broad regions. This limitation also applies to Hibbs and Olsson's study.

later on actually strengthens with time in our sample, with STATEHIST1500 having the strongest correlation.[10]

3. Estimating GDP per Capita in 1500

Maddison (2001) provides estimates of per capita income in 1500 for a subset of the countries in our sample and for some broader regions. Due to the limited number of available estimates for income in 1500, AJR used estimates of urbanization rates in that year as a substitute for income. We adopt a different strategy, that of estimating GDP per capita in 1500 based on the relationships between per capita income, urbanization, and population density. Specifically, we ran OLS regressions for countries and regions in the Maddison sample with log of GDP per capita in 1500 as the dependent variable and, either a) only the urbanization rate in 1500 as an independent variable, or b) both the urbanization rate and the log of 1500 population density, as independent variables. The logic for using urbanization as a correlate of GDP per capita is well motivated in AJR. In general, well developed agricultural technologies and extensive transportation networks are a prerequisite for high levels of urbanization. The use of population density as a correlate of living standards is less straightforward, because in the pre-industrial period, population density could be considered an indicator of technological sophistication but not necessarily of higher average incomes (Galor and Weil (2000)). Despite this, the strong correlation between the GDP per capita in 1500 and population densities in 1500 for the Maddison sample led us to use it along with urbanization rates in creating our second set of estimates. The estimated coefficients for the benchmark sample are listed in Table 2. These estimates are based on a sample of 32 major world regions and individual countries for which Maddison provides estimates. These are mostly European countries, their offshoots, a few other individual countries (India, China and Mexico) and regions

[10] *A priori* one might have expected that the correlation with AGYEARS would be strongest for STATEHIST50, then STATEHIST500, STATEHIST1000, and last STATEHIST1500. It must be remembered, however, that while STATEHIST is a stock variable, the data on which it is based go back to 1 CE only, so that in STATEHIST50, then young states like Guatemala's are treated no differently from older states like Egypt's or China's. If we had a measure of the history of statehood as of 50 CE going back two thousand rather than 50 years, we would probably have found a stronger positive correlation between state history as of 50 CE and AGYEARS.

(Africa, Asia, etc.). As the results suggest, using urbanization rates only explains 38% of the variation in log GDP per capita in 1500. Adding the logarithm of population density takes this up to 55% - a significant increase. How good are the estimates compared to the actual values of the dependent variable? Table 3 lists the summary statistics for the Maddison values, the two sets of predicted values for the sample corresponding to the benchmark regression, and two sets of predicted values for all countries for which urbanization and population densities are available. Restricting our attention to the first three rows, overall the predicted values are well in line with the observed values.[11]

Using these estimated coefficients, we compute predicted values of GDP per capita in 1500 for both in sample and out of sample countries, in this case using the population density estimates given by McEvedy and Jones for a larger sample of countries.[12] Turning to the predicted values for both out of sample and in sample countries, we again see fairly credible summary statistics. The urbanization only benchmark produces a minimum of $461, for the U.S., and a maximum of $1147, for Belgium. For the urbanization and population density benchmark the highest value of $1050 is again for Belgium and the lowest value of $327 is for Uruguay.[13] The next three lowest values are for the U.S., Canada and Australia.

Table 3b lists the correlations between the log actual (i.e. Maddison) GDP per capita, log predicted GDP per capita and the determinants of the latter. The correlation between the actual GDP and the predicted values are fairly high, with the estimate based on both urbanization and population density more strongly correlated with the actual value. The correlation between the two predicted variables themselves is also extremely high at 0.88. If we incorporate the out of sample predictions (Table 3C), we continue to observe correlations of the same magnitude. In particular the correlation between the two

[11] We also tried a regression where population density was the only independent variable. While the R-Square was fairly high at 0.40, we found that there was a heavy downward bias. Compared to the observed maximum of $1100, the predicted maximum was only around $600 and the predicted minimum was also lower than the observed minimum.
[12] Notice that this procedure allows us to estimate GDP per capita in 1500 for present-day countries in regions, e.g. Africa, for which Maddison provides an estimate for the region as a whole, only.
[13] Maddison assumes that $400 is the subsistence level in 1500. Clearly adding population density as a determinant forces the estimates to go somewhat below this number.

predicted variables remains very high at 0.87. Though the estimation technique is fairly basic, as far as we are aware this is the first constructed set of per capita incomes in 1500 across such a broad cross section of countries. We find that the ratio of the highest to the lowest income per capita varies from 2.48 (urbanization only) to 3.21 (urbanization and population density), which is within a reasonable range of Maddison's estimate of 2.67. For purposes of consistency, in the analysis that follows we use our predicted values rather than Maddison's estimates for 1500 per capita income even when the latter are available.

4. Testing Proposition (1): Influence of Early Development on Incomes on the Eve of European Expansion

We are now ready to document our first proposition: that global variation in standards of living on the eve of European expansion is to a significant degree explained by differences in the timing of the development of agriculture and of large scale political systems. Hibbs and Olsson (2004) have shown that an earlier onset of agriculture had long lasting effects and significantly affected living standards across the world as late as 1997, but they did not investigate whether this was also the case in earlier years. BCP (2002) have shown that post-1960 economic growth rates have a strong positive correlation with their earlier measure of state history (constructed up to 1950).[14] Are agricultural onset and state history measures also correlated with estimated income levels in 1500? Living standards were not as unequal then as they were at the end of the second millennium, and this dampened variation might lead to less interesting results in 1500. Despite that, the results in Table 4 support our first proposition. Both STATEHIST and AGYEARS have significant correlations with log GDP per capita in 1500 and have the correct sign. The effects are more pronounced when both urbanization and population density are used to predict 1500 per capita income. Almost half of the variance in predicted per capita income is explained by AGYEARS and STATEHIST1500,

[14] The correlation of post-1960 growth rates with the updated measure of STATEHIST constructed up to 1950 (used in Chanda and Putterman and in this paper) is 0.44– significant at the 1% level. Also, consonant with Hibbs and Olsson's result for income levels as opposed to growth rates, the correlation between updated STATEHIST1500 and 1995 per capita income is 0.24, significant at the 5% level.

according to the last column.[15] For a visual impression, the relationship between STATEHIST1500 and 1500 per capita income is shown in Figure 1.[16]

It would be interesting to see whether AGYEARS predicts income levels in 1500 only via the existence of longer-established states, or whether it has direct effects as well. Columns (3) and (6) examine this question for the two estimates of GDP per capita. Unfortunately the results are mixed. When we use urbanization based income levels, it seems that STATEHIST1500 has the overriding effect on per capita income. On the other hand, if we focus on the urbanization and population density based estimates of GDP per capita, we clearly see that both STATEHIST1500 and AGYEARS have direct effects.

How large are the economic effects? Consider the effects of STATEHIST1500 based on column 4. Peru has state history value and GDP per capita in 1500 of 0.65 and \$560, respectively—the latter being approximately the sample mean. If Peru's state history value increased by one standard deviation (0.35), taking it to the highest possible value, it's GDP per capita in 1500 would rise to \$630. Consider, instead, the effect of AGYEARS (based on column 5). According to estimates by Hibbs and Olsson, agricultural societies began to appear in Peru approximately 6150 years ago (later than the mean value of 7.3 millennia (see Table 1A)). If instead the transition had taken place one standard deviation (2.2 millennia) earlier (8350 years ago), Peru would have had a per capita income of \$640 in 1500.While these numbers may not seem large at first glance, during the pre-industrial period estimated variation in average living standards was small and a move from \$560 to \$630 would be sufficient to take Peru from the sample mean to the top end of the distribution, ahead of the United Kingdom.

5. Testing Proposition (2): The Colonial Era Reversal

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[15] We also examined the robustness of these relationships both a) when the sample is limited to AJR's (2001) group of colonized countries and b) when the sample is limited to non-OECD countries. The results carry over, except that when both STATEHIST1500 and AGYEARS are included, only the former is consistently statistically significant.

[16] Unlike the regression analysis, which uses predicted values of GDP per capita for all countries, Figure 1 uses Maddison's estimates when these are available. Countries for which this is the case are distinguished in the figure by having their letter codes in bold typeface.

Having constructed values for GDP per capita in 1500 and having confirmed our first proposition—that levels of economic development in 1500 were substantially predictable by early agriculture and state formation—we now turn to our second proposition, which restates for the 1500 to 1960 period and also extends to non-colonized countries the AJR finding that countries that were more economically developed in 1500 became less developed in the centuries that followed. Tables 5a and 5b examine the evidence. The dependent variable here is log GDP per capita in 1960.[17] The sample in Table 5a includes all colonized countries but excludes the countries that Maddison calls "Western offshoots" and Hibbs and Olsson call "neo-Europes"—that is, the U.S., Canada, Australia, and New Zealand—as well as Hong Kong and Singapore. We dropped the Western offshoots because we are more interested in examining the experiences of countries considered to be developing countries after 1960. Hong Kong and Singapore are dropped because of their unique city state characteristics.[18] The first four columns of Table 5a confirm the AJR finding—strong evidence of a reversal of fortunes by 1960. Column 1 confirms this result using the same variable as do AJR, while column 2 finds the same result using the related population density variable. The third and fourth columns document the reversal when we use our predicted values for GDP per capita. Between the two values, the one based on urbanization and population density predicts a much stronger reversal.

The last four columns of Table 5a test the reversal thesis using our measures of early development rather than income, urbanization and population density. Comparing column 5 of Table 5A to columns 1 and 4 of Table 4 further supports the reversal thesis: whereas a long history of supra-tribal polities is positively associated with income in 1500, the correlation is negative and significant at the 1% level, for income in 1960. Column 6 finds AGYEARS to be statistically insignificant. However, in columns 7 and 8 we reran the regressions of columns 5 and 6 but now restricted our sample to only those

[17] Unlike AJR, who focus on incomes in 1995, we concentrate on the change up to 1960, since our third proposition will be that the reversal during the colonial epoch was itself in the process of being reversed after that time.

[18] Due in part to that status, they are quite atypical in that while both city-states were nearly empty lands in 1500, they absorbed the urban culture and thus "social capabilities" of neighboring China (for Singapore, China and India) and of colonizing power England far more rapidly and completely than did any country-sized territory of the colonized and developing worlds.

countries for which we could construct GDP per capita data in 1500. This represents our core set of countries whose experiences in terms of GDP per capita can be traced over our three focal years of 1500, 1960 and 1998. Within this smaller sample of countries AGYEARS is statistically significant. For this core sample, STATEHIST1500 continues to predict the reversal and in fact registers a stronger negative effect. There is also a significant jump in the R-Square in these columns.

In Table 5b we repeat the exercise for developing countries rather than colonized countries. The sample differs in that it includes a few countries such as China and South Korea which were never colonized by Europeans but are viewed as economically less developed or developing in the period after 1960. For the larger sample of countries AGYEARS does not seem to predict the reversal and is also insignificant. However all the other results allow us to conclude that the reversal of fortune documented for colonized countries by AJR holds more generally for countries of the developing world.

6. Testing Proposition (3): The Resurgence of Non-European Early Developers

We last turn to our third proposition, which is that the advantages conferred by early agrarian development up to 1500 resurfaced during the post-World War II period, so that early developers grew faster than late ones in the latter period. Evidence on this proposition differs from that on the other two because the second half of the century was too short a period to bring about the full overturning of the effects of the previous 460 years. Thus if we run regressions with 1998 log GDP per capita as the dependent variable and 1500 GDP per capita values as the independent variable, we still see some evidence of an overall reversal.[19] Since we are looking for the beginning of a *process* of reversing of AJR's reversal rather than a complete overturning of the earlier reversal, our dependent variable for the post-War period is the annual *growth rate* in that period, not the achieved income level in the last observed year. Because we used Maddison's data for 1500 and 1960 for GDP per capita figures, we also use his numbers to construct the

[19] We ran such regressions and found that the overall reversal was still true though much weaker than what was observed until 1960. These results are available upon request. As also mentioned, however, GDP in 1995 is positively related to STATEHIST1500 in some samples.

growth rates in the post-War period. This, however, only allows us to construct growth rates from 1960 to 1998, since his numbers end with the latter year.

Before starting, we quickly re-examine the reversal during 1500-1960 with growth rates as the dependent variable, to make sure that there is no suspicion of our having "baited and switched" the reader by focusing on terminal income in the analysis for 1500 and 1960 but on growth rates in the analysis for 1960 to 1998. Table 6 lists the results when growth rates from 1500 to 1960 are the dependent variables. We use the two possible growth rates based on our two estimates of log GDP per capita in 1500. The independent variables we examine are the two GDP per capita numbers which we constructed and the two measures of early development, STATEHIST1500 and AGYEARS. The results are as expected. Both estimates of initial GDP per capita have significant negative effects on growth rates during the subsequent 460 years – strong evidence of absolute convergence within this sample. STATEHIST1500 also has a strong negative effect on economic growth and so does AGYEARS. Interestingly the R-squares are also quite high, especially when the independent variables are AGYEARS or the log of GDP per capita in 1500 based on both population density and urbanization. In sum, an AJR-style "reversal of fortunes" is also confirmed with respect to 1500-1960 growth rates.

We are now ready to discuss the results for growth between 1960 and 1998, which are presented in Tables 7a and 7b. Columns (1) and (2) document the effects of the 1500 GDP per capita numbers. When using urbanization as the only basis for establishing initial income we find a weak positive effect on growth rates during this period, which is significant at the 10% level in the non-OECD sample but not in the colonized country sample. On the other hand, the GDP per capita numbers extrapolated from both urbanization and population density register a positive effect significant at the 10% level in the colonized sample and at the 5% level in the larger non-OECD sample. Columns (3) to (6) focus on state history and agricultural onset. Here the results still more strongly support our contention that early starters are again growing more rapidly in the post-War period. Columns (3) and (4) represent the limited sample of countries for which we could estimate 1500 GDP levels. As the results suggest, for this sample both STATEHIST1500 and AGYEARS have significant effects on economic growth. In columns (5) and (6) we do not restrict the sample to just countries for which GDP per capita in 1500 is available.[20] The results continue to be robust—both state history and agricultural onset affect growth significantly at the 1% level. These results support our conjecture that countries that had an earlier start on development in pre-modern times have been growing more rapidly of late; the reversal of fortune has begun to be reversed. A visual impression is given by Figure 2, which plots the relationship between STATEHIST1500 and recent rates of economic growth.

The estimated coefficients in Tables 6 and 7 provide some rather interesting contrasts. Consider for example Column (6) in Table 6 and column (2) in Table 7a. These two columns examine the effects of GDP per capita in 1500 on growth rates from 1500-1960 and 1960-98, respectively, for the same sample of countries. Although the standard error is considerably higher in the second case, it is still worthwhile to note that the positive effect on growth during 1960-98 is at least twice as high as the negative effect on growth during 1500-1960. In the case of STATEHIST1500, the standard errors are more or less the same, but the positive effects during 1960-1998 are on the order of six times greater than the negative effects during 1500-1960. Comparing column (8) of Table 6 with Column (4) of Table 7 for AGYEARS we again see that the magnitude is four times higher in the post 1960 period (though the standard error is much higher as well). Thus not only did the early starters manage to begin regaining their leadership but they seemed to be doing it at a much faster pace than they had previously been losing it. In fact, the reversal process proceeded quickly enough so that, as Chanda and Putterman (forthcoming) show, the simple correlation between STATEHIST1500 and 1995 per capita income for a world sample of 95 countries was already positive and significant at the 5% level.[21] Hibbs and Olsson also find a significant positive relationship between early agricultural onset and per capita income in 1997.

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[20] The samples used to estimate columns 5 and 6 in Tables 7a and 7b correspond to columns 5 and 6 in Tables 6a and 6b respectively.
[21] BCP and Chanda and Putterman (forthcoming) show that STATEHIST1950 (called STATEHIST05 in BCP) is a significant positive predictor of 1995 income in some simple regressions. Although this partial

A possible problem with these results is that this reversal of AJR's reversal might simply be explained in terms of convergence dynamics. Absolute convergence suggests that countries that are relatively poorer should grow faster. While we know that absolute convergence does not hold for the large sample of world countries in the post-War period (DeLong (1988), Mankiw Romer and Weil (1992)), if one simply focused on the 37 colonized countries for which we constructed 1500 GDP numbers, it does turn out to hold: the simple correlation between 1960 log GDP per capita and subsequent growth is - 0.3. We know that log GDP per capita in 1500, STATEHIST1500 and AGYEARS all have negative effects on 1960 per capita income levels. Therefore it might be natural to expect that if log GDP per capita in 1960 has a negative effect on economic growth, then all of these variables have a positive effect on economic growth.

To see whether the effects of STATEHIST1500 and AGYEARS on 1960-95 growth are not simply picking up convergence dynamics, we rerun the regressions in Table 7 but with log GDP per capita in 1960 as a control variable. Column (1) of Table 8 is a basic regression that shows that absolute convergence holds for the 1960-98 period for the 37 countries for which data is available on GDP per capita in 1500. Columns (2), (4) and (5) list the results for the three variables: log 1500 GDP per capita based on both urbanization and population density, STATEHIST1500 and AGYEARS. This time around, we dropped the log GDP per capita estimate based on urbanization, since it had little predictive power for growth from 1960 to 1998.

Column (2) of the table suggests that log GDP per capita in 1500 no longer has any power to predict the 1960-98 growth rates once we include log 1960 GDP per capita, which is also now insignificant. This probably implies that 1500 GDP per capita only works, in the regressions of Tables 7a and 7b, through its effect on GDP per capita in 1960; thus its earlier recorded positive effect simply captured convergence dynamics. A

correlation disappears when certain controls are added to a series of income level regressions, BCP show that STATEHIST1950 is an excellent instrument for Hall and Jones' (1999) "social infrastructure" variable.

two stage regression which tests and supports this supposition appears in column (3).[22] The instrumental variable used here is, of course, log of GDP per capita in 1500. It is not surprising that the effects of income levels in 1500 for post-War growth simply capture convergence – after all this is just an income measure and not some deeper institutional or geographical measure. When we turn to STATEHIST1500 and AGYEARS in columns (4) and (5), however, we find that these variables continue to predict growth rates during the post-War period over and above any effects they may have on initial GDP per capita. In fact it seems that the overriding effect on the growth rate is the direct effects of these variables, since the initial GDP per capita now is no longer significant. In column 6 we repeat the same regression with the expanded sample. The significance of STATEHIST now actually rises and so does its economic effect. These results are similar for AGYEARS as well. For both sample sizes, AGYEARS is significant at the 1% level. Again, log GDP per capita in 1960 is no longer significant. Thus it seems that although countries that had had longer histories of agrarian state society suffered during the colonial era, they have begun to grow fast enough that they may soon fully rebound from this negative shock. Similar results on growth in the 1960-90 period are obtained by Burkett, Humblet and Putterman (1999) using as proxies for early development the Boserupean measures population density, cultivated acres per capita, and the irrigated share of cultivated land. Greater early or pre-industrial development is associated with faster, not slower, economic growth in the late 20th Century.

While it is difficult to undertake robustness checks for regressions run in the first two parts of this paper because of a lack of data on other variables during the pre-1960 period, it is possible to do this for growth between 1960 to 1998. Table 9 lists results which control for the some of the variables used in standard cross country growth regressions. These include the log of the investment rate, population growth rate and a human capital measure (secondary enrollment ratio). The first three columns list results when we do not control for the 1960 level of GDP per capita. The remaining three columns add this variable as well to test for the role of convergence dynamics discussed earlier. As is apparent from these regressions, STATEHIST1500 and AGYEARS are

[22] Note that the first stage regression is the same as the one that appears in Column 4 of Table 5A

significant predictors of economic growth even after controlling for these variables. This is true even when the log of GDP per capita in 1960 is controlled for. However this is not true for log GDP per capita in 1500; as in table 8, it is only a significant predictor of growth when the 1960 GDP per capita is not included. As in most growth regressions, the investment rate is consistently significant. However this is not true for population growth rates and secondary enrollment rates. Finally, initial GDP per capita in 1960 is not consistently significant. In column (4) it is significant, while in columns (5) and (6) it is not significant. This suggests that long run geographical and institutional measures might have played a deeper role than simple convergence dynamics in determining growth rates in the second half of the twentieth century.[23]

7. Conclusion

Over most of economic history, an early start in agricultural development, leading to the growth of population density, cities, and polities above the tribal level, has conferred a continuing economic advantage, an effect recently confirmed for the present day by Hibbs and Olsson. Yet, during the period of European economic expansion starting roughly in 1500, Acemoglu, Johnson and Robinson have demonstrated that early developers, at least among countries colonized by Europeans, experienced slower or even negative economic growth.

In this paper, we show how these two opposing tendencies fit together. We reconfirm, but for the much earlier and pivotal year 1500, Hibbs and Olsson's result that early agrarian development conferred an advantage. We then demonstrate that the AJR result of a decline in the living standards of the non-European countries that were more advanced in 1500 holds also when we include non-colonized developing countries, when we leave out the "neo-Europes," and when we use our derived estimates of income in 1500 rather than their proxy for income, the urbanization rate. And we show that an early start on agriculture and state formation had perverse effects on growth prospects between

[23] BCP and Chanda and Putterman (forthcoming) undertake additional robustness tests, including in their post-War growth regressions the same ICRG institutional quality measure used by Hibbs and Olsson and used earlier by Knack and Keefer (1995), and ethnic heterogeneity as used in Easterly and Levine (1997).

1500 and 1960. However, unlike AJR, we break the data at the year 1960 and find that the reversal process, which they extend right through 1995, was actually being undone during the post-World War II period, during which the effects of European expansion and colonialism appear finally to have been wearing off. During 1960 – 1998, old agrarian societies like China, Taiwan, South Korea, and (more recently) India began to catch up with earlier industrializers, while most of the new states of sub-Saharan Africa, much of Latin America, and other countries that were less advanced with respect to agrarian state development, urbanization and population density in 1500, experienced slow or no net economic growth.

Our findings may have an important bearing for the debate about the impact of institutions on economic growth. While not necessarily challenging the proposition that institutional differences play a part in explaining differences in economic performance in recent decades, our finding that the "reversal of fortune" was a phenomenon that ended with post-World War II decolonization raises serious doubts about AJR's claim that institutions put in place at the time of colonization have persisted in their effects to the present day. In recent decades, centuries-old differences in "social capability" (Abramovitz, 1995; Chanda and Putterman, 2004) seem to count for more than do traces of property rights regimes reflecting differing needs of colonial masters.

What, exactly, is the advantage conferred by early agrarian development? While this is not the place for a lengthy exposition, it seems that the early development of agriculture and the state may have brought in its wake not only increases in economic specialization and population density, but also changes in culture and institutional capabilities.[24] Although Western Europe's break from the Eurasian pack to establish trading, colonial, and industrial hegemony over most of the world temporarily turned the relationship between early development and growth on its head outside of Europe,[25] the institutional capacities of those old societies that were not too far behind Europe in 1500

[24] More extended expositions are found in Putterman, 2000 and Chanda and Putterman, 2004. See also the review article by Diamond, 2004.
[25] There is a large literature on why the industrial revolution took place first in Europe. Interesting treatments include those of Diamond, 1998, Landes, 1999, and Pomeranz, 2000.

were once again putting them at an advantage in the late 20th Century.[26] This suggests that building up social capabilities is a very long-term process, and that although that process might be shortened through well chosen capacity-building programs, it doesn't serve policy-makers well to underestimate the size of the task.

[26] We are well aware of the challenge that some early developers, especially in the "fertile crescent" and Egypt, have not done very well of late. Diamond, 1998 and 2004, attributes the "fertile crescent's" current state to ecological fragility and over-exploitation. Relative to Western Europe and East Asia, the long-term decline of the old fertile crescent and Egypt relative to Western Europe and East Asia may arguably already have been in evidence by 1500. Yet some observers believe that Egypt and Iraq could be Middle East success stories given the right policies.

Data Appendix

State History (STATEHIST50, STATEHIST500, STATEHIST1000, STATEHIST1500): We began by dividing the period from 1 to 1950 C.E. into39 half centuries. For each period of fifty years, we asked three questions (and allocated points) as follows: 1. Is there a government above the tribal level? (1 point if yes, 0 points if no); 2. Is this government foreign or locally based? (1 point if locally based, 0.5 points if foreign [i.e., the country is a colony], 0.75 if in between [a local government with substantial foreign oversight]; 3. How much of the territory of the modern country was ruled by this government? (1 point if over 50%, 0.75 points if between 25% and 50%, 0.5 points if between 10% and 25%, 0.3 points if less than 10%). Answers were extracted from the historical accounts on each of 107 countries in the Encyclopedia Britannica, including the regional articles in the Macropedia section. The scores on the three questions were multiplied by one another and by 50, so that for a given fifty year period, what is today a country has a score of 50 if it was an autonomous nation, 0 if it had no government above the tribal level, 25 if the entire territory was ruled by another country, and so on. We then combined the data for various time periods (half centuries). .For example to construct STATEHIST1500 we used the first 30 half centuries. We experimented with different ways of "discounting" to reduce the weight of periods in the more remote past (All results in this paper use the 5% discount rate). Finally in order to make the series easier to interpret, the resulting sum was divided by the maximum possible value the series could take given the same rate of discounting the past. Thus the value that the index can take for any given country lies between zero and one. A summary for each country is available in Putterman (2003).

Years since the Onset of Agriculture (AGYEARS): Calibrated estimates of approximate number of years since regions moved from foraging to agricultural societies using 2000CE as the year of reference. Original data comes from Hibbs and Olsson (2004).

Population Density: Calculated from population numbers and total land area from McEvedy and Jones (1978). For the estimates of Table 2, the numbers for the included world regions are taken from Maddison (2001), while the numbers for individual countries are those from McEvedy and Jones.

Urbanization: There are two sets of numbers here. The first set of numbers is used to run the benchmark regressions to estimate the relationship between urbanization and Maddison's GDP per capita estimates in 1500. Urbanization rates for this sample comes mainly from Bairoch (1988), supplemented by AJR (2001). This includes mostly European countries and major world regions. The second sample of urbanization numbers used to construct the expanded set (mostly colonized countries) of GDP per capita in 1500 comes from AJR (2001).

GDP per capita in 1500: The raw numbers are in 1990 international dollars and are taken from Maddison (2001). The expanded sample is based on the regressions in Table 2.

GDP per capita in 1960 and 1998: These are in 1990 international dollar numbers and are taken from Maddison (2001).

Investment Rate (1960-2000) and *Population Growth Rate* (1960-2000): This is constructed from Penn World Tables version 6.1. For most countries the data ends at 1998 and thus the average reflects a 60-98 average.

Secondary Enrollment Ratio (1960): From the data set for Barro and Lee (1994).

Country list and data availability

Country	country code	1500 gdp per cap	AGYEARS	statehist 1500	1500 pop density	Urbanization 1500	growth 60-98
(***core sample, colonized***)							
Algeria	DZA	1		1	1	1	1
Argentina	ARG	1	1	1	1	1	1
Bangladesh	BGD	1	1	1	1	1	1
Belize	BLZ	1	1		1	1	1
Bolivia	BOL	1	1	1	1	1	1
Brazil	BRA	1	1	1	1	1	1
Chile	CHL	1	1	1	1	1	1
Colombia	COL	1	1	1	1	1	1
Costa Rica	CRI	1	1	1	1	1	1
Dominican Republic	DOM	1	1	1	1	1	1
Ecuador	ECU	1	1	1	1	1	1
Egypt, Arab Rep.	EGY	1	1	1	1	1	1
El Salvador	SLV	1	1	1	1	1	1
Guatemala	GTM	1	1	1	1	1	1
Guyana	GUY	1		1	1	1	1
Haiti	HTI	1	1	1	1	1	1
Honduras	HND	1	1	1	1	1	1
India	IND	1	1	1	1	1	1
Indonesia	IDN	1	1	1	1	1	1
Jamaica	JAM	1	1	1	1	1	1
Lao PDR	LAO	1	1		1	1	1
Malaysia	MYS	1	1	1	1	1	1
Mexico	MEX	1	1	1	1	1	1
Morocco	MAR	1	1	1	1	1	1
Myanmar	MMR	1		1	1	1	1
Nicaragua	NIC	1		1	1	1	1
Pakistan	PAK	1	1	1	1	1	1
Panama	PAN	1	1	1	1	1	1
Papua New Guinea	PNG	1	1	1	1	1	1
Paraguay	PRY	1	1	1	1	1	1
Peru	PER	1	1	1	1	1	1
Philippines	PHL	1	1	1	1	1	1
Sri Lanka	LKA	1	1	1	1	1	1

Tunisia	TUN	1	1	1	1	1	1
Uruguay	URY	1	1	1	1	1	1
Venezuela, RB	VEN	1		1	1	1	1
Vietnam	VNM	1			1	1	1
(***other non-OECD sample***)							
Afghanistan	AFG			1	1		1
Angola	AGO			1	1		1
Bahamas, The	BHS				1		
Barbados	BRB			1	1		
Benin	BEN		1	1	1		1
Botswana	BWA		1	1	1		1
Burkina Faso	BFA		1	1	1		
Burundi	BDI		1	1	1		
Cameroon	CMR		1	1	1		1
Cape Verde	CPV		1	1	1		1
Central African Republic	CAF		1	1	1		1
Chad	TCD		1	1	1		
Comoros	COM		1		1		1
Congo, Dem. Rep.	ZAR		1		1		
Congo, Rep.	COG			1	1		1
Cote d'Ivoire	CIV		1	1	1		1
Cuba	CUB				1		1
Dominica	DMA				1		
Eritrea	ERI				1		
Ethiopia	ETH		1	1	1		
Gabon	GAB			1	1		1
Gambia, The	GMB		1	1	1		1
Ghana	GHA		1	1	1		1
Grenada	GRD				1		
Guinea	GIN		1	1	1		
Guinea-Bissau	GNB		1		1		
Kenya	KEN		1	1	1		1
Lesotho	LSO		1	1	1		
Madagascar	MDG		1	1	1		1
Malawi	MWI		1	1	1		
Mali	MLI		1	1	1		1
Mauritania	MRT		1	1	1		1
Mozambique	MOZ		1	1	1		1
Namibia	NAM		1		1		1
Nepal	NPL		1	1	1		1
Niger	NER		1	1	1		1
Nigeria	NGA			1	1		1
Rwanda	RWA		1	1	1		1
Senegal	SEN		1	1	1		1
Sierra Leone	SLE		1		1		1
Somalia	SOM				1		1
South Africa	ZAF		1	1	1		1
St. Kitts and Nevis	KNA				1		

St. Lucia	LCA				1		
St. Vincent and the Grenadines	VCT				1		
Sudan	SDN		1		1		1
Suriname	SUR				1		
Swaziland	SWZ		1	1	1		1
Tanzania	TZA		1		1		1
Togo	TGO		1	1	1		1
Trinidad and Tobago	TTO			1	1		1
Uganda	UGA		1	1	1		1
Zambia	ZMB		1	1	1		1
Zimbabwe	ZWE		1	1	1		1
(***other countries***)							
Albania	ALB				1		
Antigua and Barbuda	ATG				1		
Aruba	ABW				1		
Bahrain	BHR						1
Bermuda	BMU				1		
Bulgaria	BGR		1		1		
Bulgaria	BGR		1		1		
Cambodia	KHM				1		1
Cayman Islands	CYM				1		
China	CHN	1	1	1	1	1	1
Cyprus	CYP			1	1		
Czech Republic	CZE		1				
Djibouti	DJI						1
Equatorial Guinea	GNQ		1		1		
Fiji	FJI			1			
Georgia	GEO		1				
Hungary	HUN	1	1		1	1	
Iran, Islamic Rep.	IRN			1	1		1
Iraq	IRQ				1		1
Israel	ISR		1	1			1
Jordan	JOR		1	1	1		1
Korea, Dem. Rep.	PRK						1
Korea, Rep.	KOR	1	1	1	1	1	1
Kuwait	KWT						1
Latvia	LVA		1				
Lebanon	LBN				1		1
Liberia	LBR				1		1
Malta	MLT		1				
Mauritius	MUS		1	1			1
Mongolia	MNG		1		1		1
Netherlands Antilles	ANT				1		
Oman	OMN				1		1
Poland	POL		1		1		
Puerto Rico	PRI				1		1
Qatar	QAT						1
Romania	ROM		1		1		

Russian Federation	RUS	1			1	1	1
Sao Tome and Principe	STP				1		
Saudi Arabia	SAU						1
Seychelles	SYC						1
Slovak Republic	SVK		1				
Syrian Arab Republic	SYR		1	1	1		1
Taiwan, China	OAN		1	1	1		1
Thailand	THA		1	1	1		1
Turkey	TUR	1	1	1	1	1	1
United Arab Emirates	ARE						1
West Bank and Gaza	WBG						1
Yemen, Rep.	YEM				1		
Yugoslavia, Fed. Rep.	YUG				1		
Austria	AUT	1	1	1	1	1	1
Belgium	BEL	1	1	1	1	1	1
Denmark	DNK	1	1	1	1	1	1
Finland	FIN	1	1	1	1	1	1
France	FRA	1	1	1	1	1	1
Germany	DEU	1	1	1	1	1	1
Greece	GRC	1	1	1	1	1	1
Iceland	ISL			1	1		
Ireland	IRL		1	1	1		1
Italy	ITA	1	1	1	1	1	1
Japan	JPN	1	1	1	1	1	1
Luxembourg	LUX		1				
Netherlands	NLD	1	1	1	1	1	1
Norway	NOR	1	1	1	1	1	1
Portugal	PRT	1	1	1	1	1	1
Spain	ESP	1	1	1	1	1	1
Sweden	SWE	1	1	1	1	1	1
Switzerland	CHE	1	1	1	1	1	1
United Kingdom	GBR	1	1	1	1	1	1
Canada	CAN	1	1	1	1	1	1
Australia	AUS	1		1	1	1	1
New Zealand	NZL	1		1	1	1	1
United States	USA	1	1	1	1	1	1
Hong Kong, China	HKG	1	1	1	1	1	1
Singapore	SGP	1	1	1	1	1	1
Libya	LBY	1			1	1	

Note: a 1 indicates that data are available for the country and variable.

References

Abramovitz, Moses, 1995, "The Elements of Social Capability," pp. 19-47 in Perkins and Koo, eds., *Social Capability and Long-Term Economic Growth*. New York: St. Martin's Press.

Acemoglu, Daron, Simon Johnson and James Robinson, 2002, "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution", Quarterly Journal of Economics, November, 1231-1294.

Bairoch, Paul, 1988, Cities and Economic Development: From the Dawn of History to the Present, University of Chicago Press.

Barro, Robert and Jong-Wha Lee, 1994, "Sources of Economic Growth," *Carnegie-Rochester Conference Series on Public Policy*.

Bockstette, Valerie, Areendam Chanda and Louis Putterman, 2002, "States and Markets: The Advantage of an Early Start," *Journal of Economic Growth* 7: 347-69, 2002.

Burkett, John P., Catherine Humblet and Louis Putterman, 1999, "Pre-Industrial and Post-War Economic Development: Is There a Link?" *Economic Development and Cultural Change,* 47 (3): 471-95.

Chanda, Areendam and Louis Putterman, 2004, "The Quest for Development: What Role Does History Play?" *World Economics* 5 (2): 1-31.

Chanda, Areendam and Louis Putterman, forthcoming, "State Effectiveness, Economic Growth, and the Age of States," in Matthew Lange and Dietrich Rueschemeyer, eds., *States and Development: Historical Antecedents of Stagnation and Advance.* Basingstoke, England: Palgrave Macmillan.

De Long, Bradford J., 1988, "Productivity, Growth, Convergence and Welfare: Comment," American Economic Review, LXXVIII, 1138-54.

Diamond, Jared, 1998, *Guns, Germs and Steel: The Fates of Human Societies.* New York: W. W. Norton.

Diamond, Jared, 2004, "Economics: The Wealth of Nations," *Nature* 429 (no. 6992): 616-7 (June 10).

Easterly, William and Ross Levine. 1997. "Africa's Growth Tragedy: Policies and Ethnic Divisions." *Quarterly Journal of Economics* 112: 1203-1246.

Galor, O. and D. Weil, 2000, "Population, technology and growth: From the Malthusian regime to the demographic transition and beyond," *American Economic Review*, 90, 806-28.

Glaeser, Edward L., La Porta, Rafael, Forencio Lopez-de-Silanes and Andrei Shleifer, 2004, “Do Institutions Cause Growth?” Journal of Economic Growth, 9(3): 271-303

Hall, Robert E. and Jones, Charles I., 1999, “Why Do Some Countries Produce So Much More Output per Worker than Others?” *The Quarterly Journal of Economics* 114: 83-116.

Hibbs, Douglas A., and Ola Olsson, 2004, “Geography, biogeography, and why some countries are rich and others are poor,” *Proceedings of the National Academy of Sciences* 101: 3715-3720.

Knack, Stephen and Philip Keefer. 1995. “Institutions and Economic Performance: Cross Country Tests Using Alternative Institutional Measures.” *Economics and Politics* November, 7(3): 207-227.

Landes, David, 1998, *The Wealth and Poverty of Nations: Why Some are so Rich and Some so Poor*. New York: Norton.

Maddison, Angus, 2001, The World Economy: A Millenial Perspective, OECD

Mankiw, Gregory N., David Romer and David N Weil, 1992, “A Contribution to the Empirics of Economic Growth”, *Quarterly Journal of Economics*, May, pp407-437.

McEvedy, Colin and Richard Jones, 1978, *Atlas of World Population History.* New York: Facts on File.

Pomeranz, Kenneth, 2000, *The Great Divergence: China, Europe, and the Making of the Modern World Economy*. Princeton: Princeton University Press.

Putterman, Louis, 2000, “Can an Evolutionary Approach to Development Predict Post-War Economic Growth?” *Journal of Development Studies* 36(3): 1-30.

Putterman, Louis, 2003, “State Antiquity Appendix Version 2,” available at www.econ.brown.edu/fac/Louis_Putterman/.

Table 1a
Agricultural Onset and State History:
Summary Statistics

	Observations	Mean	Std Deviation	Min	Max
Sample: All Countries					
AGYEARS	111	7.31	2.2	4.96	9.85
STATEHIST50	107	0.20	0.32	0.00	1.00
STATEHIST500	107	0.21	0.31	0.00	1.00
STATEHIST1000	107	0.26	0.32	0.00	1.00
STATEHIST1500	107	0.31	0.33	0.00	1.00
Sample: Colonized Countries					
AGYEARS	71	6.14	1.68	4.96	9.85
STATEHIST50	77	0.14	0.30	0.00	1.00
STATEHIST500	77	0.14	0.28	0.00	1.00
STATEHIST1000	77	0.17	0.29	0.00	1.00
STATEHIST1500	77	0.22	0.31	0.00	1.00
Sample: Non OECD Countries					
AGYEARS	91	6.86	2.09	4.96	9.85
STATEHIST50	85	0.19	0.34	0.00	1.00
STATEHIST500	85	0.19	0.32	0.00	1.00
STATEHIST1000	85	0.22	0.32	0.00	1.00
STATEHIST1500	85	0.27	0.33	0.00	1.00

Table 1b
Agricultural Onset and State History:
Correlations

	AGYEARS	S50	S500	S1000	S1500
Sample: All Countries (n=88)					
AGYEARS	1.00				
STATEHIST50	0.51	1.00			
STATEHIST500	0.59	0.94	1.00		
STATEHIST1000	0.70	0.84	0.93	1.00	
STATEHIST1500	0.75	0.73	0.82	0.94	1.00
Sample: Colonized Countries (n=63)					
AGYEARS	1.00				
STATEHIST50	0.51	1.00			
STATEHIST500	0.55	0.98	1.00		
STATEHIST1000	0.62	0.91	0.94	1.00	
STATEHIST1500	0.66	0.78	0.82	0.93	1.00
Sample: Non OECD Countries (n=69)					
AGYEARS	1.00				
STATEHIST50	0.57	1.00			
STATEHIST500	0.61	0.98	1.00		
STATEHIST1000	0.68	0.91	0.94	1.00	
STATEHIST1500	0.71	0.80	0.84	0.94	1.00

Table 2
Estimating GDP per capita in 1500

	1	2
Constant	6.133*** (0.062)	6.132*** (0.05)
Urbanization in 1500	0.024*** (0.006)	0.016*** (0.005)
Log Population Density in 1500		0.058*** (0.015)
R-Square	0.38	0.55
Observations	32	32

Table 3a
Summary statistics for Maddison estimates and predicted 1500 GDP per capita

	Obsvns	Mean	Std Deviation	Min	Max
Maddison's GDP pc estimates	32	595	168	411	1100
Predicted GDP pc (Urbanization only)	32	587	123	461	1147
Predicted GDP pc (Urbn + Popden)	32	593	121	367	1050
Predicted GDP pc (Urbanization only)	74	565	94	461	1147
Predicted GDP pc (Urbn + Popden)	72	557	107	327	1050

Table 3b
Correlations between Maddison and predicted GDP per capita, population density and urbanization rates.
(32 observations)

	Log GDP pc 1500 (Maddison)	Predicted Log GDP pc 1500 (urbanization)	Predicted Log GDP pc 1500 (density+urbn)	Urbanization Rates 1500	Log Population Density 1500
Log GDP pc 1500 (Maddison)	1.00				
Predicted Log GDP pc1500 (urbanization)	0.57	1.00			
Predicted Log GDP pc 1500 (density+urbn)	0.74	0.88	1.00		
Urbanization Rates 1500	0.57	1.00	0.88	1.00	
Log Population Density 1500	0.73	0.59	0.90	0.59	1.00

Table 3c
Correlations between predicted GDP per capita, population density and urbanization rates.
(72 observations)

	Predicted Log GDP pc 1500 (urbanization)	Predicted Log GDP pc 1500 (density+urbn)	Urbanization Rates 1500	Log Population Density 1500
Predicted Log GDP pc1500 (urbanization)	1			
Predicted Log GDP pc 1500 (density+urbn)	0.87	1		
Urbanization Rates 1500	1	0.87	1	
Log Population Density 1500	0.59	0.91	0.59	1

Table 4
Explaining (predicted) GDP per capita in 1500

	1	2	3	4	5	6
	Dependent Variable					
	Predicted Log GDP pc 1500 (urbanization only)			Predicted Log GDP pc 1500 (urbn + popden)		
Constant	6.227*** (0.018)	6.059*** (0.08)	6.18*** (0.08)	6.146*** (0.028)	5.798*** (0.099)	5.96*** (0.096)
STATEHIST 1500	0.246*** (0.046)		0.206*** (0.05)	0.395*** (0.058)		0.265*** (0.075)
AGYEARS		0.034*** (0.01)	0.007 (0.011)		0.064*** (0.012)	0.03** (0.013)
Observations	59	55	52	59	55	52
R- Square	0.31	0.16	0.27	0.46	0.36	0.47

Table 5a
Documenting the Reversal of Fortune
Dependent Variable: Log GDP per capita 1960
Sample: Colonized countries (excludes Hong Kong, Singapore and Western Offshoots)

	1	2	3	4	5	6	7*	8*
Urbanization 1500	-.044** (0.023)							
Log Population Density 1500		-0.223*** (0.044)						
Log GDP pc 1500 (urbanization only)			-1.83** (0.953)					
Log GDP pc 1500 (urbn +popden)				-2.549*** (0.588)				
STATEHIST 1500					-0.627*** (0.236)		-0.973*** (0.257)	
AGYEARS						-0.014 (0.037)		-0.26*** (0.045)
R-Square	0.10	0.21	0.10	0.34	0.07	0.001	0.26	0.51
Observations	37	73	37	37	63	59	34	31

Notes: Columns (7) and (8) restricts the sample to countries for which we also have estimated 1500 GDP numbers. Constant included but suppressed

Table 5b
Documenting the Reversal of Fortune
Dependent Variable: Log GDP per capita 1960
Sample: Non-OECD countries (excludes Hong Kong and Singapore)

	1	2	3	4	5	6	7*	8*
Urbanization 1500	-.046** (0.022)							
Log Population Density 1500		-.180*** (0.045)						
Log GDP pc 1500 (urbanization only)			-1.897** (0.938)					
Log GDP pc 1500 (urbn +popden)				-2.483*** (0.552)				
STATEHIST 1500					-.441** (0.221)		-.921*** (0.237)	
AGYEARS						0.016 (0.038)		-.237*** (0.048)
R-Square	0.11	0.14	0.11	0.34	0.04	0.002	0.27	0.45
Observations	40	88	40	40	72	69	37	34

Notes: Columns (7) and (8) restrict the sample to countries for which we also have estimated 1500 GDP numbers.

Table 6
Documenting the Reversal: Growth Rate between 1500 and 1960
Sample: Colonized countries (excluding Hong Kong, Singapore and Western Offshoots)

	1	2	3	4	5	6	7	8
	1500-1960 Avg. Annual Growth Rate (1500 income estimate based on urbanization only)				1500-1960 Avg. Annual Growth Rate (1500 income estimate based on urbanization & population density)			
Log GDP pc 1500 (urbanization only)	-.006*** (0.002)				-0.006*** (0.001)			
Log GDP pc 1500 (urbn +popden)		-.007*** (0.001)				-.007*** (0.001)		
STATEHIST 1500			-.002*** (0.0005)				-.002*** (0.0006)	
AGYEARS				-.0006*** (0.0001)				-.0006*** (0.0001)
R-Square	0.21	0.47	0.35	0.53	0.20	0.51	0.35	0.52
Observations	37	37	34	31	37	37	34	31

Table 7a
Dependent Variable: Growth from 1960 to 1998
Sample: Colonized countries (excludes Hong Kong, Singapore and Western Offshoots)

	1	2	3	4	5	6
Log GDP pc 1500 (urbanization only)	0.012 (0.011)					
Log GDP pc 1500 (urbn +popden)		0.015* (0.008)				
STATEHIST1500			0.012*** (0.004)		0.014*** (0.004)	
AGYEARS				0.002*** (0.0009)		0.004*** (0.0008)
R-Square	0.02	0.05	0.17	0.24	0.09	0.23
Observations	37	37	34	31	63	59

Table 7b
Dependent Variable: Growth from 1960 to 1998
Sample: Non-OECD countries (excludes Hong Kong, Singapore and Western Offshoots)

	1	2	3	4	5	6
Log GDP pc 1500 (urbanization only)	0.025* (0.013)					
Log GDP pc 1500 (urbn +popden)		0.03** (0.012)				
STATEHIST1500			0.019*** (0.005)		0.02*** (0.005)	
AGYEARS				0.004*** (0.001)		0.005*** (0.0009)
R-Square	0.04	0.12	0.28	0.28	0.17	0.30
Observations	41	41	37	34	72	69

Table 8
Growth From 1960 to 1998 after controlling for 1960 GDP per capita
Sample: Colonized countries (excludes Hong Kong, Singapore and Western Offshoots)

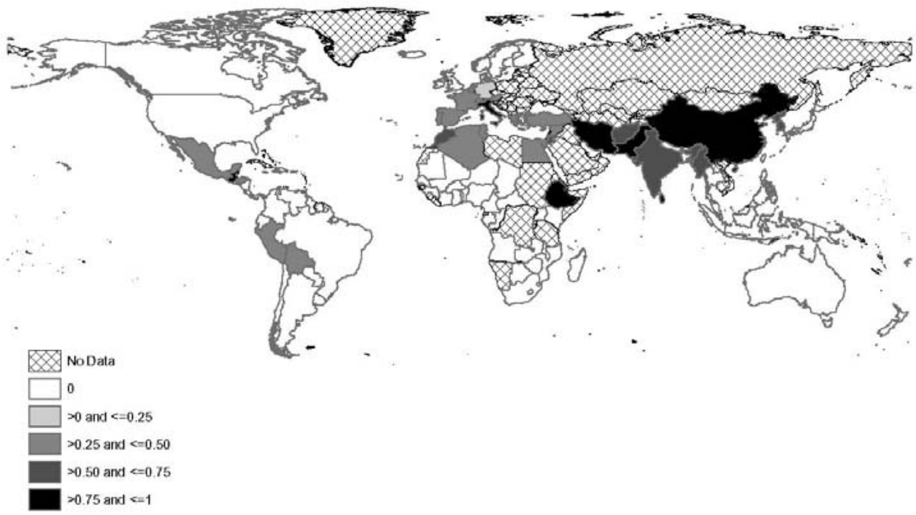
	1	2	3	4	5	6	7
	OLS	OLS	2SLS	OLS	OLS	OLS	OLS
Log GDP pc 1960	-0.004** (0.002)	-0.003 (0.002)	-.006** (0.002	-0.002 (0.003)	0.005 (0.004)	-0.0003 (0.003)	0.001 (0.003)
Log GDP pc 1500 (urbn +popden)		0.005 (0.010)					
STATEHIST1500				0.010* (0.006)		0.0143*** (0.005)	
AGYEARS					0.004*** (0.001)		0.004*** (0.0009)
R-Square	0.08	0.09	--	0.19	0.31	0.09	0.23
Observations	37	37	37	34	31	63	59

Table 9
Growth From 1960 to 1998
Robustness Check
Sample: Colonized countries (excludes Hong Kong, Singapore and Western Offshoots)

	1	2	3	4	5	6
Log GDP pc 1500 (urbn +popden)	0.028** (0.012)			0.006 (0.013)		
STATEHIST1500		0.018*** (0.004)			0.013*** (0.005)	
AGYEARS			0.003*** (0.001)			0.003** (0.001)
Log(INV19602000)	0.007 (0.005)	0.007** (0.003)	0.007** (0.003)	0.011** (0.005)	0.009** (0.003)	0.008* (0.004)
Population Growth (1960-2000)	-0.434 (0.441)	0.200 (0.354)	0.529* (0.314)	-0.089 (0.420)	0.093 (0.313)	0.427 (0.331)
Secondary Enrollment Ratio 1960	0.005 (0.024)	0.035 (0.022)	0.026 (0.021)	0.016 (0.024)	0.052** (0.022)	0.036 (0.023)
Log GDP pc 1960				-.009** (0.003)	-0.006 (0.004)	-0.003 (0.005)
R-Square	0.18	0.36	0.44	0.31	0.41	0.46
Observations	32	56	50	32	56	50

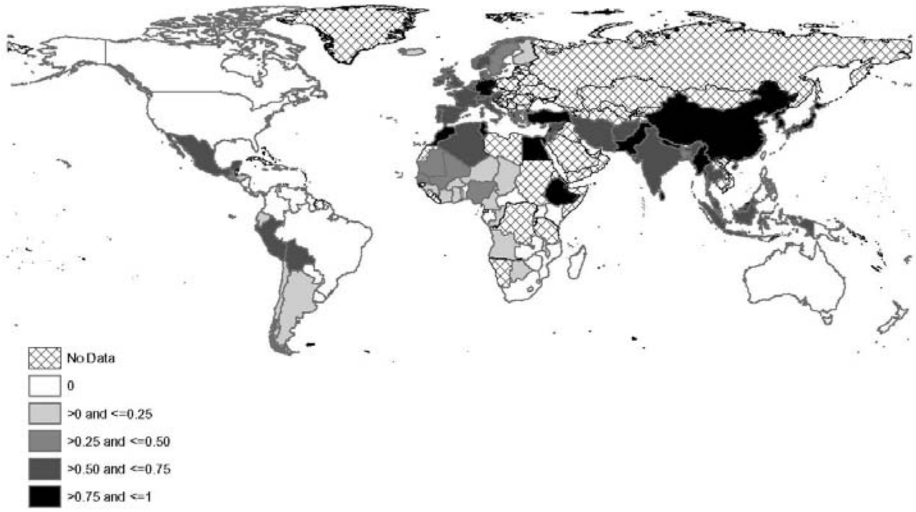
Map 1

State History 50 CE



Map 2

State History 1500 CE



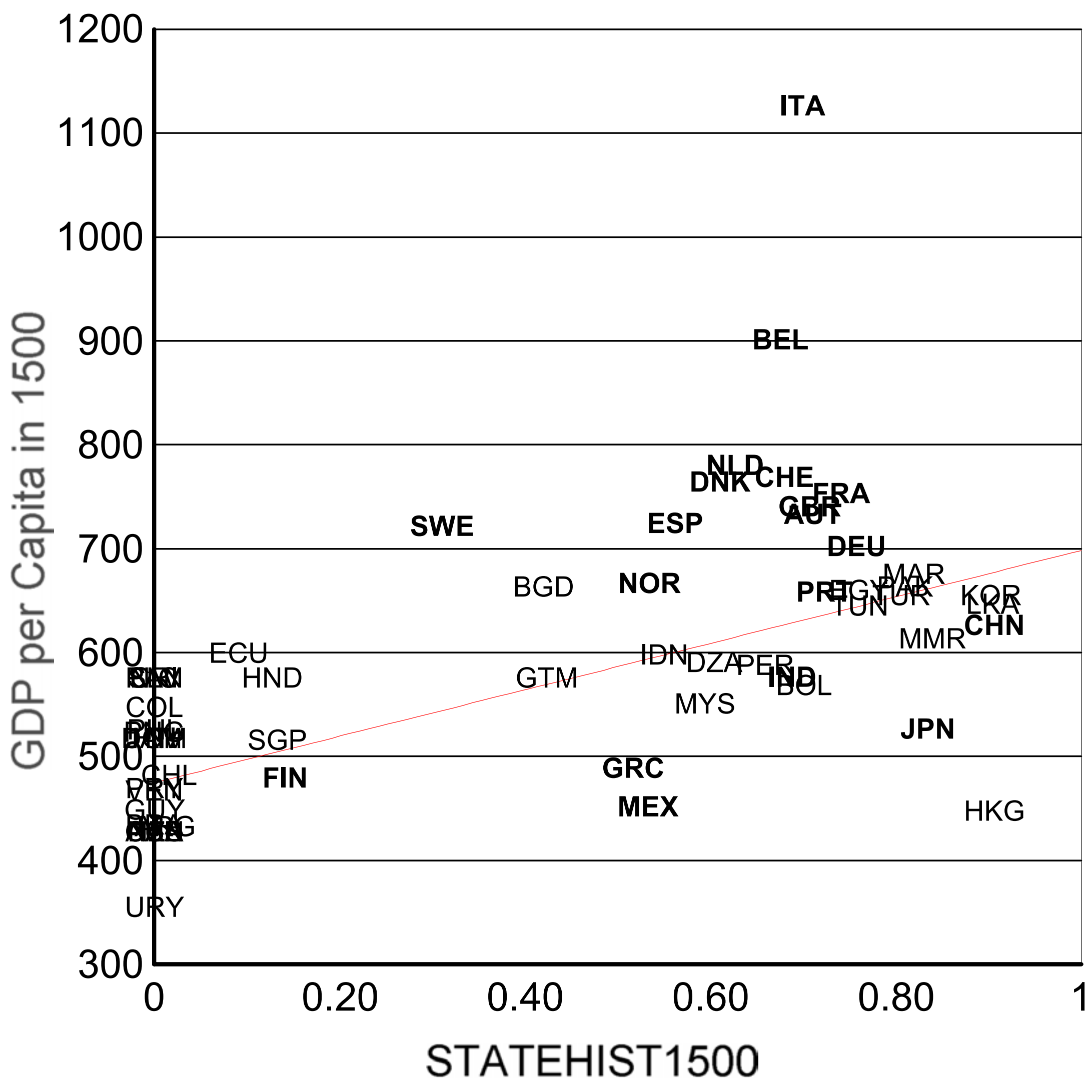


Figure 1. GDP per capita in 1500 plotted against STATEHIST1500.[27]

[27] Countries whose codes appear in bold typeface are plotted using 1500 income estimates by Maddison; the others use predicted 1500 income based on urbanization and population density in 1500. Line drawn is best fitting linear relationship between the two variables.

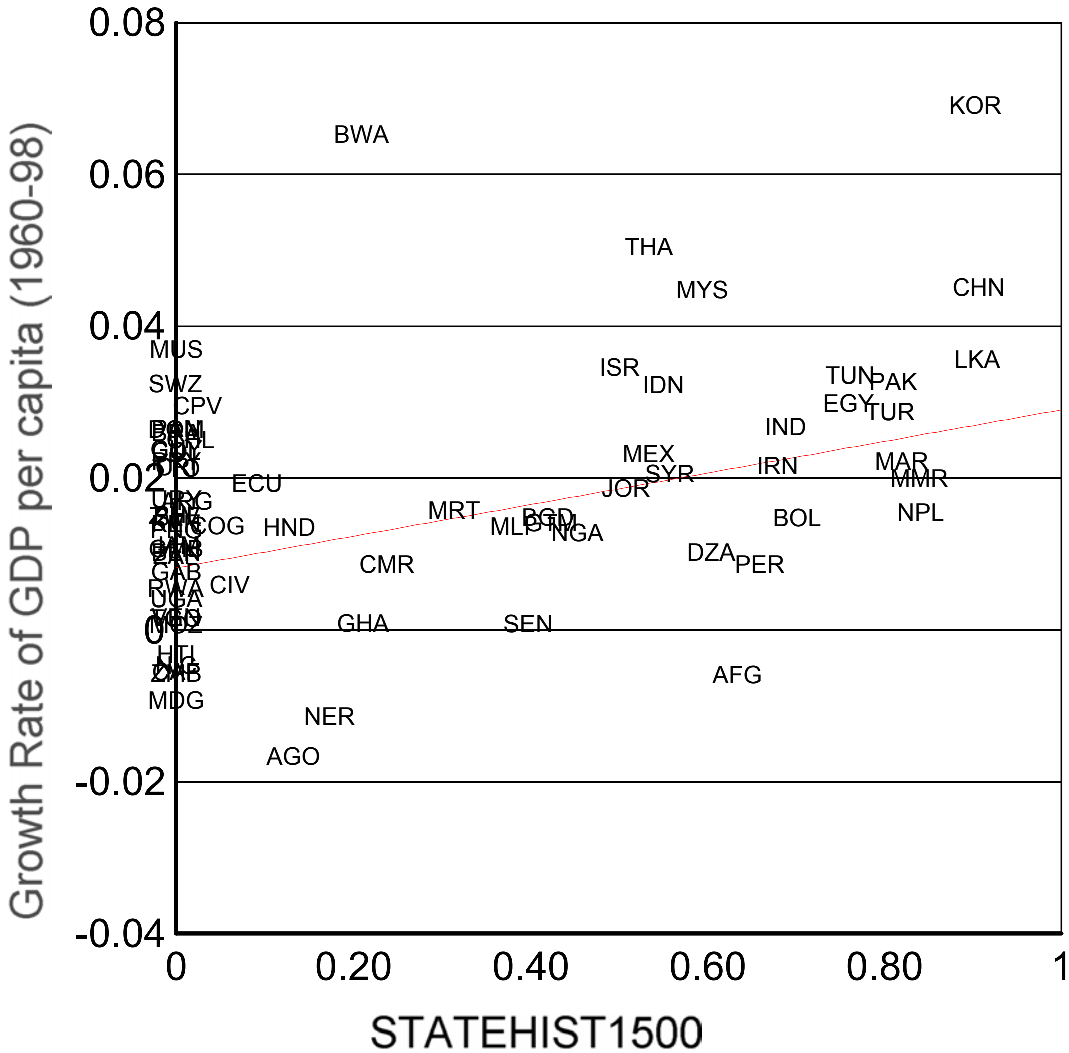


Figure 2. 1960-98 GDP per capita growth plotted against STATEHIST1500.[28]

[28] Line drawn is best fitting linear relationship between the two variables.