The Reversal of Fortune Thesis Reconsidered

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Abstract

Acemoglu, Johnson, and Robinson (2002) have claimed that the world income distribution underwent a 'Reversal of Fortune' from 1500 to the present, whereby formerly rich countries in what is now the developing world became poor while poor ones grew rich. We question their analysis with regard to both of their proxies for pre-modern income, namely urbanization and population density. More specifically, an alternative measure of urbanization with more observations generates a positive (but not significant) correlation between pre-modern and contemporary income, while a better measure of population density on arable land no longer produces a robust relationship.

1 Introduction

In a seminal paper Acemoglu et al. (2002) argue that countries in the developing world have experienced a 'Reversal of Fortune,' whereby those that were previously rich in the pre-colonial era have become poor, while those that were poor are now rich. Rather than explaining this reversal through geographic factors, they claim that different sets of institutions imposed by colonial rule resulted in differing patterns of industrialization over the past two hundred years, and that this phenomenon happened across the colonial world, regardless of the nature of the colonial power. Their thesis has drawn a great deal of attention due to its strong emphasis on European colonial rule as the major explanation for divergence in the modern world income distribution.

Naturally the biggest problem with any analysis of long-term income trends is the lack of accurate data on pre-modern income levels. Acemoglu et al. (2002) (henceforth AJR) proxy for pre-modern income in two ways, namely urbanization and population density. In both cases they argue that a higher value represents a higher aggregate income inasmuch as only societies with high incomes could support urban and dense populations.[1] In this paper, however, we question their data for these two proxies of pre-colonial income. First, their measure of urbanization contains no data from Africa and thus consists of only 41 observations; when we use an alternative measure of urbanization with 71 observations from Africa and the Americas the relationship disappears and even changes sign. Second, despite their claims to the contrary, their data on population density does not properly account for arable land, and, when corrected with better data, their results collapse across a number of econometric specifications. We use standard Ordinary Least Squares regression approaches as done by AJR.

We therefore not only suggest that AJR's analysis does not hold on a global scale but offer two specific reasons for this result. First, in no specifications do the data show a reversal within Africa, thereby suggesting that Africa's poverty was largely untouched by colonialism. Secondly, their results are largely driven by the four Neo-Europes, which, when excluded, render the relationship between pre-colonial income and contemporary GDP per capita either weakly significant or not significant. Thus, while we do not rule out a 'Reversal of Fortune' among select countries, our results suggest that whatever reversal took place was not a generalized phenomenon.

The rest of the paper is organized as follows. In Section 2, we describe the differences between AJR's data on urbanization and population density and ours. In Section 3 we present our new empirical results of regressing contemporary income levels on these two proxies of pre-modern incomes. We then offer an interpretation of the results in Section 4 and Section 5 concludes.

2 Description of the Data

2.1 Urbanization

The first proxy used by AJR for income in 1500 is urbanization, or more specifically the percentage of a given population living in cities. They use data on urbanization from Bairoch (1988) and Eggimann (1999) by supplementing Bairoch (1988)'s data on cities greater than 5000 people with Eggimann (1999)'s estimates of cities larger than 20,000 people and then converting Eggimann (1999)'s data to a 5000-person minimum. They claim in an earlier version that 5000 people is a much better threshold as it accounts for a greater number of small pre-modern cities (Acemoglu, Johnson, and Robinson, 2001; Appendix A: 1).

However, it is no accident that both Chandler (1987) and Eggimann (1999) only list data on pre-modern cities greater than 20,000 people as the data on pre-modern urbanization in the developing world is remarkably poor. Indeed, Bairoch (1988: 520) himself notes that 'given the current state of data and research, it is impossible in the case of most countries to assemble figures on urban population sufficiently complete to give a valid indication of the population of all cities with more than five thousand;' he indicated that his future efforts would be directed at lowering the population threshold to 8000 people for Europe.[2] Historians agree that data on small ancient cities can be inaccurate for the reasons that abandoned cities can disappear over time, migration routes can make it difficult to measure cities' permanent populations and much archaeological work on ancient cities in the tropics remains to be done (Connah, 2001; Hopkins, 2009). Thus even Chandler (1987)'s comprehensive data lacks population figures for 18 of the 60 cities he identifies in Africa and the Americas in 1500.

To correct for these problems we use Chandler (1987)'s data on cities of 20,000 or more for Africa and the Americas. Far from being idiosyncratic, the 20,000 benchmark determinant for urbanization is currently used by such countries as Nigeria and Syria and was used for a period by the United Nations; economists and economic historians who have used it as well include Annable (1972), Berry (1961) and Long (2005), among others. Moreover, using Chandler (1987) as our source has several advantages. First, unlike AJR's use of both Bairoch (1988) and Eggimann (1999), all of our data originates from a single source. Second, by using data directly from its source we avoid the need to convert it and thereby open ourselves to criticism of the conversion process.[3] Third and finally, this data allows us to include data on Africa in 1500 in our regressions. While AJR decided to exclude African data because they claim that it was not 'detailed' enough (Acemoglu et al., 2002: 1238), Chandler (1987)'s data contains 43 cities in Africa for 1500, or more than twice as many as in the Americas (with 17 cities). Moreover, Chandler (1987: 6) himself notes that, thanks to 16th-century data on African cities from Leo Africanus, 'Africa at 1500 stands as one of the best-prepared lists in this book.'[4] While using Chandler (1987)'s data means that we lose our observations from Asia, where Chandler (1987) only lists cities larger than 40,000, by adding Africa we improve the number of observations from 41 in AJR to 71 here.

2.2 Population Density

The second proxy used by AJR for pre-modern income is population density. For their data AJR calculate population density on arable land for the simple reason that including non-arable land would make pre-modern states like ancient Egypt appear very thinly populated and thus not very rich. They take their data on arable land from McEvedy and Jones (1978), with the claim that doing so 'excludes primarily desert, inland water and tundra' (Acemoglu et al., 2002: 1243). However, while McEvedy and Jones (1978) sometimes present data on arable land for various countries, in 86 of the 91 observations used by AJR they list no data on arable land, leading AJR to assume all land as arable for these observations. Yet this assumption is highly problematic in a large number of countries like Australia, Botswana and Canada which have large tracts of non-cultivable frozen tundra, deserts and mountains.

To correct for this error we employ here data from the FAO (2000), which for the first time estimated global data for land that is potentially arable (or potentially cultivable) for growing any one of twenty-one major crops under rainfed conditions, thereby making it suitable for assessing population densities in 1500 when modern agricultural practices were not yet in use. The FAO thus allows us to exclude deserts, mountains and other non-cultivable areas that are included in the AJR data. More technically, the FAO specifies land that suffers from such problems as poor soil drainage (as in Bangladesh, for instance), low cation exchange capacity or low nutrient levels (as in Angola and Botswana), high acid levels (as in Malaysia and the Democratic Republic of Congo), phosphorus deficiency (as in Brazil and Burundi), salinity and sodicity (as in Djibouti and Paraguay) and steep slopes (as in Myanmar and Vietnam) among others. Much of this potential arable land (henceforth PAL) is currently under pasture or constitutes forests whose clearing would imperil local ecologies, but for simplicity's sake we assume that all PAL could be cultivated. We also examine a more stringent definition of PAL called 'equivalent potential arable land' (EPAL) which downgrades marginal land proportional to its suitability for agriculture.[5]

One concern with this data is that it does not account for soil erosion since 1500. However, evidence suggests that soil erosion is more a consequence of the use of non-arable land, in particular land with steep slopes and low nutrient levels, than a cause of non-arability (FAO, 2000: 33; Pimentel et al., 1995: 1117-1118). Moreover, even if we assume that erosion and degradation did lead to significant changes over time in arability, the FAO (2000: 28) shows that soils have suffered more erosion in Africa, Asia and South America than in North America and Australasia. According to this logic there may have been even more PAL in 1500 in Africa, Asia and South America than today, which would mean lower densities in 1500 in those areas claimed by AJR to have been the richest regions in the world at the time. In other words, better historical data on land arability would most likely only add further evidence against the Reversal thesis.[6]

We can see the differences between select countries estimated by AJR as having 100% of their land as arable and the FAO data in Table 1. The disparities are stark, especially in the Neo-Europes and Africa. In fact, the FAO's estimates of PAL may be overly generous in some cases.

For instance, the Canada Land Directory grades soil quality from level 1 to level 7, where levels 1-4 are suitable for permanent agriculture land, levels 5 and 6 are suitable for grazing and level 7 is land unsuitable for agriculture; it estimates that only 10.3% of Canada's land falls within levels 1-5, and only 5.0% within levels 1-3 (Canada Land Inventory, 1976). Similarly, the Botswanan Ministry of Agriculture estimated only 5.2% of its land to be cultivable in the 1970s, with only 1% of land under cultivation at any one point (Alverson, 1984). Thus, in at least these two cases, EPAL is a better measure of cultivable land than PAL.

[Insert Table 1 here]

Another way to assess the accuracy of the FAO data is to compare it to those cases where McEvedy and Jones (1978) compute arable land for given countries.[7] For instance, AJR calculate only 11.4% of Sudan's land as cultivable based on McEvedy and Jones (1978)'s calculations of arable and pasture land – i.e., land already in some form of use by farmers or pastoralists. Yet, as elsewhere in Africa, Sudan has historically had low population densities that were not able to fully exploit its large tracts of cultivable land. Its large reserves of available fertile land contributed to its reputation in the 1970s as the potential 'Breadbasket of the Middle East,' which led to subsequent attempts to use land more productively despite ongoing war and poor governance. Thus the FAO's calculation of 867,000 Km2 of PAL – or 35% of all land – is closer to other estimates of 840,000 and 810,000 Km2 from El-Farouk (1996) and Kaikati (1980), respectively, than the mere 300,000 km2 calculated by McEvedy and Jones (1978).[8]

3 Empirical Analysis

With these new data on urbanization and arable land we can now re-estimate AJR's models. We should note, however, several changes to the dataset. First, eight Caribbean countries included in the AJR paper could not be included here due to a lack of data on potential arable land, namely the Bahamas, Barbados, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, St. Vincent and Trinidad and Tobago. AJR also lack data on population densities for these countries, but assume that they have the same population density as the Dominican Republic (Acemoglu et al., 2002: 1289). We could do the same here but see no reason why we should assume that these countries, which have a combined population of 2.4 million people, had population densities on potential arable land in 1500 closer to the Dominican Republic (PAL density of 3.2) than to Jamaica (32.1).[9]

Second, we have added new data as well. For instance, we have included other former European colonies with a combined population of 41.5 million people that were inexplicably not included in the AJR analysis, namely Cambodia, Djibouti, Equatorial Guinea, Guinea-Bissau and Yemen.[10] We have also included better data for both Singapore and Hong Kong, which in each case AJR assumed had the same population density figures as the US in 1500 (Acemoglu et al., 2002: 1289). (As with the Caribbean sample, AJR provide no justification for this assumption.) In the case of Singapore we have assigned it the same population density for 1500 as Malaysia inasmuch as the two countries only became separate political entities in the 19th century. As regards Hong Kong we can compute its population density more accurately given McEvedy and Jones (1978)'s estimate of a population of 5000 people in 1500 and the FAO's calculation that only 240 out of Hong Kong's 1104 km2 territory is potential arable land.[11]

Third, inasmuch as the 'Reversal of Fortune' argument involves the transition from pre-colonial occupation to colonial domination and then post-colonial independence, we exclude three countries included in AJR which should not have been in their analysis, namely Cape Verde (which had no human occupants prior to colonization) and Ethiopia and Nepal (neither of which were colonized by Europeans). Using the same logic we also added two countries which were colonized by Europeans after 1500 but which lie in the Mediterranean, namely Cyprus (under UK administration 1878-1960) and Malta (UK administration, 1814-1964).[12] Our data is listed in Appendix 1, with descriptive statistics for our variables in Appendix 2. Having noted these changes, however, it should be noted that all results presented in this paper do not substantially change when using AJR's original sample of countries (results obtainable from authors).

We also use three geographical controls in our analysis, namely average latitude, average distance to coastline and average elevation per country, which are similar to the control variables used by AJR.[13]

3.1 Urbanization

In Figures 1 and 2 we plot log GDP per capita in 1995 against the urbanization variable used by AJR and our new urbanization variable, CHANDLER, respectively. In Figure 1, the OLS fit suggests a negative relationship between the two variables. However, in Figure 2, the OLS fit suggests a positive relationship with a poor fit.

[Insert Figures 1 and 2 here]

In Table 2, we present the results for OLS regressions of log GDP per capita (PPP) in 1995 on urbanization. The basic model we estimate is:

$$GDP_i = ά + β Urbanization_i + έ_i$$

where GDP_i is log GDP per capita (PPP) in 1995 for country *i*, $Urbanization_i$ is the Chandler urbanization estimate for country *i* and $έ_i$ is an error term assumed to be normally distributed. In Panel A we present the results with the full sample and the continent sub-samples. The first column records the result with the urbanization variable used by AJR, yielding a negative and significant coefficient. In column 2 (and all columns hereafter) we use the Chandler urbanization variable and find that the urbanization coefficient is positive and no longer significant in our full sample. In column 3 we re-run the regression after dropping observations with urbanization equal to zero and find a positive and significant relationship. This result suggests that, for those countries which had some level of urbanization in 1500, there exists a positive relationship between income per-capita in 1500 and 1995, albeit one which is not robust to our three geographical controls (not reported here).

[Insert Table 2 here]

When we split the sample by continents, as also done by AJR, we obtain different results for each continent group. We find that the relationship remains significant for the Africa sub-sample (column 4), although this result is not significant upon adding geographical controls (not reported here). Column 5 demonstrates a weakly significant and negative coefficient in the sample excluding Africa; however, as before the coefficient is not significant after the controls are added (also not reported). We also present results in columns 6-9 for sub-samples excluding the Neo-Europes (Canada and the US only, as our data does not include Australia and New Zealand), and for sub-samples of former French, Spanish and British colonies. We obtain a weakly positive and significant relationship between urbanization and log GDP for the sample excluding the Neo-Europes, and an insignificant relationship in all other sub-samples. We also test for a sub-sample of former British colonies excluding the two Neo-Europes (not reported here), with similar results.[14]

To check if we are ignoring smaller cities, we can assume that the aforementioned 18 cities listed by Chandler (1987) for Africa and the Americas that do not have population figures have the minimum level of 20,000 people per city. We rerun our regressions, presented in Panel B. For none of the sub-samples do we obtain a negative and significant coefficient for the Urbanization Max variable. The only differences between Panels A and B are that the sub-sample excluding zero values for urbanization, our Africa sub-sample and without Africa sub-sample regressions lose some of their significance.

Thus, in using the Chandler definition of urbanization we observe that the 'Reversal of Fortune' result obtained by AJR does not hold. To summarize our findings:

- The relationship between urbanization and log GDP per capita is not significant for the (African and American) full sample and all but one sub-sample.
- The relationship is positive and significant for the sub-samples excluding zero values of urbanization and for our Africa sub-sample. However, this result is not robust to the inclusion of geographical controls.
- These results hold whether we include or exclude the 18 cities listed by Chandler (1987) that do not have population figures.

3.2 Population Density

In this section we observe the relationship between population density and log GDP. The results obtained here are mixed compared to what we obtained using the urbanization variable. The following figures plot log GDP per capita in 1995 against log population density in 1500; first, in Figure 3 for population density variable used by AJR, and in Figure 4 for our new population density variable, PAL. We observe a clear negative relationship in Figure 3. However, in Figure 4, while the plot generates a similar negative sloping OLS fit, it appears to be driven by specific data points. To isolate the effects of certain countries, we will therefore not just test for the relationship using the full sample data, but also by using sub-samples of countries, as described below.

[Insert Figures 3 and 4 here]

We estimate OLS regressions of log GDP per capita (PPP) in 1995 on our new population density variables. The basic model we estimate is:

$$GDP_i = \gamma + \theta PopulationDensity_i + \acute{\varepsilon}_i$$

where GDP_i is log GDP per capita (PPP) in 1995 for country *i*, $PopulationDensity_i$ is the population density estimate for country *i* and $\acute{\varepsilon}_i$ is an error term assumed to be normally distributed. Table 3 presents the results for the continent specific sub-samples and the former colony sub-samples. In Panel A columns 1 and 2 present the results with the AJR definition of population density and the FAO-corrected definition of population density, respectively. While in both cases there is a negative and significant relationship, the size of the coefficient for the FAO population density variable is less than half of the coefficient of the AJR variable. Moreover, the goodness of fit (the R^2) of the FAO variable regression is 0.09, or only one quarter the size of the 0.35 R^2 obtained in the original AJR regression. Column 3 presents the results with the FAO variable and geography controls, and the relationship remains negative and significant. However, the following sub-samples obtain mixed results. While the coefficient is negative and strongly significant for the sample without Africa (column 4), it is not significant for only Africa (column 5). For the sample without the Americas in column 6 the relationship is again not significant, and barely significant for the sample with only the Americas (Column 7).

[Insert Table 3 here]

In Panel B we present the regressions with the former colony sub-samples. While AJR find that for the sample excluding the four Neo-Europes results in a significant relationship (t-statistic = 5.33),[15] in our sample the same sub-sample generates a barely significant relationship (with t-statistic = 1.90). The relationship is not significant for former French and Spanish colonies in columns 2 and 3, respectively. In column 4 the relationship is again significant for former British colonies, but becomes insignificant when the Neo-Europes are dropped from the sub-sample in column 5.[16]

For robustness, we run the same regressions using EPAL. We observe a similar set of relationships between population density and log GDP in Table 4. In the full sample equivalent population density has a negative and significant relationship with log GDP, with similar results for the sub-sample without Africa; however it is not significant in the sub-samples of only Africa and without the Americas. When excluding Neo-Europes it is again weakly significant and is not significant for sub-samples of former French and Spanish colonies, and former British colonies excluding the Neo-Europes.

[Insert Table 4 here]

As with AJR we also estimate the above regressions using population density per kilometre of potential arable land in the year 1000 as an instrument for PAL. Our results, which are available upon request, correspond exactly to the same results we found with the PAL and EPAL variables previously. The relationship is negative and significant for the full sample but not for most of the sub-samples.

Our results in Tables 3-4 thus suggest that the relationship between population density in 1500 and contemporary GDP per capita is not robust.

We can now summarise our findings:

- The relationship between population density and log GDP per capita is negative and significant for the full sample, the sample excluding Africa, and the sample with former British colonies.
- It is weakly significant for the sample of the Americas and the sample excluding the Neo-Europes.
- It is not significant for the sub-samples of Africa, the sample excluding the Americas and the sub-samples of former French, Spanish, and British colonies excluding the Neo-Europes.
- Our results are robust for both the PAL and EPAL variables and are validated by the 2SLS regressions.

4 Interpretation

In using new population density and urbanization data we find two consistent results. First, the data suggests that the 'Reversal of Fortune' thesis fails to work for African countries, which together comprise a majority of our and AJR's full sample. This finding adds to and corresponds with a long literature on Africa which suggests that the continent was already poor before the advent of formal colonialism in the late 19th century, whether due to low population densities (Austin, 2008a; Green, 2011), malaria (Bhattacharyya, 2009; Bloom and Sachs, 1998) or ethnic diversity (Birchenall, 2009; Easterly and Levine, 1997), among other possible factors. It also corresponds to a recent literature suggesting an ambiguous and sometimes positive effect of colonial rule on development in Africa, especially as regards population growth, height and nutrition (Clapham, 2006; Moradi, 2009). As suggested by (Hopkins, 2009), more work on African economic history is thus necessary to help tease out the effects of colonialism on long-term economic growth.

Our second consistent finding is a lack of a reversal among former French and Spanish colonies, accounting for 49% of the sample. While we can explain the former case by the fact that 19 of 23 former French colonies were in Africa, only 2 of 19 former Spanish colonies were outside the Americas.[17] This disparity among colonial powers is not surprising, however, considering the voluminous literature on the different effects of colonial powers on post-colonial economic and political development (Bertocchi and Canova, 2002; Blanton, Mason, and Athow, 2001; Grier, 1999; Lange, Mahoney, and Vom Hau, 2006). There is some evidence in our results that this disparity is a result of the Neo-Europes, but, as with our results for Africa, this remains a topic for further investigation.

5 Conclusion

This paper has questioned the empirical analysis of AJR's 'Reversal of Fortune' thesis, specifically as regards their use of both pre-colonial urbanization and population density as proxies for pre-modern income. We found in both cases that alternative and more appropriate measurements of both proxies fail to generate a robust negative relationship between income in 1500 and contemporary GDP per capita with appropriate levels of statistical significance, and in the case of urbanization the coefficient even changes signs to suggest a positive relationship.

With our urbanization data we did not find any strong evidence of the Reversal thesis for either our full sample of countries or any of our sub-samples. With our population density variables our full sample supported the Reversal thesis but several sub-samples did not, namely those that exclude the Americas and include only African countries, former French and Spanish colonies and former British colonies without Neo-Europes. At best these results suggest that a Reversal took place among certain countries, especially in the Neo-Europes; at worst our results suggest a total lack of a Reversal among most countries in our sample.

Our point here is not to suggest that the 'Reversal of Fortune' argument is entirely incorrect. There exists a great deal of evidence to suggest that India, for instance, had higher wages than many parts of western Europe in the 16th and 17th centuries, but that over the next three centuries Indian wages dropped while European wages increased dramatically (Allen, 2005). Other recent more qualitative work on the subject has agreed with certain aspects of the Reversal hypothesis even though it suggests alternative mechanisms (Bayly, 2008; Lange et al., 2006). Our evidence, however, suggests that that this Reversal was not a global phenomenon, especially in Africa and among former French and Spanish colonies. This result is also in line with Przeworski (2004)'s critique of AJR where he observes a Reversal only for the four Neo-Europes (or what he calls the 'British off-shoots'). Certainly future scholars would benefit from further investigations into the nature of this Reversal and its causes.

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Figure 1: Log GDP per Capita (PPP) in 1995 against Urbanization Rate in 1500, AJR

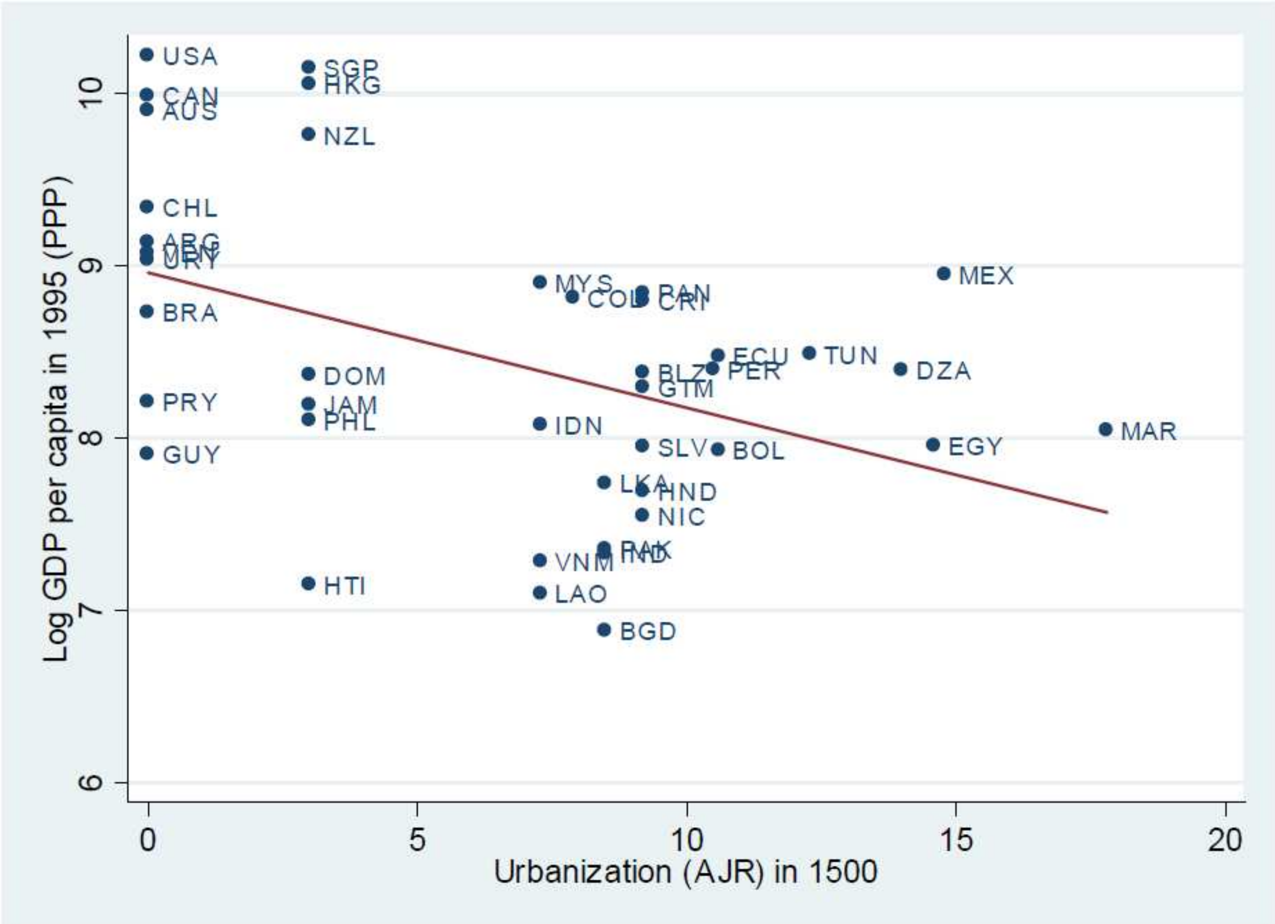

Figure 2: Log GDP per Capita (PPP) in 1995 against Urbanization Rate in 1500, Chandler

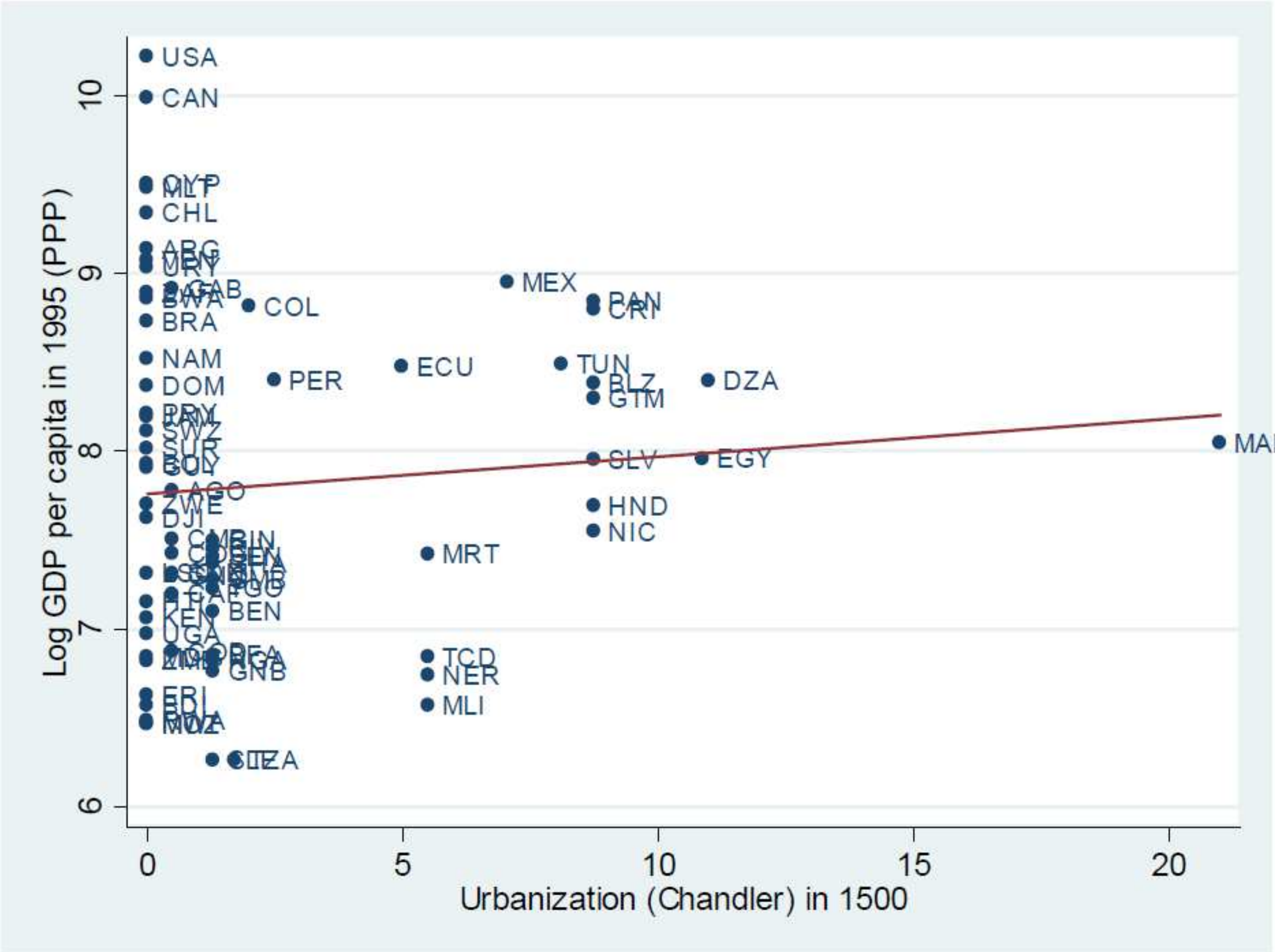

Figure 3: Log GDP per Capita (PPP) against Log Population Density in 1500, AJR

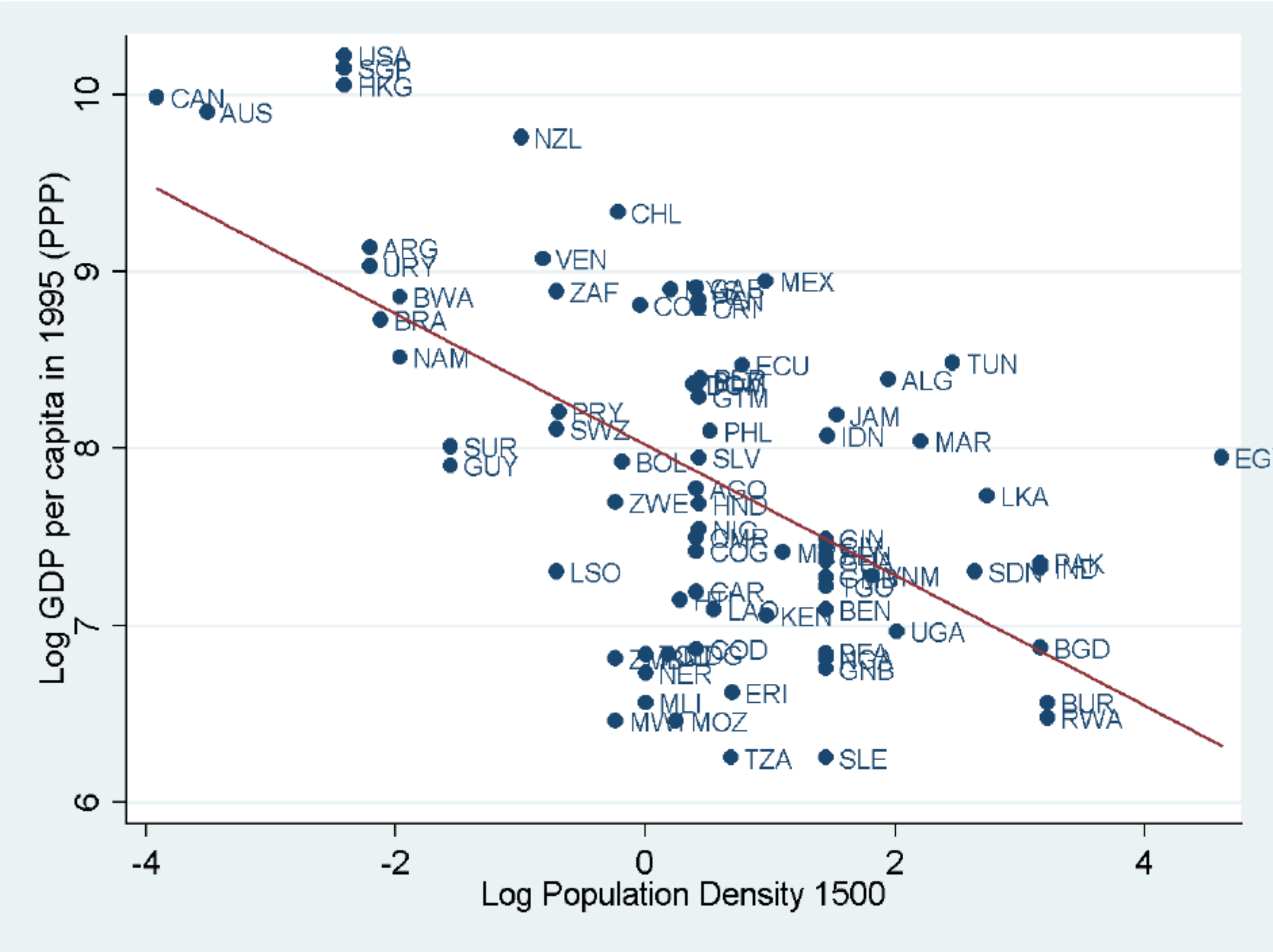

Figure 4: Log GDP per Capita (PPP) against Log Population Density in 1500, FAO

Table 1: Selected Discrepancies in Arable Land Measurements, in percentages (Source: (Acemoglu et al., 2002; FAO, 2000))

Country	Arable Land	Potential Arable Land	Equivalent Potential Arable Land
Canada	100%	12.7%	7.7%
Botswana	100	15.8	8.7
Australia	100	16.2	10.9
South Africa	100	23.0	14.7
Laos	100	25.4	15.9
Kenya	100	26.8	16.6
Rwanda	100	30.0	19.0
New Zealand	100	32.5	20.1
USA	100	37.5	28.5

Table 2: OLS Regressions of Log GDP per Capita (PPP) in 1995 on Urbanization (Chandler)

Panel A: Regressions with Chandler Urbanization variable

	Full AJR	Full Chandler	Excluding zero values	Only Africa	Without Africa	Without Neo-Europes	Only former French Colonies	Only former Spanish Colonies	Only former British Colonies
Urbanization	-0.078***	2.121	7.402***	4.222**	-5.660*	3.186*	2.055	-3.739	-1.788
	(0.023)	(1.928)	(2.447)	(1.834)	(3.199)	(1.873)	(2.580)	(3.619)	(4.533)
N	39	71	39	44	27	69	21	18	25
R^2	0.32	0.01	0.19	0.06	0.09	0.02	0.02	0.07	0.00

Panel B: Regressions with Chandler Urbanization 20,000 Max variable

	Full AJR	Full Chandler	Excluding zero values	Only Africa	Without Africa	Without Neo-Europes	Only former French Colonies	Only former Spanish Colonies	Only former British Colonies
Urbanization Max		1.469	5.957*	3.675*	4.591	2.095	1.642	-3.523	-2.018
		(1.956)	(3.105)	(2.018)	(3.113)	(1.929)	(3.016)	(3.610)	(5.036)
N		71	40	44	27	69	21	18	25
R^2		0.00	0.06	0.05	0.06	0.01	0.01	0.06	0.01

Notes: Standard errors in parentheses are White heteroscedasticity robust.

***: Significant at the 1% level
**: Significant at the 5% level
*: Significant at the 10% level

Table 3: OLS Regressions of Log GDP per Capita (PPP) in 1995 on Population Density of Potential Arable Land

Panel A: Regressions for continent subsamples

	Full AJR	Full FAO	Full FAO	Without Africa	Only Africa	Without Americas	Only Americas
Population Density	-0.370*** (0.057)	-0.155*** (0.05)	-0.203*** (0.049)	-0.188*** (0.046)	-0.01 (0.086)	-0.075 (0.069)	-0.140* (0.073)
Controls	no	no	yes	no	no	no	no
N	80	86	83	42	44	61	25
R^2	0.35	0.09	0.29	0.22	0.00	0.02	0.13

Panel B: Regressions for colony subsamples

	Without Neo-Europes	Only former French Colonies	Only former Spanish Colonies	Only former British Colonies	Former British colonies without Neo-Europes
Population Density	-0.087* (0.046)	-0.233 (0.258)	-0.076 (0.064)	-0.152** (0.064)	-0.032 (0.069)
Controls	no	no	no	no	no
N	82	23	19	35	31
R^2	0.03	0.10	0.05	0.10	0.01

Notes: Standard errors in parentheses are White heteroscedasticity robust.

***: Significant at the 1% level
**: Significant at the 5% level
*: Significant at the 10% level

Table 4: OLS Regressions of Log GDP per Capita (PPP) In 1995 on Equivalent Potential Arable Land

Panel A: Regressions for continent subsamples

	Full	Without Africa	Only Africa	Without Americas	Only Americas
Population Density	-0.148*** (0.048)	-0.180*** (0.045)	0.005 (0.077)	-0.067 (0.066)	-0.135* (0.072)
N	86	42	44	61	25
R^2	0.09	0.22	0.00	0.02	0.13

Panel B: Regressions for colony subsamples

	Without Neo-Europes	Only former French Colonies	Only former Spanish Colonies	Only former British Europes	Former British colonies without Neo-Europes
Population Density	-0.083* 0.044	-0.200 0.258	-0.074 0.062	-0.144** 0.062	-0.029 0.068
N	82	23	19	35	31
R^2	0.03	0.08	0.05	0.09	0.01

Notes: Standard errors in parentheses are White heteroscedasticity robust.

***: Significant at the 1% level
**: Significant at the 5% level
*: Significant at the 10% level

Appendix 1: Urbanization and Population Density in 1500

Country	Urban (%) AJR	Urban (%) Chandler	Population Density AJR	Population Density PAL	Population Density EPAL
Algeria	14	11.0	7.0	11.7	19.6
Angola		0.5	1.5	2.1	3.1
Argentina	0	0.0	0.1	0.3	0.4
Australia	0		0.0	0.2	0.2
Bangladesh	8.5		23.7	45.2	55.4
Belize	9.2	8.8	1.5	4.4	6.5
Benin		1.3	4.2	6.0	8.3
Bolivia	10.6	0.0	0.8	1.5	2.0
Botswana		0.0	0.1	1.0	1.7
Brazil	0	0.0	0.1	0.2	0.3
Burkina Faso		1.3	4.2	6.0	8.3
Burundi		0.0	25.0	57.9	94.3
Cambodia				12.3	16.3
Cameroon		0.5	1.5	2.1	3.1
Canada	0	0.0	0.0	0.2	0.3
CAR		0.5	1.5	2.1	3.1
Chad		5.5	1.0	4.2	6.3
Chile	0	0.0	0.8	18.0	30.0
Colombia	7.9	2.0	1.0	1.5	2.1
Congo D. R.		0.5	1.5	2.1	3.1
Congo Rep.		0.5	1.5	2.1	3.1
Costa Rica	9.2	8.8	1.5	4.4	6.5
Cote d'Ivoire		1.3	4.2	6.0	8.3
Cyprus		0.0		46.2	79.4
Djibouti		0.0		33.6	78.7
Dominican Rep.	3	0.0	1.5	3.2	4.9
Ecuador	10.6	5.0	2.2	4.7	6.5
Egypt	14.6	10.9	100.5	3305.8	6779.7
El Salvador	9.2	8.8	1.5	4.4	6.5
Eq. Guinea		0.5		2.1	3.1
Eritrea	0.0	2.0		4.6	6.8
Gabon		0.5	1.5	2.1	3.1
Gambia		1.3	4.2	6.0	8.3
Ghana		1.3	4.2	6.0	8.3
Guatemala	9.2	8.8	1.5	4.4	6.5
Guinea		1.3	4.2	6.0	8.3
Guinea-Bissau		1.3	4.2	6.0	8.3
Guyana	0	0.0	0.2	0.3	0.5
Haiti	3	0.0	1.3	3.5	5.9
Honduras	9.2	8.8	1.5	4.4	6.5
Hong Kong	3		0.1	20.8	29.4
India	8.5		23.7	45.2	55.4
Indonesia	7.3		4.3	10.9	15.7
Jamaica	3	0.0	4.6	32.1	46.3
Kenya		0.0	2.6	9.5	15.3
Laos	7.3		1.7	6.8	10.9
Lesotho		0.0	0.5	2.1	3.2
Madagascar		0.0	1.2	2.0	3.1
Malawi		0.0	0.8	1.1	1.7
Malaysia	7.3		1.2	3.0	4.2
Mali		5.5	1.0	4.2	6.3

Malta		0.0		51.3	76.9
Mauritania		5.5	3.0	4.2	6.3
Mexico	14.8	7.1	2.6	9.6	13.7
Morocco	17.8	21.0	9.1	12.2	19.6
Mozambique		0.0	1.3	1.6	2.3
Namibia		0.0	0.1	1.0	1.7
New Zealand	3		0.4	0.6	0.9
Nicaragua	9.2	8.8	1.5	4.4	6.5
Niger		5.5	1.0	4.2	6.3
Nigeria		1.3	4.2	6.0	8.3
Pakistan	8.5		23.7	45.2	55.4
Panama	9.2	8.8	1.5	4.4	6.5
Paraguay	0	0.0	0.5	0.9	1.5
Peru	10.5	2.5	1.6	4.6	6.5
Philippines	3		1.7	5.4	7.4
Rwanda		0.0	25.0	57.9	94.3
Senegal		1.3	4.2	6.0	8.3
Sierra Leone		1.3	4.2	6.0	8.3
Singapore	3		0.1	3.0	4.2
South Africa		0.0	0.5	2.1	3.2
Sri Lanka	8.5		15.5	26.9	32.4
Sudan		0.5	14.0	4.6	6.4
Suriname		0.0	0.2	0.3	0.5
Swaziland		0.0	0.5	2.1	3.2
Tanzania		1.7	2.0	2.6	3.8
Togo		1.3	4.2	6.0	8.3
Tunisia	12.3	8.1	11.7	24.2	38.6
Uganda		0.0	7.5	10.6	15.3
Uruguay	0	0.0	0.1	0.0	0.0
USA	0	0.0	0.1	0.2	0.3
Venezuela	0	0.0	0.4	0.7	1.0
Vietnam	7.3		6.1	17.3	25.6
Yemen				45000.0	112500.0
Zambia		0.0	0.8	1.1	1.7
Zimbabwe		0.0	0.8	1.1	1.7

Appendix 2: Descriptive Statistics of Key Variables

	Observations	Mean Value	Standard Deviation	Minimum	Maximum
Log of GDP per capita (PPP) in 1995	86	7.87	1.01	6.25	10.22
Population density in 1500 on potential arable land (PAL)	87	575.86	4832.19	0.01	45000
Population density in 1500 on Equivalent potential arable land (EPAL)	94	1281.93	11615.62	0.01	112500
Log of population density in 1500 (PAL)	87	1.52	1.97	-4.96	10.71
Log of population density in 1500 (EPAL)	94	1.85	1.95	-4.83	11.63
Urbanization in 1500 (Chandler)	72	0.02	0.04	0.00	0.21
Urbanization (Chandler), Max	72	0.03	0.04	0.00	0.21

[1] Moreover, they are not alone in using these proxies; other recent literature to use one or both measures include Huillery (2009) and Oster (2004).
[2] As acknowledged by Acemoglu et al. (2001, Appendix A: 1), Bairoch did not complete this work before he died in 1999, let alone move on to completing a dataset of all pre-modern cities greater than 5000 people.
[3] For instance, AJR use Zipf's law as one way to convert the data, despite the fact that recent evidence suggests that Zipf's law does not apply widely across countries (Soo, 2005).
[4] Incidentally, Chandler (1987: 3-5)'s praise of his African data is accompanied by a long discussion about the poor state of his data on China and even medieval Europe. In this regard note LeGates and Stout (1996: 21)'s criticism that Chandler's data 'must be viewed with extreme caution' due to varied sources and inconsistent methods. However, most economists and economic historians use Chandler (1987) without caveats as it is the most comprehensive quantitative source on the history of urbanization.
[5] Where one hectare of very suitable, suitable, moderately suitable and marginal land are counted as 1.0, 0.7, 0.5 and 0.3 hectares, respectively.
[6] Another issue with backdating the FAO relates to climactic shifts. However, as noted by Robinson (2003: 59-61) among others, the little Ice Age which covered large parts of the world in the early modern period lasted from the mid-16th through the late 19th and early 20th centuries and thus would not affect estimates for 1500.
[7] In fact, McEvedy and Jones (1978) do not have a single metric like the FAO for potential arable land; instead they variously list figures for 'cultivated' (Egypt), 'productive' (Algeria, Morocco and Tunisia), and 'pasture' and 'arable' (Sudan) land. For more criticism of McEvedy and Jones (1978) see Austin (2008b) and Hopkins (2009).
[8] Sudan's EPAL is 629,450 Km2, which is still closer to these other estimates than the sum from McEvedy and Jones (1978).
[9] None of our results differ substantially when we include these Caribbean countries along either Dominican or Jamaican lines.
[10] As with Acemoglu et al (2002: 1244), we exclude from the analysis countries colonized in the 20th century for the reason that their colonial experience was too short to have an impact on long-term economic growth patterns.
[11] Note that AJR's assumption of population densities of 0.09 people per square kilometre would have meant total populations of 64 people in Singapore and 99 people in Hong Kong in 1500. Both figures are clearly implausible, in particular considering the migration of settlers to Hong Kong from other parts of China during the Ming dynasty (Carroll, 2007: 10).
[12] Both Cyprus and Malta were colonized in the 19th century and decolonized in the 1960s alongside a large number of other European colonies. Both colonies were classified as Crown Colonies like most other British colonies (unlike the white settler dominions); indicative in this regard was the appearance of Queen Elizabeth on bank notes in both colonies before independence. (As with other British colonies like Kenya, Cyprus in fact was first colonized as a Protectorate before becoming a Crown Colony in 1925.) Finally, as with other colonies both Malta and Cyprus had colonial Governors until independence, upon which the British crafted their post-independence constitutions.
[13] We have also used a number of other controls from the literature on long-term economic growth patterns (Bockstette et al., 2002; Easterly and Levine, 2003; Olsson and Hibbs, 2005; Putterman, 2008), with no changes in our results.
[14] This sub-sample thus includes such countries as Guyana, India, Jamaica, Kenya and Zimbabwe, among others.
[15] Acemoglu et al (2002: 1250).
[16] All but two of these results from Table 3 are the same if we drop small states from the sample, defined as those with a size of less than 50,000 square kilometres. First, the p value in the regression excluding neo-Europes changes from p=0.07 to p=0.03 (but not at p=0.000 as in AJR); second, the p value in the regression only including countries in the Americas increases from 0.07 to 0.168.
[17] Namely, Equatorial Guinea and the Philippines.