The Persistence of Fortune: Geography, Agglomeration, and Institutions in the New World*

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Abstract

Using subnational historical data, this paper establishes the persistence of economic activity in the New World over the last half millennium. We construct a data set incorporating measures of pre-colonial population density, new measures of present regional per capita income and population, and a comprehensive set of locational fundamentals. These fundamentals are shown to have explanatory power: native populations throughout the hemisphere were found in more livable and productive places. We then show that high pre-colonial density areas tend to be dense today: population agglomerations persist. The data and historical evidence suggest this is due partly to locational fundamentals, but also to classic agglomeration effects: colonialists established settlements near existing native populations for reasons of trade, knowledge and defense. We then show that high density (historically prosperous) areas also tend to have higher incomes today: fortune persists for the United States and most of Latin America. This is contrary to findings, using country level data, of reversals of fortune in colonized areas that have been interpreted as evidence for the growth impeding impact of extractive institutions. That said, extractive institutions, in our case slavery, reduce persistence even if they do not overwhelm other forces in its favor.

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1 Introduction

Tenochtitlán was home to one of the largest concentrations of indigenous peoples in the New World when it was conquered by the Spaniards five centuries ago, and constituted an urban agglomeration rivaling those of Europe. In the words of Hernán Cortés (1522):

> This great city of Tenochtitlán is as big as Seville or Córdoba...It has many plazas where commerce abounds, one of which is twice as large as the city of Salamanca...and where there are usually more than 60,000 souls buying and selling every type of merchandise from every land... There are as many as forty towers, all of which are so high that in the case of the largest there are fifty steps leading up to the main part of it and the most important of these towers is higher than that of the cathedral of Seville. The quality of their construction, both in masonry and woodwork, is unsurpassed anywhere.[1]

Mexico City, erected on the ruins of Tenochtitlán, remains one of the largest and most prosperous cities in Latin America. This paper uses new subnational data from 18 countries in the Western Hemisphere to examine the degree to which such persistence is generally the case: Do rich (high pre-colonial population density) areas before the arrival of Columbus tend to be populous and rich today?

Most similar to the present work, Davis and Weinstein (2002) find persistence in Japanese population concentrations over very long historical spells, and despite massive wartime devastation.[2] Other recent works suggest persistence in economic activity over thousands (Comin et al., 2010) or tens of thousands of years (Ashraf and Galor, 2012). Such persistence is consistent first, with the importance of locational fundamentals such as safe harbors, climates suitable to agriculture, rivers, or concentrations of natural resources that, even if not used for exactly the same purposes, nonetheless retain value over time (Ellison and Glaeser (1999), Rappaport and Sachs (2003), Fujita and Mori (1996), Gallup et al. (1998), and Easterly and Levine (2003)). It may also suggest the importance of agglomeration effects, perhaps arising from increasing returns to scale (see Krugman, 1991, 1993) or Marshallian externalities

[1] La Gran Tenochtitlán, Segunda Carta de Relación(1522). Authors' translation.

[2] In a tragically similar case to that of Hiroshima and Nagasaki, Miguel and Roland (2011) find that heavily bombed areas of Vietnam also recovered almost fully relative to non-bombed areas.

arising from human capital or technological externalities (Krugman (1992), Comin et al. (2010), Glaeser et al. (1992), Bleakley and Lin (2012)) which may lead to path dependence and persistence across time even after the initial attraction of a site has faded in importance.[3]

However, working against persistence in the context of colonized areas, Acemoglu et al. (2002) argue for what they term a "reversal of fortune:" areas colonized that had large populations of exploitable indigenous populations developed extractive institutions that were, particularly during the second industrial revolution, growth impeding. Their finding, using global country level data, of a negative correlation between pre-colonial population densities and present day incomes has been influential in moving institutions to center stage in the growth debate, and suggests that such forces can more than fully offset agglomeration and locational forces in determining the geographical distribution of prosperity.

This paper revisits the persistence question at the subnational (state, department, region) level for the Western Hemisphere. We focus on the Americas because of the availability of anthropological and archaelogical estimates of indigenous population densities before Columbus at a geographically disaggregated level, the near universal colonization by one or more European powers, and the diversity of subsequent growth experiences. We match the pre-colonial population estimates to new data on present population density and per capita income generated from household surveys and poverty maps. We then incorporate a comprehensive set of geographic controls, including new measures of agricultural suitability and river density, which we show to have explanatory power as locational fundamentals determining pre-colonial settlement patterns. Data at this finer level of geographical aggregation allow us to take a more granular look at the role of locational, agglomeration and institutional forces behind the distribution of economic activity. In particular, using subnational data with country fixed effects mitigates identification problems caused by unobserved country or region specific factors arising from particular cultural or historical

[3] For a discussion of the importance of these effects for the ongoing evolution of economic geography among developing countries see World Bank (2008).

inheritances, and national policies (see also Gennaioli et al. (2011)).

Our empirical results suggest that the forces for persistence dominate. Population density today is strongly and robustly correlated with pre-colonial population density. Current per capita income, while somewhat more sensitive to the functional form of the estimation, is as well. Combining these results with historical evidence suggests that both locational fundamentals and agglomeration externalities plausibly explain why such persistence should occur despite the violent interaction of cultures of entirely distinct cultural, economic, institutional and technological characteristics. We do also find evidence that the institutional dynamic forwarded by Acemoglu et al. (2002) is at play. Using subnational data on slavery from the US, Brazil and Colombia, we show that such extractive institutions appear to reduce persistence, although they do not dominate the forces in its favor. The only two examples of countries with a significant negative correlation of present and past prosperity, Argentina and Chile, and the notable individual subnational unit reversals occuring in a overall country context of persistence, do not have a clear institutional interpretation.

2 Data

The use of subnational data to explore differential performance along various dimensions is now well established. As noted above, Davis and Weinstein (2002) use regional level data for Japan to document the remarkable persistence of population densities, highlighting the importance of both locational fundamentals and increasing returns to scale. Mitchener and McLean (2003) exploit modes of production and geographical isolation leading to differential de facto institutions as explaining differential growth rates across US states. Banerjee and Iyer (2005) exploit the variation in colonial property rights institutions across India to explain relative performance in agricultural investments, productivity and human development outcomes. Bonet and Roca (2006) show that areas of settlement of slaves in Colombia affect present development outcomes. Naritomi et al. (2007) analyze how variations in colonial de facto institutions in Brazil led to different public good provision outcomes in modern times. Acemoglu and Dell (2010) examine differences in productivity across Latin American subregions and postulate that differences in institutions and enforcement of property rights, entry barriers and freeness and fairness of elections for varying levels of government are responsible. Dell (2011) uses district level data from Peru and Bolivia to demonstrate the long term impact of the Mita on development through the channels of land tenure and long term public goods provision.[4] In a kindred paper using subnational data across the hemisphere, Bruhn and Gallego (2011) argue that differences in the types of regional colonial activities, whether engendering extractive or inclusive institutions, lead to lower or higher incomes, respectively. Most recently, Gennaioli et al. (2011) use subnational data from 110 countries to argue for the overiding importance of human capital in accounting for regional differences in development.

2.1 Population and Income Data

We compile subnational data on pre-colonial population densities, contemporary population densities and household incomes for the 18 countries in the hemisphere listed in Table 1, which summarizes the data by country.

Present Subnational Population Density: This measures present population per square kilometer in each subnational unit and is drawn from a highly disaggregated spatial data set on population, income and poverty constructed on the basis of national census data by the World Bank (2008) for the World Development Report on *Reshaping Economic Geography*. Population is aggregated from the census by the present subnational unit and the density is then calculated.[5]

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[4]Regional differences in institutional arrangements have also been documented in the case of slavery in the US and Brazil (Degler, 1970), and sharecropping and women's rights in Colombia (Safford and Palacios, 1998).

[5]Censuses: US, El Salvador 2000: Brazil, Panama; 2001: Bolivia, Ecuador; 2002: Chile, Guatemala, Paraguay; 2005: Mexico, Nicaragua, Peru, 2006: Uruguay. All other countries: figures correspond to survey data estimates at the regional level or small-area estimates based on survey and census data.

Subnational Income per Capita: Income in 2005 PPP US dollars is drawn from the same spatial data set. "Poverty maps" are generated which combine household level data sets with limited or non-representative coverage with census data to generate income maps for much of the hemisphere (see Elbers et al., 2003). These poverty maps address the problem that in some cases such as Mexico household income surveys are not representative at the "state" level.[6] Household income data are preferable to national accounts data as a measure of regional prosperity. In the case of natural resource rich regions, income may or may not accrue to the locality where it is generated and hence may provide a distorted measure of level of development. As an example, the revenues from oil pumped in Tabasco and Campeche, Mexico, are shared throughout the country, although they are often attributed entirely to the source state in the National Accounts (see Aroca et al., 2005). This is a broader issue that emerges wherever resource enclaves are important. For instance, from a national accounts point of view, the richest subnational units in Argentina, Colombia, Chile and Peru, respectively, are Tierra del Fuego (oil), Casanare (oil), Antofagasta (copper), and Moquegua (copper), all of which, with the exception of the last, are average or below average in our household survey measured income. Further, the geographical inhospitability of these locales ensured and continues to ensure relatively little human habitation: Antofagasta is in the driest desert in the world and Tierra del Fuego is the closest point in the hemisphere to Antarctica. This combination can give rise to a negative, although relatively uninteresting, correlation of pre-colonial population density with present income. That said, such correlations still emerge even in our income data due to the selection of the population in these areas: The very small population related to extraction of natural resources has relatively high levels of human capital and remuneration and hence, we may still find that areas which

[6]We thank Gabriel Demombynes for providing the data. See original study for methodological details. We expect that while somewhat more complete, our data is similar to the census based data used by Acemoglu and Dell (2010). For Argentina, Colombia and Venezuela, the spatial data base reports the unsatisfied basic needs index rather than income. We project subnational GDP (production) series on this index to scale it to household income. GDP source: Argentina (CEPAL, Consejo Federal de Inversiones, Colombia (DANE)), Venezuela (Instituto Nacional de Estadística). We expand the sample to include Canada and the United States using the (2005) censuses. The resulting estimates of mean per capita income have been rescaled so that the population-weighted average matches 2007 GDP per capita at 2005 US dollars (PPP adjusted).

the indigenous avoided are now relatively well off in per capita terms.

Pre-colonial Population Density: This measures the estimated number of indigenous people per square kilometer just before colonization. These data draw on a long tradition of academic research dating from the turn of the last century, much of it fuel for the debate over whether the colonial powers encountered a "pristine wilderness" or, alternatively, a world densely inhabited by indigenous peoples subsequently devastated by disease and conquest (Denevan, 1992b). The estimates contributed by the authors in *The Native Population in the Americas in 1492* (Denevan, 1992a) are among the most comprehensive and refined to date and they form the core of the data. The details on the construction of the pre-colonial density measures and their mapping to modern subnational units can be found in Bruhn and Gallego (2011). We expand the sample further using analogous data on Canada from Ubelaker (1988), and Nicaragua from Newson (1982). Though the project of estimating populations half a millennium past is necessarily speculative, the estimates synthesize the most recent available geographical, anthropological, and archeological findings. In particular, they draw on documentary evidence such as reports by Europeans, actual counts from church and tax records, as well as contemporary and recollected native estimates and counts. Depending on the country, projections across similar geographic areas, regional depopulation ratios, age-sex pyramids, and counts from subsamples of the population (such as warriors, adult males, tribute payers) are used, as well as backward projections from the time of contact with Europeans. These are corroborated by evidence including archaeological findings, skeletal counts, social structure, food production, intensive agricultural relics, carrying capacity, and environmental modification. Importantly, neither modern GDP, climate models nor current population measures are used in the construction of these estimates. Figure 1 maps these pre-colonial population densities. While some related studies have focused on cities as the unit of observation, such data are not available at our frequence for the pre-colonial period and we work with regional densities. However, as Davis and Weinstein (2002) note, for numerous reasons in particular related to defining a city over time, estimated regional population densities are arguably preferable.

2.2 Locational Fundamentals

To establish the importance of locational fundamentals, we match the population and income subnational data to a comprehensive set of geographical controls. Accounts of 18th century explorers, and anthropoligical studies confirm the importance to Indian settlements of both arable land and waterways for food and transport, characteristics also attractive to subsequent European settlers and potentially current inhabitants.[7] We incorporate two new measures to capture agricultural suitability and river density.

Suitability for Agriculture: Since agriculture was critical to early settlement, we employ a new measure of agricultural suitability as developed by Ramankutty et al. (2002). This measure uses a combination of three different data sets. First, it calibrates the satellite-based International Geosphere-Biosphere Programme Data and Information System (IGBP-DIS) 1 km land-cover classification data set against a worldwide collection of agricultural census data to capture cultivable land. To derive climatic parameters that may restrict the use of this soil, a second data set captures the mean-monthly climate conditions including temperature, precipitation and potential sunshine hours. Finally, it draws on the IGBP-DIS global soil data sets that contains soil properties such as soil carbon density, nitrogen content, pH, and water holding capacity. Combining these through a model of land suitability, Ramankutty et al. (2002) generate an index of the probability that a particular grid cell will be cultivated. We employ a spatial average of this measure over subnational units.

Waterways and Coasts: For measures of the ubiquity of settlement-suitable waterways,

[7]Denevan (1992b) discusses the extensive evidence on the importance of agriculture throughout the hemisphere in precolonial times. De Vorsey Jr (1986) cites the 18th century explorer William Bartram as noting that "An Indian town is generally so situated, as to be convenient for procuring game, secure from sudden invasion, a large district of excellent arable land adjoining, or in its vicinity, if possible on an isthmus betwixt two waters, or where the doubling of a river forms a peninsula; such a situation generally comprises a sufficient body of excellent land for planting corn, potatoes, squash, pumpkins, citrus, melons, etc." p. 13.

we employ the recently developed HydroSHEDS data that provide globally consistent hydrographic information at high resolution as collected during a Space Shuttle flight for NASA's Shuttle Radar Topography Mission (SRTM). HydroSHEDS generates a mapping of river systems from which we develop a measure of the number of potentially suitable river sites based on the density of rivers in each geographic unit.[8]

Clearly, populations could also be sustained by marine-based economies where farmland and rivers were of less importance. In fact, one current strand of theorizing on the initial colonization of the Western hemisphere posits an ocean going people progressively hopping down the western coast (Pringle, 2011). Hence proximity to the coast for saltwater trade, transport, fishing potential and amenities potentially persists in importance, much as it was subsequently for European settlement, and to capture this we employ a measure of whether or not the region is landlocked tabulated by Bruhn and Gallego (2011).

We also employ several other controls that capture suitability for human settlement as collected by Bruhn and Gallego (2011): average temperature in degrees Celsius, altitude of the capital city of the state in kilometers, and annual rainfall in meters. Some of these clearly overlap the agricultural suitability measure and hence need to be interpreted as capturing effects beyond those on agriculture. Table 2 summarizes the data.[9]

2.3 Institutions

Slavery: As a direct measure of extractive institutions, we exploit the data on slavery, measured as the percentage of enslaved and "free colored people," in the three countries

[8]HydroSHEDS stands for Hydrological data and maps based on SHuttle Elevation Derivatives at multiple Scales. The HydroSHEDS project was developed by the World Wildlife Fund and U.S. Geological Survey among other organizations.Densities were calculated using zonal statistics in ARC-GIS map. Though HydroSHEDS depicts the flow of cells into a given river system, beyond a certain size we do not take into account the flow of the river per se for two reasons. First, settlements are not likely to be proportional to the size of a river, again, beyond a certain threshold. Second, due to the geographical projection, the cells do not map precisely one to one to actual flows.

[9]Ashraf and Galor (2011b) have further suggested as determinants of population time elapsed since the Neolithic revolution, distance from the regional technological frontier, and absolute latitude. As their data is at country level, these effects would be absorbed by the fixed effects and we do not include them.

for which they are available: Brazil, Colombia and the United States. As sources, we used Bergad (2007) and different national historic censuses. For Brazil, we used the 1872 Census and for Colombia the 1851 Census.[10] For the United States, we used the 1860 Census as well as the data compiled in Nunn (2008). To capture the broader influence of slavery, both in the year of the census and in previous years, we include both slaves and the general black population which would include now-freed slaves.

3 Empirical Results

3.1 Locational Fundamentals and Pre-Colonial Densities

Figure 1 and Table 1 present a map and summary statistics of pre-colonial population densities. What is immediately clear is the great heterogeneity of pre-colonial population densities both within and between countries, as well as the substantial overlap of distributions across countries. The Latin American countries span densities averaging from around 0.4 person per square kilometer for Argentina to 1.7 for Venezuela, 2.5 for Brazil to 17 for Peru and 32 for Mexico. Further, Table 1 confirms a large range of variances of initial density. Mexico and Peru are not only dense on average, but have much larger variances than, for instance, the US. However, overall, the US and Canada fit comfortably in the Latin American distribution. With a mean population density of .39, the US is above Uruguay and is roughly the same as Argentina. Canada, at 1.22 is above Argentina, Bolivia, and Uruguay and is just below Paraguay and not so far from Venezuela. Looking at both mean and variance, the US and Argentina are effectively identical: $(.39, 1.34)$ vs $(.44, 1.45)$.

As a first check on the quality of our locational fundamentals proxies, Tables 3 and 4 report the results of running

[10] We thank Jaime Bonet and Adolfo Meisel Roca for providing their colonial data for Colombia and for pointing us towards Tovar Pinzón (1994) compendium of colonial statistics.

$$f(D_{Precol,ij}) = \alpha + \gamma LOCATIONAL_{ij} + \gamma_2 LOCATIONAL_{ij}^2 + \mu_i + \epsilon_{ij} \tag{1}$$

where $D_{Precol,ij}$, is pre-colonial density, and $f(.)$ allows flexibility in functional form of the dependent variable. As will be discussed more below, the persistence findings are somewhat sensitive to functional form and hence as robustness checks we run all our specifications with pre-colonial density both in levels and in logs. $LOCATIONAL$ is a the vector of subnational locational fundamentals and μ_i is a country specific fixed effect. Though we report a specification where fundamentals enter linearly, we also report one with quadratic terms to acknowledge that human utility is not likely to be linear in locational fundamentals, most obviously for temperature and rainfall. With altitude, also, gaining some height may limit the likelihood of disease or invasion, but the benefits potentially decline again after a point.

Tables 3 and 4 respectively present estimates for each of the level and log formulations of the dependent variable, pre-colonial population, both without and with country fixed effects (FE). We report the latter despite the fact that the territorial boundaries and corresponding national governments, institutions, and other characteristics clearly were not established at the time for two reasons. First, the generation of the pre-colonial populations was done with the present national boundaries defining the unit of analysis and by different authors and hence there may be subtle differences at that level. Second, in subsequent regressions we will care very much about abstracting from country wide effects and hence the analogous specification is desirable for reference. For robustness purposes, we also report the corresponding results using the MS (or M-S) estimator (Maronna and Yohai, 2000).[11]

[11] The estimator is a combination of M and S estimates. In the case where some variables are categorical (0-1) and some are continuous and random which may contain leverage points, as is the case here, M estimates are not robust and S estimates are computationally expensive. The MS estimator combines both and though less well-known than, for instance, quantile regression for managing potential outliers, it has several advantages. First, it is more robust to bad leverage points- outliers in the explanatory variables that also have large residuals- than either OLS or quantile estimation. Second, it is likely to provide more efficient estimates of the standard errors than the bootstrapped quantile estimates since it adjusts for outliers. Finally, it attains the maximum breakdown point, being robust to up to half of the observations being contaminated. In practice, a sizeable share of our observations in all pooled specifications are identified as outliers and hence

The MS FE are our preferred estimates and we base our calculations of maximum and minimum influence on them.

Locational fundamentals appear important to where pre-colonial native populations were concentrated, explaining up to 70 percent of the observed variance in the case of the log OLS FE. R^2 are not calculated for the MS estimator. Since the variance of the dependent variable is attentuated by the log transformation, both the higher explanatory power in the log forms, and the larger standard errors (generally less significance) in the levels form are to be expected. In general, the MS estimators generate more significant coefficients consistent with standard errors that are estimated taking into account outliers and we focus most on these. That said, while there are important differences, the stories, particularly in log formulations are not radically different between the OLS and MS estimations.

Suitability for agriculture enters significantly and positively in all but one log form specification (columns 2-8) and all levels form MS specifications (columns 5-6), albeit with diminishing value: Pre-colonial native populations were attracted to good farming conditions, but not necessarily the best we now know to be available. In both the log and level formulations, the FE estimates are quite close in value as well. Overall, this is a robust finding. The negative quadratic term reflects the low population density found both in the US Midwest and the high suitability areas of both Argentina and Brazil which, for whatever informational or historical reasons, were not heavily settled. In the log form MS FE specification (column 8), the maximum appears at a probability of cultivation of .68 which corresponds broadly to Missouri, Misiones (Argentina) and Caldas (Colombia).

The relatively high densities found in often arid relatively unsuitable areas along the coasts (see Figure 1) may, again, reflect the marine, rather than agricultural basis of the local economy. Consistent with Rappaport and Sachs (2003), being landlocked enters

a high breakdown point is desirable.

negatively and significantly in the levels form MS specifications (columns 5 and 6), and the log form FE and MS FE specifications (columns 3 and 7), although in this case it is rendered insignificant by the inclusion of quadratic terms of the other variables. While there is some concern that the coastal dummy both here and elsewhere may be picking up non linearities in other locational fundamentals, there is therefore some evidence that proximity to a coast is associated with higher population density.

Our measure of river density enters significantly, although with somewhat inconsistent influence. It enters negatively in the levels form linear OLS and MS FE specifications (columns 1 and 7) and the log form linear MS specification (column 5). In the log form quadratic MS specification (column 6), it enters negatively and significantly with a positive coefficient on the quadratic (column 6) but then enters with the reverse polarities in the MS FE (column 8). In practice, the curvature is mild but arguably the MS FE is preferred given the correction for possibly correlated fixed effects. Looking at Figure 1, it is likely that the negative/concave tendencies are partly driven by the Amazon which, despite having the richest network of waterways in the hemisphere, has very low indigenous density and which includes a substantial number of subnational units in Venezuela, Colombia, Ecuador, Peru and especially Brazil. A similar pattern is found in the US where, despite relatively (for the US) high population concentrations in the Mississipi watershed, particularly the present day states of Mississippi and Louisiana, even higher concentration are found in Connecticut, California, Massachusetts,and Rhode Island which show lesser river densities. The maximal value for the log MS FE specification occurs around the mean value for the sample at 3.3, roughly the value in California or New Hampshire.

Average temperature emerges positively in the levels form linear OLS, MS and MS FE estimates (columns 1,5,7), and in the log form linear OLS and MS (columns 1 and 5). In both the log form MS and MS FE quadratic specifications (columns 6 and 8), temperature enters positively with a negative quadratic term. The levels form MS quadratic (column

6) somewhat contradictorily shows a negative free standing and positive quadratic term, but when fixed effects are introduced, (column 8) the variable becomes insignificant. On balance, the results support the idea that humans dislike cold but, after a point, would prefer not to be any warmer. The optimal temperature in the log form MS FE specification plausibly appears to be around that found in Virginia or Mexico City (Mexico).

Altitude enters positively and significantly in the levels form MS linear and quadratic estimates (columns 5 and 6) and log form OLS linear and quadratic, OLS FE, MS, and MS FE (columns 1,2,3,5, and 7). The log form quadratic specifications introduces a slight convexity that reflects the higher densities at sea level and then, especially, at the highest altitudes where we find substantial Inca populations: La Paz and Potosi (Bolivia), as well as Huancavalia and Puno (Peru). Overall, within the limits of our sample, altitude is conducive to human settlement.

The results for rainfall broadly support, again, a concave relationship with population density: rain is desirable up to a point. In the log form MS quadratic specification (column 6), it emerges strongly with a positive free standing and negative quadratic term, a result echoed somewhat more weakly by both the levels and log form MS FE quadratic specifications (columns 8). It also enters negatively in the log form linear MS FE estimates. Recalling that the agricultural suitability term has already factored in rainfall, this finding is telling us that desert is intrinsically undesirable, but that rainfall also has diminishing value. New Hampshire appears to have the optimal level of rainfall.

In sum, we find quite strong correlations between many of our locational fundamentals proxies and pre-colonial population density suggesting that, unsurprisingly, indigenous populations were concerned with agriculture, fishing, transport, being warm enough but not too warm, perhaps avoiding diseases, and not being too dry or too wet. Of equal import, the exercise suggests that these are credible controls to be used in the subsequent regressions on persistence.

3.2 Persistence: Overview and Specification

We next explore the correlation of pre-colonial population densities with present population densities and with present per capita income. Again, the summary statistics for all three variables are found in Table 1. As a first look at the data, Figures 2 and 3 offer a striking fact. For the US, both today's state level population density and income per capita are positively correlated with the density of the indigenous population before the arrival of Columbus: economic activity appears to persist. In the next two sections, we document these correlations more rigorously for a broad set of countries of differing pre-colonial densities and present per capita incomes. For each dependent variable, we begin estimating country by country

$$f(D_{2005,ij}; Y_{2005,ij}) = \alpha_i + \beta_i g(D_{precol,ij}) + \epsilon_{ij} \tag{2}$$

where $D_{2005,ij}$, population density of subunit i of country j, and $Y_{2005,ij}$, present per capita income, are sequentially the dependent variables, $D_{precol,ij}$ is pre-colonial density, and $f(.)$ and $g(.)$ again allow flexibility in functional form. In addition to the log and levels specifications, we also report the rank correlation coefficient (effectively another transformation) which makes our results directly comparable to those of Davis and Weinstein (2002).[12] Finally, we then pool the data and estimate the within parameter β:

$$f(D_{2005,ij}; Y_{2005,ij}) = \alpha + \beta g(D_{precol,ij}) + \gamma LOCATIONAL_{ij} + \mu_i + \epsilon_{ij} \tag{3}$$

[12]Davis and Weinstein (2002) report the raw correlation coefficient rather than OLS coefficients. We do not do this for reasons of comparability to the mutivariate regressions that follow.

3.3 Current Population

3.3.1 Evidence for persistence in population

Table 5 reports β from the country by country regressions of present on pre-colonial populations density. The estimations are in OLS due to limited observations and hence are subject to the outlier concerns discussed above. However, they appear to confirm that the positive relationship found for the US is significant in both the log-log and level-level specifications. In fact, they suggests it as an overall stylized fact for the hemisphere. In the log-log specification, 15 of the 18 countries show a significant and positive elasticity. Canada is the only one to show a significant negative coefficient, largely driven by the Arctic Northwest Territories, Yukon and Nunavut which have relatively lower population densities today. For Colombia, El Salvador and Guatemala, the elasticity is above 1 suggesting a concentration of population across time. In the level-level specification 11 of 18 countries show significantly positive relationships with, again, only Canada showing a significant and negative coefficient. 14 of the 18 countries show significant and positive rank correlations, 12 show correlations that exceed .5, and Chile, Guatemala, Nicaragua and Venezuela all exceed .75. Overall, the magnitudes are broadly similar to the .71 found by Davis and Weinstein (2002) for Japan over the period CE 725 to 1998. Consistent with the lower coefficient in the log-log specification, the US is among the lowest of those showing a positive and significant correlation at .37. And again, Canada is the only negative and significant entrant. In general, the Latin American countries show far higher degrees of population persistence than the US or Canada. This may partially reflect the dramatic differences in immigration experiences at the *country* level between the US and Canada on one hand, and Latin America on the other which, with the exception of Argentina, was relativly closed.[13]

[13]From the point of view of establishing the particular channels postulated by the reversal of fortune literature, it may be argued that capital cities have a *sui generis* dynamic and should be excluded. From a general point of view of understanding agglomeration effects and persistence, this is less clear- whatever the impetus that established these cities, the existing megalopolises in Latin America are not supported in the main by goverment activities at present. Precisely the emergence of such "Urban Giants" has been studied by Ades and Glaeser (1995), while Krugman and Elizondo (1996) have focused on Mexico City. In the end, even dropping these overall strengthens the persistence results. The levels levels regression for Argentina, Brazil, and Guatemala become significantly positive and nothing becomes less so.

Table 6 pools the countries. Here, fixed effects are potentially of greater importance than in the last section because of the desire to control for country level historical effects or policies that would affect the between dimension, and we focus primarily on the FE and MS FE estimates. That said, the OLS regression estimates (column 1) are positive and significant in both functional forms and the between estimator is positive and significant in the log-log and insignificantly positive in the level-level form (column 2). The 'fixed effect estimator (column 3) generates a strongly significant coefficient in both the level-level and log-log specification, the latter yeilding an elasticity of .4. The results remain very similar when the sample is reduced to reflect the unavailability of locational fundamentals for some countries (columns 4) with the elasticity rising to .5. The MS FE estimates (column 6) also remain strongly positive and significant. Strikingly, despite an important drop in the magnitude of the coefficients in the the MS level-level specification, every fixed effect estimation in each of the two functional forms yields a coefficient on pre-colonial density that is strongly significant and positive, with the elasticity of the log-log specification on the order of .5. Population density shows strong persistence across time.

We include the fundamentals in quadratic form to soak up as much fundamental influence as possible and this lowers the magnitude of the persistence coefficient somewhat but leaves it strongly significant: in levels, the OLS FE estimates do not change (column 5), but they substantially do in the MS case (column 7) where they fall from 3 to .6 reflecting the treatment of outliers. In the log form, adding the locational fundamentals drops the coefficient substantially less, from .5 to .3 in the OLS FE (column 5) and from .5 to .4 in the MS (column 7). Part, but not the majority of our finding of persistence is thus due to persistence in fundamentals. These fundamentals enter broadly similarly to the way they did in the previous exercise, although with some important differences. Agricultural suitability is not significant in any specification confirming that it is not the driver of population agglomeration in the modern world. Rivers emerge with roughly the same degree of significance as previously with a negative quadratic term in the levels form MS specification and with both coefficients significant in the log form MS FE. Landlocked is negative and significant only in the levels form MS FE specification. Temperature enters convexly, again, although generally more significantly. Altitude is generally insignificant except for entering negatively in the MS log specification. Rainfall again appears significant in both terms in the OLS FE level, MS FE level and MS log specifications.

In sum, many of the locational fundamentals emerge statistically significant in determining current populations and with similar sign as they did in explaining pre-colonial population density although, taking all the variables together, the explanatory power is not as high as it appears to be then. The maximum R^2 is .43 in the log FE specification compared to .7 previously. Critically, however, despite a quite complete set of locational controls, the pre-colonial densities themselves appear to be robustly significant. Persistence appears to exist for other reasons related to the existence of the populations themselves.

3.3.2 What drives population persistence?

What might these reasons be? In Latin America, native populations were indeed a source of tribute and labor and hence it is not surprising that Spanish cities would be built near existing population centers, whatever factors drove their initial settlement. However, in the US, pre-colonial native populations were relatively small, topping out at around 2 people per square kilometer, and they were generally, with the exception of South Carolina (Breen, 1984), not exploited for tribute or labor by French, Anglo and Dutch colonizers. This suggests that while the argument that the Spanish and Portuguese located near indigenous populations for purposes of tribute or forced labor through the Encomienda or Mita is compelling, it is not the only mechanism through which pre-colonial agglomerations were perpetuated. To begin, throughout the new world explorers depended on native cartography and knowledge to map the relevant geographical and demographic sites (De Vorsey, 1978). New settlement was likely not to be random, but influenced by the previous "known world". The Spanish further needed the knowledge and skills acumulated by the native populations. Cortés employed the stone masons and architects of the pyramids, canals and aqueducts of vanquished Tenochtitlán to remodel Moctezuma's palace into his own, and to raise the most important city in the New World from the ruins of the Aztec capital. The large population of craftsmen and artisans was of world caliber (Parkes, 1969). The conquistadores more fundamentally needed those with a knowledge of plant life, agronomy, and hunting to feed their new towns. Hence, just by virtue of already supporting a civilization in all its dimensions, Tenochitlan was attractive beyond the brute labor force it offered and in spite of its actually lackluster locational fundamentals.[14]

In other regions, the native populations were valued for otherworldly and strategic reasons. The missions set up along the Alta California (now US) coast-San Diego, Los Angeles, Santa Barbara, San Jose and San Francisco-were established beside major native population centers (as in the Southwest) to recruit souls to Christianity, but also to create colonial subjects to occupy territories perceived under threat of English and Russian encroachment (Taylor, 2001). In these cases, it was the population agglomeration itself, rather than the locational fundamentals per se, that were the attraction and exploitation was not the primary motivation.

In non-Spanish North America, the competing colonial powers also established many cities including Albany (Dutch), Augusta (British), Pittsburgh (French and British), Philadelphia (British), St. Louis (French) on or next to native population settlements.

[14]Tenochitlan's location was allegedly determined by the god Huitzilopochtli to be established on a small, swampy, island whose chief attraction appears to be that it was uncoveted by the neighboring tribes and was defensible. Parkes (1969) notes that the Mexica (Aztecs) were the last tribe of seven to enter the valley and wandered as outcasts, selling their services as mercenaries to the dominant tribes, and eating reptiles and pond scum to survive. They had the worst pickings of a not entirely favorable locale. The valley of Mexico, and in particular Tenochitlan, had unreliable weather, with a short growing season and frequent drought. Famine was not uncommon. The lake was subject to storms and a major flood in 1499 caused the loss of much of Tenochitlan (Thomas, 1993). Simpson (1962) notes that "With the silting up of the lakes and consequent flooding, the city was frequently inundated with its own filth and became a pesthole. Epidemics were a scourge for centuries and were not brought under control until the opening of the Tequixquiac drainage tunnel in 1900" (page 164).

Partly, the colonists, like the native populations, valued the areas of rich alluvial lands along the major river systems that served as the primary mode of transportation and communication, or the strategic locations. Bleakley and Lin (2012) argue that portage sites around rapids or falls gave rise to agglomerations in commerce and manufacturing that persist today, suggesting path dependence and increasing returns to scale. However, the native populations were critical attractions in themselves as well, again, largely for informational, commercial, and strategic reasons. As Taylor (2001) notes, "On their contested frontiers, each empire desperately needed Indians as trading partners, guides, religious converts, and military allies. Indian relations were central to the development of every colonial region"(p. 49). From Canada to Louisiana, trade and defense led the French to establish their trading posts as nodes of trade and negotiation for securing alliances and food. In the North, French and Dutch Fur traders exploited existing networks of native tribes as suppliers of pelts. Quebec, for example, was located in an area where the local natives were skilled hunters and the nearby and numerous Huron nation served as provisioners and trade middlemen. Similarly, on Vancouver Island and throughout the Pacific Northwest, the British traded extensively with natives in sea otter pelts. Linking geographical fundamentals and pre-colonial populations, Bleakley and Lin (2012) note that the portage site on the Savannah River (now Augusta) was an important collection point for pelts brought by the native hunters. Pre-colonial Indian population concentrations offered benefits to colonizers along many dimensions, and those of trade in goods and information are classic positive externalities associated with agglomerations.

Conversely, for some indigenous agglomerations, contact with European culture and technology may have perpetuated their dominance after an initial period of trauma, particularly given the proximity to the Industrial Revolution. Comin et al. (2010) for instance, document an association between technology in 1500 AD and present income, roughly our period. Ashraf and Galor (2011a) argue that at the moment of transition between technological regimes, more cultural diffusion facilitates innovation and the adoption of new technologies.

Our documented patterns of persistence may therefore be partly driven by the degree to which the conquest transferred the old world technological endowment.[15] The population centers of the earlier Maya, Anasazi, and Toltec civilizations have vanished. Perhaps partly because of their contact with the Spanish, the Aztec population center persists.

Taken together, locational fundamentals, agglomeration externalities, and technological transfer may plausibly contribute to an explanation of why pre-colonial densities mapped to early colonial densities which, in turn, have persisted to this day.

3.4 Current Income

3.4.1 Evidence for persistence of income

The previous section confirms for the Americas Davis and Weinstein's (2002) finding that population density is persistent over very long periods of time. While an important conclusion in itself, Acemoglu et al. (2002) have also argued that historically population densities reflected wealth or prosperity-richer areas can support larger populations-and hence were fortune persistent, we would find a positive correlation with present income as well. Their striking finding, using global country level data, that pre-colonial population densities are negatively correlated with present income per capita, has lent credence to their conclusion that extractive institutions were growth inhibiting and caused a "reversal of fortune."[16] What follows revisits this correlation at the subnational level.

Because the relationship with income is more heterogeous and complex than that with population, we reproduce figures for eight informative countries in Figure 4 which again, with

[15] See Coatsworth (2008). Steckel and Prince (2001) argue that one reason that the US plains native americans were the tallest people in the world was the buffalo and game made more accessible with the introduction of horses, metal tools, and guns by Europeans.

[16] The relationship between present population and present income may be expected to be less tight than historically was the case for at least two reasons: as Ashraf and Galor (2011b) and Galor (2011) note, the traditional Malthusian relationship between population and wealth weakens with technological progress, and the natural resource endowment effects discussed earlier.

two exceptions, suggest persistence. Table 8 tabulates the β of present income per capita on pre-colonial densities from equation 1. Again, the first column is a log-log specification. The second is a log-level specification. In both specifications, Argentina and Chile show negative and very significant coefficients consistent with, for example, the reversal of fortune argument. However, in the log-log formulation, Bolivia, Colombia, El Salvador, Nicaragua and the US and are positive and often strongly significant. In the log-levels formulation, the coefficient for Bolivia becomes insignificant, but the corresponding positive coefficient for Canada becomes significant.[17]

The pooled regressions (Tables 9 and 10) are more sensitive to specification than those for current population density but, taken in total, support persistence. In the log-level estimates, the case is particularly strong. The coefficient on pre-colonial density shows a negative, but insignificant relationship in the OLS and between estimators, but a strongly significant positive relationship in all of the within estimates. Including the locational fundamentals leaves the OLS FE estimates unchanged at .09 albeit somewhat more statistically significant. The MS freestanding estimates are lower than the OLS FE case (.06) and actually experience a statistically significant rise to .1 when the fundamentals are included. Whether due to the fact that altitude and rainfall now enter with reversed sign relative to the pre-colonial density regressions, or other factors, locational fundamentals appear to decrease persistence in this case. The log-level specifications strongly support persistence that is *not* related to locational fundamentals: high density pre-colonial density areas appear richer now because they were dense.

In both log-level and log-log specifications, the influence of locational fundamentals appears attenuated somewhat: agricultural suitability, river density and temperature never appear significantly. In modern economies, farming areas are no longer the richest areas

[17]When capitals are dropped, the log-level coefficient for Bolivia becomes significant and positive, as does the log log coefficient for Canada. On the other hand, the log-level coefficient in El Salvador loses significance and in Mexico, dropping the Federal District does lead to a reversal in the log-log specification as the Northern states come to dominate the regression.

of the economy; river density is not essential for fishing or transport; air conditioning allows living in desertic areas such as the US Southwest. Landlocked enters negatively and significantly and altitude and rainfall enter positively with diminishing effect as in the pre-colonial regressions. However, their introduction into the log-log specification complicates the previous results. The coefficient on pre-colonial density enters negatively and significantly for the OLS (column 1) and between regressions (column 2), but no significant relationship in either of the OLS FE or the MS free standing specifications (columns 4, 5, and 6). The introduction of locational fundamentals (column 7) now leads to a negative and significant coefficient, consistent with the reversal of fortune argument.

The differing results with respect to the log-level specification suggest the potential sensitivity to functional form in all such exercises, and the need to explore why each form yields the results it does. In the present case, the differences in results partly arise from the fact that the two formulations give very different weight to critical observations. In the regressions with pre-colonial density in levels, very dense regions are heavily weighted. However, in the log-log specifications, high pre-colonial density areas are pulled toward the mean. At the other end of the spectrum, wealthy areas with very small pre-colonial populations now take very extreme values and become more influential. For example, the Galapagos Islands in Ecuador constitute the most extreme observation with vast tourist rents paired with the virtual absence of pre-colonial population. The next most influential points, Magallanes and Ibañez de Campo in Chile are respectively the closest and second closest regions to Antarctica and have roughly 150,000 people each today.[18] Arguably, we are less interested in the fact that tourism can thrive in an environment where natives did not (Galapagos) or that natural resources are often found in uninhabitable places than in understanding the impact of increasingly substantial native populations. Hence, we find the levels formulations more germane to the question of persistence and the importance of

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[18]Bruhn and Gallego (2011) report a negative and significant coefficient using their national accounts data in the log log specification which, in line with the discussion in the data section, we attribute to the fact that this data exagerates the income of resource rich/low population areas. That said, rerunning their specification in log-levels again generates strongly significant and positive coefficients.

institutions.

The weighting effect also appears to give relatively more influence in the log-log specification to the only two countries, Argentina and Chile, that Figure 4 and Table 8 suggest had strong negative and significant correlations, yet which have very low pre-colonial densities. Table 11 shows that, dropping these two countries, there are now no remotely significant negative coefficients in the log-log formulation (columns 5-8) while the log-level regression estimates (columns 1-4) remain positive and significant. Understanding what drives the negative correlation in these two pivotal cases therefore is of special import to interpreting the results and, as we will see below, the evidence does not suggest an institutionally driven reversal dynamic.

In the next section, we first take a more careful historical look at two clear examples of persistence, the US and Colombia; and then the emblematic colonial experiences, Mexico and Peru, which appear with positive, but statistically insignificant tendency. Finally, we examine the roots of the negative relationship found in Argentina and Chile.

3.4.2 Clear examples of persistence: The US and Colombia

Persistence holds strongly in the US whether pre-colonial density enters in log or level form. California, Massachusetts, and Rhode Island again, show the highest pre-colonial density and above average incomes. Among the mid level pre-colonial density states, New Jersey, Connecticut, Delaware, are also among the richest, and Washington and Oregon are solidly above average. This mass of points on the two coasts drives the upward sloping relationship while a diffuse mass of largely southern and mountain states anchors the low per colonial density-low current income nexus.

As noted earlier, higher incomes plausibly find their roots both in the initial native agglomerations and locational fundamentals that attracted both native populations and

Europeans. There is also an argument for poor institutions driving the poorer regions, albeit not the one envisaged specifically in Acemoglu et al. (2002) but rather more in line with Acemoglu et al. (2001). The adverse disease environment and climate of much of the South discouraged settlement and, in the end, colonization required the importation of African slaves. This gave rise to a different set of extractive institutions *inversely* related to pre-colonial densities. In fact, the only state that, on the surface, would fit the Acemoglu et al. (2002) dynamic might have been Mississippi since it incorporated the third largest native civilization in North America, was abused by the Spaniards, and is now the poorest state. However, the reversal of the state's fortune from a rich cotton center in the 19th century is likely more due to the institutional, demographic and education legacy of African slavery than the long vanished native population.[19] We explore the influence of slavery on persistence in a more structured manner in section 4. Overall, for a moderate range of pre-colonial densities, the US suggests the persistence of economic activity.

Colombia is a critical case study for establishing persistence and testing the reversal of fortune dynamic for several reasons. First, though it is not among the countries with the highest pre-colonial density, it is a classic example of Spanish conquest with the usual attendent institutions. Hence, while we might argue that something about Anglo or French colonists led to different colonizer-native dynamics, this would not be the case in Colombia. Second, the country is highly geographically framented and its regions have shown a fierce autonomy, long resisting centrally imposed rule. As Safford and Palacios (1998) note, "Provincial government remained effectively independent of the Audiencia [the local Spanish

[19]As Taylor (2001) notes, the Spanish conquistador Hernando de Soto arriving in the fertile Mississippi river valley in 1540-1542 was impressed by size of native populations, the expansive maize fields, the power of their chiefs to command large numbers of well trained warriors, even the pyramids, one of which was the third largest in North America after those of central Mexico (The pyramid at Cahokia was near present day St. Louis.) De Soto died on the banks of the Mississippi, frustrated at finding no gold, and the Spaniards withdrew to Mexico City, but not before widespread pillaging and infection decimated the native population. When the French returned a century later, only the Natchez people near present day Natchez, Mississippi remained in strength and organization. French encroachments on Natchez territories in 1729 led to massacres by the French and their Choctaw allies and dispersion and sale into slavery in the French West Indies of the surviving population. With the passage of another century, Natchez and Mississippi would emerge very prosperous at the height of the cotton boom.

seat of control], and Santa Fe de Bogota lacked formal authority of what is now western Colombia"(p. 55). This means that national institutions were relatively less important than local institutions and, as noted earlier, a variety of local institutional structures coexisted. Several regions employed both native and African slaves and evolved extractive institutions to manage them, others far less. Similarly, the Mita, Resguardo, and Encomienda are found to varying degrees in different departments. While such fragmentation and differentiation is common in Latin America, Colombia is thus arguably one of the best suited to test the institutional story underlying the reversal of fortune at the subnational level. Yet, Colombia shows one of the cleanest examples of persistence in the sample (Figure 4). Not only the capital, but other areas of high pre-colonial density-Valle de Cauca, Santander, and Antioquia-have among the highest present day incomes. This is strongly suggestive of the importance of locational fundamentals and agglomeration effects, and less so, perhaps, of dynamics relating to extractive institutions.

That said, one particular reversal within the country merits investigation if only because it would seem to fit the institutional story so well. Although understated in the figures, Cauca department and its principal city Popayán fell from one of the two most important regions in Colombia-a major provider of early Colombian presidents and possessor of one of the country's two mints-to one of the poorer regions. The Spaniards favored it for the availability of indigenous labor to extract its mineral wealth, and its subsequent use of imported African slaves defined its culture in fundamental ways. However, the city that it lost market share to, Cali, in Colombia's now second richest department, Valle de Cauca, had an indigenous population density 30% larger and only 10% fewer slaves per capita than Cauca. In fact, it had the largest number of slaves of any department in Colombia.[20] The period critical to the reversal appears to be 1878 to 1915 with the construction of the Pacific Railroad connecting Cali with Buenaventura, Colombia's largest Pacific port, and through the Panama Canal (finished in 1914) to the rest of the world, while Popayán remained

[20]According to the 1843 Census of Colombia, 7.1% of the population was slaves in Cauca and 6.4% in Valle; in 1851 4.7% and 4.3% respectively. Initial indigenous density was 7.1 and 9.2 respectively.

relatively isolated (Safford and Palacios 2002). It is likely that the location of the railroad, while importantly dictated by Cali's proximity to the Cauca River, is partly due to political economy considerations. However, a story related to initial populations or slavery does not appear clearly. It seems more likely that a permanent shock to locational fundamentals fundamentally altered the relative attractiveness of the two regions rather than dramatic differences in institutional quality.[21]

3.4.3 Mexico and Peru: Evidence for persistence on balance

Mexico and Peru are the emblematic examples of the colonization of the New World. They also show pre-colonial densities, and variances, that are among the highest in our sample. Hence, positive agglomeration effects should be exaggerated, as, presumably, should those arising from extractive. Both El Salvador and Nicaragua have comparable densities and show a significant positive coefficient in Table 8 indicating persistence. However, for neither Mexico nor Peru is this the case. Closer examination suggests, however, that they, too, offer support for the importance of the forces of persistence, albeit contaminated by changes in locational fundamentals.

For Peru, Figure 4 suggests that Lima, La Libertad, Ica and Piura all correspond to very high pre-colonial density areas that remain among the better off regions today. However, Lambayeque province undermines the statistical relationship by showing the highest density observation but below average current income. In fact, dropping Lambayeque from the sample causes the log-level coefficient to jump from .39 to a strongly significant 1.1. Lambayeque's decline appears largely driven by compounding natural disasters-negative locational fundamental shocks. In pre-colonial times, the region was a major center of the Chimor and then, Inca cultures. The Spanish colonizers subsequently built a livestock industry on appropriated native land and irrigation systems, as in Tenochitlan, taking

[21] A similar story is the rise and fall of Mompóx, Colombia. This affluent port in the Magdalena River saw its demise when the river shifted course, allowing the development of Magangué. Since then, this UNESCO World Heritage Site has virtually remained stuck in time.

advantage of the infrastructure and knowledge of the previous civilization. From 1650 to 1719, a dynamic sugar based hacienda economy emerged and generated numerous fortunes. However, after 1720, the economy collapsed into a century long period of stagnation. While this was partly due to competition from other Peruvian (including local native) and Caribbean producers, a plague of cane-eating rats in 1701 followed by two devastating floods in 1720 and 1728 constituted idiosyncratic but very long lived shocks which caused widespread foreclosures and the bankruptcy of the traditional producing class. Only in the late colonial period did the regional economy recover somewhat to a now average level income as the new owners shifted from sugar to livestock and tobacco (Ramirez, 1986).[22] Since the shocks driving Lambayeque's fate seem idiosyncratic and dropping the region causes Peru to join countries showing persistence with lower mean densities, Peru, should probably be seen as confirming persistence across a wide range of initial densities.

Mexico appears to combine two distinct sets of growth dynamics that interact to obscure any clear relationship. The first is the persistence effect. The Mexican Federal District (city) is the highest density region in our sample and it is one of the richest regions in all of Latin America. Morelos, the second densest region in our sample, has above average income. Both suggest persistence in the most native intensive regions of the hemisphere. Tlaxcala, the third most dense area in Mexico ranks among the lower levels of prosperity. However, it seems unlikely that we can attribute it to especially extractive institutions since, in exchange for being the principal allies of the Spaniards and sheltering them in a particularly dire moment in the conquest of Tenochitlan, the Tlaxcalans were granted "perpetual exemption from tribute of any sort," a share of the spoils of conquest, and control of two bordering provinces, an agreement that was substantially respected for the duration of Spanish rule (see Simpson, 1953; Marks, 1994, p. 188).[23] Among the very highest pre-

[22]Lambayeque did differ in its continued heavy reliance on Indian labor as competitor sugar growing areas shifted more toward African slaves, although it is not clear whether this should have generated more or less toxic extractive insitutions.

[23]In fact it may have been the opportunities for adventurism in partnership with the Spaniards in other areas of the New World that diverted energies from the home region. Tlaxcalans aided the Spaniards in

colonial densities in our sample, the Acemoglu et al. (2002) effect is not obviously in evidence.

However, there is a second dynamic. The present high income of the low pre-colonial density states of Baja California Sur, Nuevo Leon, Baja California Norte, Chihuahua, Sonora, and Coahuila provide a strong countervailing "reversal" that offsets the persistence effects. The proximity of these states to the increasingly dynamic US border makes it difficult to disentangle the influence of various types from the North (proximity to markets, knowledge spillovers), where it was in large part an appendage of the US economy, as opposed to the absence of extractive institutions. At the time of the establishment of the border at the Rio Grande, it was linked by population flows and contraband; during the civil war, it was a signficant Southern export outlet; and by the turn of the century, it had received substantial US investments in railroads and mining that gave the impetus to the development of capitalism in the North (Mora-Torres, 2001). For instance, US firms operated mines in the North for export to US foundries (e.g. Consolidated Kansas City Smelting in Chihuahua). The three large foundries that formed the basis for the future dynamism of the principal industrial city in northern Mexico, Monterrey, Nuevo Leon (with spillovers to much of the north of Mexico) were primarily oriented toward the US market, and the largest was established by the Guggenheim interests with US capital (Morado, 2003).[24] As Marichal (1997) notes, the emerging industry in these areas gave impetus to a set of de facto and eventually de jure institutions and pro-industry regulations which may well have only been able to emerge in an environment where the regulatory structure had not been driven by extractive considerations. That said, the fact that a positive correlation (strongly significant in the log levels specification) emerges when we abstract from the border states causes us to think that the institutional effect was not dominant, and

dominating conquered tribes moving North. The oldest church in North America, found in Santa Fe, New Mexico was constructed by Tlaxcalan artisans.

[24]As Mora-Torres (2001) notes, these foundries emerged largely as a result of the McKinley tariffs of 1890, which taxed foreign imports at roughly 50 percent. This threatened both Mexican exports of ore to the US, as well as the smelters on the US side that processed them. The response was to move the smelters over the border to the railway center of Monterrey. The result of the accumulated US capital investment was "that the northern economy became an extension of the U.S. economy and that the North turned into the new center of Mexican capitalism" p. 9.

that the proximity to the US was the primary driver of the prosperity of the low density North.

3.4.4 Reversals: Argentina and Chile

Above we noted that two low density countries, Argentina and Chile, provide the only two examples of statistically significant "reversals" (Figure 4) and drove a negative coefficient in the pooled MS log-log specifications. Hence, understanding the cause of their negative relationship becomes important for the overall interpretation of the results. For Argentina, the evidence supports an idiosyncratic geographical fundamentals story rather than an institutional one. The richest areas in Figure 2-the Province of Buenos Aires, La Pampa, Cordoba, Santa Fe and Entre Rios surround Buenos Aires City-tend, in fact, to be in areas of low pre-colonial population density. The other richer departments, Santa Cruz and Chubut, are relatively undiversified mineral producers in relatively unattractive climates and hence show the "resource inversion" discussed earlier. At the other extreme, Corrientes and Misiones are relatively underdeveloped humid semi-tropical areas that were traditionally isolated and show the highest pre-colonial density and, hence, potentially extractive institutions. But it must be kept in mind that these densities map in both absolute and relative magnitude to those of Massachusetts and California within an overall distribution that, again, is remarkably similar that of the US. Hence, from the Acemoglu et al. (2002) perspective, we need to explain why the endogenously emerging institutions are so different in the two countries. In addition, Buenos Aires may well not have been such a paragon of inclusionary institutions that would account for its unusual growth. It was a major port of slave desembarcation in the New World and, in the last years of Spanish domination, it was 30% Black (Andrews, 1980).[25]

It seems more likely that the present distribution of income arises from Buenos Aires' status as the principal Atlantic port of the Spanish empire. This was not always the case.

[25]As a final point, Ades and Glaeser (1995) note argue that industry did not play a prominent role in the rise of Buenos Aires so that a case for it being more suited to the second wave of the Industrial Revolution seems unlikely. Even by 1914, only 15 percent of the labor force was in manufacturing and the government displayed "hostility toward manufacturing and innovation" p 221.

Despite the evolution of the surrounding pampas economy, prior to the mid 18th century Buenos Aires was a backwater, surviving on smuggling contraband silver and slaves. This was largely due to an absurd repression of natural locational advantage. By Spanish law, the production of silver and other products of the interior towns were directed over the Andes to Lima on the Pacific, where they were loaded on convoys passing through the Isthmus of Panama and then to Spain. The more logical route-through the Atlantic port of Buenos Aires, and then directly to Spain-was forbidden. However, largely for geostrategic reasons arising from the emergence of the North American colonies as a potential Atlantic power, the policy was reversed in 1776 when Spain established Buenos Aires as the capital of the new Viceroyalty of Rio de la Plata. Trade was now mandated through Buenos Aires and forbidden through Lima, leading to an abrupt reorientation of the country's economy away from the traditional interior towns, and towards the emerging coastal economy (Scobie, 1964). Hence, by royal fiat, locational fundamentals went from being repressed to dominant.

Chile also shows a significant negative relationship between pre-colonial densities and present income but one which, again, does not appear driven by the institutional story for two reasons. First, several observations at the highest end of the country's relatively low density (4.7 per square kilometer)-Bio Bio, Maule, O'Higgins, Los Lagos, and Araucania-are among the poorest. However, these form a contiguous region, with the area below the Bio Bio River that includes them dominated by the Mapuche Indians and conquered only very late in the 19th century. That is, extractive institutions would have been set up after the advent of the second industrial revolution. Hence, the institutional case is not as compelling, perhaps, as one stressing the costs of being out of the global technological loop. In fact, the eventual conquest had to wait for the Chileans to import recent advances in weaponry to which the Mapuches did not have access. The capital, Santiago, offers a counter example: it has the same density and is contigous to this region, but it was conquered much earlier and is much more prosperous. Second, the country is one of extremes with extractive industries in some of the driest and coldest areas of the planet which were not attractive to native populations. This implies a relatively uninteresting correlation of relatively low pre-colonial densities, and moderately high incomes (for a very few people) today. Excluding these areas leaves no correlation whatsoever.

In sum, in both Argentina and Chile the negative correlation of present income with pre-colonial population density does not seem caused by a systematic dynamic with extractive institutions, but rather idiosyncratic historical factors. Hence, for both this reason, and because we find stronger justification for the log-level specification, we find the evidence overall for persistence more compelling.

4 The Institutional Channel: Slavery in Brazil, Colombia, and the US

Evidence for the persistence of economic activity does not, of course, mean that extractive institutions were not important to development, and we find evidence for such effects, even if they do not overwhelm other persistence drivers.

As an alternative source of extractive institutions we are able to collect data on the incidence of slavery at the subnational level for Brazil and Colombia and the US. While data comparability and classification issues are non-trivial, the average share of the population enslaved in the mid 19th century (see data appendix) was 28% in the American South, 13% in Brazil and 2.9% in Colombia. We use the more expansive measure that includes free Blacks which raises Brazil to first position, although the results do not change qualitatively when we use the more narrow measure.

$$Log(Y_{2005,ij}) = \alpha + \beta g(D_{precol,ij}) + \delta SLAVERY + \delta_{int} SLAVERY * D_{precol} + \gamma FUNDAMENTALS_{ij} + \mu_i + \epsilon_{ij} \quad (4)$$

where δ_{int} captures the interaction of pre-colonial density and slavery and μ_i are now three fixed effects for Brazil, Colombia and the US South with the US North as the omitted category. Columns 1-5 in Tables 12 and 13 progressively introduce the elements of equation 3. Column 1 includes pre-colonial density along with dummies for Brazil, Colombia and the American South.[26] In the full sample in both log-level and log-log specifications (column 1), pre-colonial density is significant and positive, lending support from a smaller sample to the case for persistence. Column 2 repeats the same regression with the smaller sample dictated by the more restrictive slavery variable with a loss in significance of the persistence term. Columns 3 add the slavery term and, for both log and level specifications, it enters negatively and significantly. While it lowers the dummy on Brazil perhaps 20 percent in both specifications, it has no effect on the Colombia dummy. Slavery does not seem to explain the gap with the US. Column 4 adds slavery interacted with initial population density. It enters negatively in both specifications and of similar sign although only significantly in the levels specification. Further, the coefficient on pre-colonial density roughly doubles with the inclusion of the interaction of slavery and density in the levels specification and increases by 30 percent in the log specification suggesting that extractive institutions did have a negative agglomeration effect as postulated by Acemoglu et al. (2002). The same results are found in the MS specifications (column 6).

Adding locational fundamentals (column 5) changes the coefficient little but renders it insignficant in the OLS FE estimates. However, the MS estimator finds both the free standing and interactive terms significant in both level and log specifications. Though the sample is small, nonetheless, the results offer support for extractive institutions at least reducing, if not overturning the persistence induced by agglomeration externalities and fundamentals.

[26]The South is comprised of Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas, Virginia, West Virginia.

Finally, though the inclusion of slavery reduces the dummies on Brazil and Colombia somewhat, they remain large: conditional on slavery and initial agglomerations, Brazil's income is less than a quarter of that of the US. Explaining these remaining country regional fixed effects is beyond the purview of this paper but suggests that the variables included may not be the dominant explanation of between country income distribution by themselves. Combined with the evidence for within country persistence, this raises some questions about the interpretation of a negative between-country correlation, which as in Acemoglu et al. (2002), we also find in the log-log specification, as primarily the result of extractive institutions. Further thinking is in order to explain why in Colombia, for example, such effects within should not be sufficiently powerful to generate a negative correlation, yet explain the country's position relative to the US.

5 Conclusion

This paper documents that, within countries, economic activity in the Western Hemisphere has tended to persist over the last half millennium. We construct a data set on subnational population densities and incomes derived from poverty maps, and show that pre-colonial population densities are strongly correlated with present day population and somewhat less consistently, with income per capita. This is strongly and clearly the case for low pre-colonial density countries like the US, but also for classic Latin conquest cases like Colombia, and, on balance for the extreme high density cases like Mexico and Peru. We also generate new proxies for suitability for agriculture and river density that contribute to a comprehensive set of locational fundamentals. These appear as significant determinants of the location of pre-colonial densities and of our present day measures, but they do not eliminate the impact of pre-colonial densities. Further, the historical case studies suggest reasons for both fundamentals and pre-colonial densities to be important. Not only would colonizers also value the rivers, coasts, fertile land, natural resources, and climate that attracted the native populations, but they would need the native populations themselves as sources of human capital (architects, agronomists, and craftsmen), trading partners, sources of information, strategic bulwarks against enemy encroachment, and souls to save. In turn, the contact with new technologies may have, after the initial trauma, strengthened these agglomerations. As the south of Chile suggests, not being conquered until almost the 20th century, while undoubtedly reflecting social or geographical conditions that also affected growth, was likely a formula for technological isolation, not developmental success.

That said, we also find evidence for the negative institutional effects associated with pre-colonial agglomerations postulated by Acemoglu et al. (2002). Using the share of slaves in the population as a proxy for extractive institutions, we find that regions with a higher incidence of slavery show both lower incomes and less persistence. Hence, persistence is likely to have been stronger were such institutions not a feature of the colonization. However, these effects do not appear strong enough to cause reversals. Many of the regions of the very highest pre-colonial density remain among the most prosperous regions today, and the few countries and regions exhibiting reversals seem less driven by institutional than idiosyncratic fundamentals-related stories. Geographical and agglomeration factors appear, overall, to cause fortune to persist.

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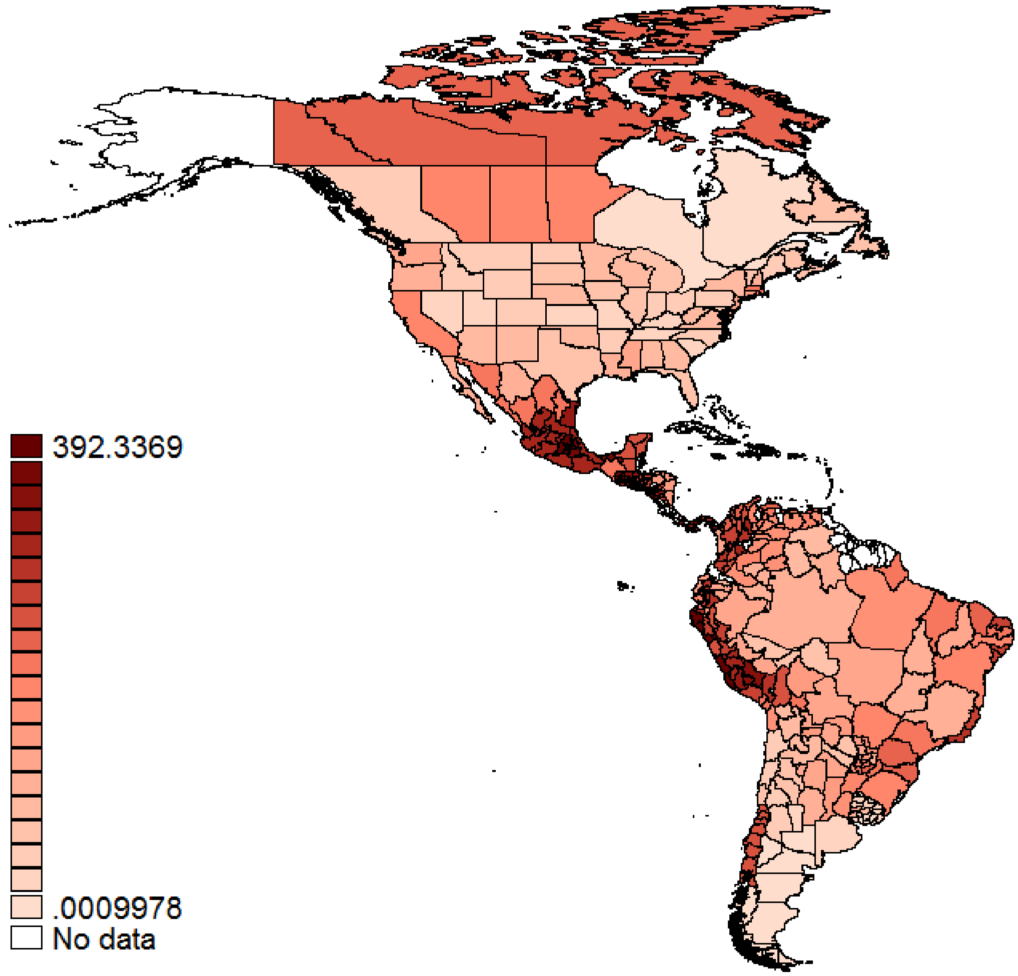
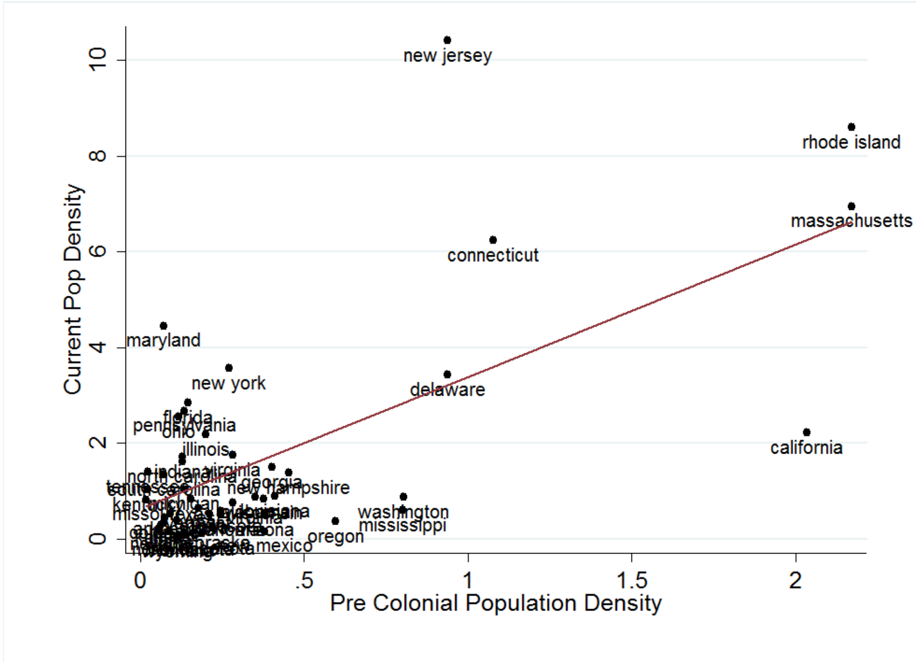
Figure 1: Pre-colonial Population Density



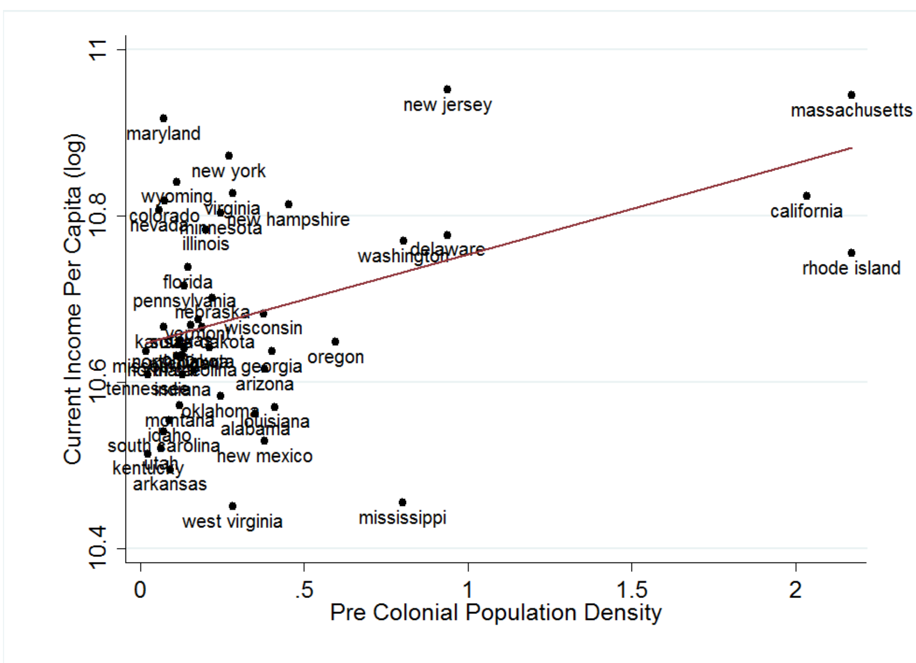
Note: Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, Income is per capita (PPP 2005 US dollars) in 2000. Data from national censuses, Denevan (1992), and Bruhn and Gallego (2010). More detailed data sources and descriptions in the text.

Figure 2: Population Density in 2000 against Pre-colonial Population Density (United States)



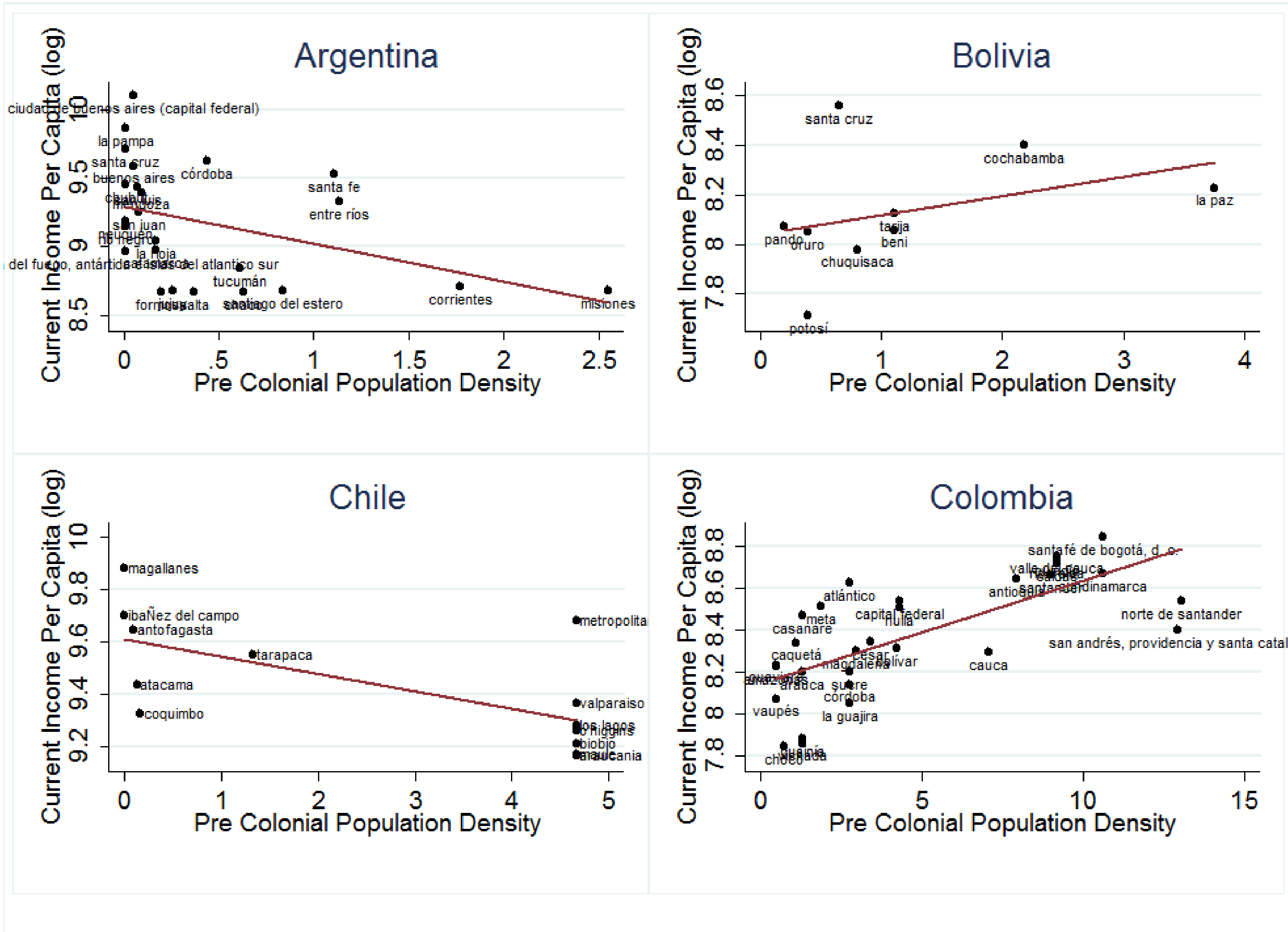
Note: Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, Current Population Density is the total population in 2000 divided by the area of the state or province in square kilometers. Data from national censuses, Denevan (1992), and Bruhn and Gallego (2010). More detailed data sources and descriptions in the text.

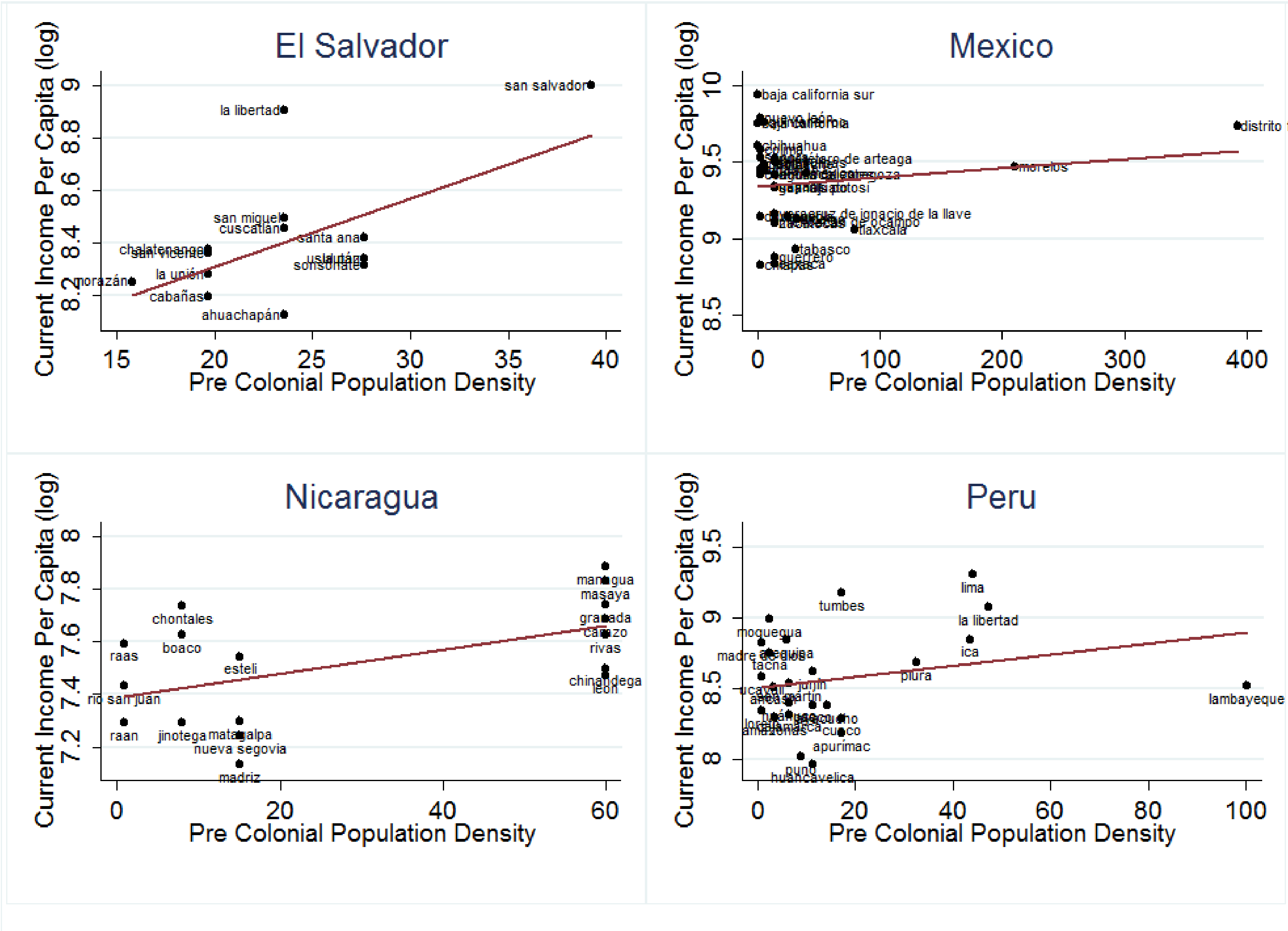
Figure 3: Log Income per Capita in 2005 against Pre-colonial Population Density (United States)



Note: Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, Income is per capita (PPP 2005 US dollars) in 2000. Data from national censuses, Denevan (1992), and Bruhn and Gallego (2010). More detailed data sources and descriptions in the text.

Figure 4: Log Income per Capita in 2005 against Pre-colonial Population Density (Latin America)





Note: Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, Income is per capita (PPP 2005 US dollars) in 2000. Data from national censuses, Denevan (1992), and Bruhn and Gallego (2010). More detailed data sources and descriptions in the text.

Table 1: Summary Statistics- Population Density and Income

	Obs	Pre-colonial Population Density				Current Population Density				Income			
		Mean	Coef. Var	Min	Max	Mean	Coef. Var	Min	Max	Mean	Coef. Var	Min	Max
Argentina	24	0.44	1.45	0.01	2.55	626.06	4.80	1.20	14727.03	10576.16	0.46	5834.35	24328.34
Bolivia	9	1.18	0.96	0.20	3.74	9.53	0.84	0.82	26.17	3494.36	0.25	2239.15	5219.44
Brazil	27	2.55	0.97	0.20	8.58	53.39	1.40	1.41	346.75	7590.93	0.46	3343.24	18287.33
Canada	13	1.22	1.06	0.02	3.00	6.34	1.19	0.01	24.40	34540.71	0.17	27479.80	48436.04
Chile	13	2.65	0.87	0.01	4.66	53.05	1.99	1.05	393.50	12852.48	0.24	9545.53	19533.39
Colombia	30	4.96	0.82	0.49	13.04	424.40	2.36	0.48	4310.09	4554.56	0.27	2546.91	6917.57
Ecuador	22	5.76	0.78	0.01	12.06	56.10	0.92	2.01	182.80	5764.57	0.30	3738.26	10463.96
El Salvador	14	24.19	0.24	15.80	39.25	326.73	1.30	95.58	1768.80	4669.67	0.29	3378.47	8094.27
Guatemala	8	22.95	0.35	5.64	29.08	248.97	1.57	10.23	1195.48	3699.73	0.56	2132.71	8526.96
Honduras	18	8.09	0.55	1.00	17.64	134.67	1.22	15.81	614.83	3171.35	0.30	1512.21	5170.91
Mexico	32	31.90	2.38	0.40	392.34	227.55	3.36	5.61	4352.62	12119.95	0.29	6780.40	20709.32
Nicaragua	17	29.82	0.89	1.00	60.00	103.28	1.20	8.58	473.80	1896.24	0.22	1250.37	2658.39
Panama	9	13.40	0.67	0.06	24.78	38.66	0.88	2.42	116.80	9046.41	0.31	4880.31	13950.97
Paraguay	18	1.27	0.56	0.20	3.29	58.62	2.28	0.10	579.36	4162.39	0.18	2923.94	5516.21
Peru	24	17.36	1.30	0.78	100.15	31.80	0.18	1.08	222.23	5623.75	0.35	2846.11	10980.10
US	48	0.39	1.34	0.02	2.17	169.50	0.99	5.16	1041.54	44193.13	0.14	34533.35	62765.91
Uruguay	19	0.11	2.05	0.00	0.85	33.44	1.80	2.25	263.51	8195.26	0.21	6024.20	13965.81
Venezuela	19	1.78	0.42	0.35	2.78	96.70	0.48	0.40	415.52	9788.84	0.13	7843.90	13191.90

Note: Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, Current Population Density is the total population in 2000 divided by the area of the state or province in square kilometers and Income is in per capita (PPP 2005 US dollars) in 2000. Data from national censuses, Denevan (1992), and Bruhn and Gallego (2010). More detailed data sources and descriptions in the text.

Table 2: Summary Statistics- Population Density and Income

	Mean	**Median**	**Sd**	**Min**	**Max**
Agriculture	0.56	0.58	0.28	0.00	1.00
Rivers	3.28	3.29	1.23	0.00	6.92
Landlocked	0.57	1.00	0.50	0.00	1.00
Temperature	19.97	20.40	5.83	2.38	29.00
Altitude	0.66	0.19	0.92	0.00	4.33
Rainfall	1.28	1.10	0.95	0.00	8.13

Note: Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text.

Table 3: Pre-colonial Population Density and Locational Fundamentals (pooled)

	(1) OLS	(2) OLS	(3) OLS FE	(4) OLS FE	(5) MS	(6) MS	(7) MS FE	(8) MS FE
Agriculture	0.1	-0.04	0.06	-0.02	0.005**	0.03**	0.006***	0.02**
	(0.08)	(0.11)	(0.06)	(0.11)	(0.00)	(0.01)	(0.00)	(0.01)
Agriculture^2		0.1		0.08		-0.02*		-0.01*
		(0.12)		(0.15)		(0.01)		(0.01)
Rivers	-0.03***	-0.03	-0.002	0.02	0.0004	-0.0005	-0.002***	-0.002
	(0.01)	(0.03)	(0.01)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)
Rivers^2		0.0008		-0.002		-0.00005		-0.00009
		(0.00)		(0.00)		(0.00)		(0.00)
Landlocked	0.01	-0.005	0.02	0.02	-0.007***	-0.005***	-0.001	-0.0007
	(0.03)	(0.02)	(0.03)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)
Temperature	0.004*	0.01	-0.003	0.01	0.0008***	-0.0009*	0.0002*	0.00009
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Temperature^2		-0.0002		-0.0004		0.00005***		0.000002
		(0.00)		(0.00)		(0.00)		(0.00)
Altitude	0.06	0.1	0.02	0.02	0.004***	0.005**	0.0006	0.0005
	(0.04)	(0.08)	(0.04)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)
Altitude^2		-0.02		-0.003		-0.0006		0.00003
		(0.02)		(0.00)		(0.00)		(0.00)
Rainfall	-0.01	-0.02	-0.01	-0.03	-0.0005	-0.0002	0.00003	0.001
	(0.01)	(0.03)	(0.01)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)
Rainfall^2		0.002		0.003		-0.0002		-0.0004**
		(0.00)		(0.00)		(0.00)		(0.00)
Constant	0.02	-0.02	0.02	-0.10	-0.009***	0.002	0.006**	0.003
	(0.06)	(0.06)	(0.09)	(0.09)	(0.00)	(0.01)	(0.00)	(0.00)
N	330	330	330	330	330	330	330	330
R^2	0.061	0.058	0.109	0.099				

Note: Regression of sub national Pre-colonial Population Density on locational fundamentals. Estimation by OLS and robust MS regression with country fixed effects. Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Log Pre-colonial Population Density and Locational Fundamentals (pooled)

	(1) OLS	(2) OLS	(3) OLS FE	(4) OLS FE	(5) MS	(6) MS	(7) MS FE	(8) MS FE
Agriculture	1.2	6.9**	2.2***	5.0**	2.0***	5.4***	0.8*	4.6***
	(1.40)	(2.79)	(0.52)	(2.18)	(0.48)	(1.40)	(0.46)	(0.66)
Agriculture^2		-5.6*		-2.9		-2.9**		-3.3***
		(3.15)		(1.88)		(1.35)		(0.57)
Rivers	-0.3	-0.5	0.04	0.4	-0.8***	-2.0***	-0.1	0.5**
	(0.24)	(0.50)	(0.21)	(0.59)	(0.09)	(0.31)	(0.07)	(0.20)
Rivers^2		0.02		-0.07		0.2***		-0.08***
		(0.07)		(0.07)		(0.04)		(0.02)
Landlocked	-0.7	-0.7	-0.7*	-0.6	0.05	0.2	-0.2*	-0.2
	(0.45)	(0.48)	(0.41)	(0.37)	(0.19)	(0.18)	(0.13)	(0.11)
Temperature	0.2***	0.10	0.02	0.2	0.06**	0.3***	-0.04	0.2*
	(0.05)	(0.24)	(0.05)	(0.16)	(0.03)	(0.08)	(0.06)	(0.11)
Temperature^2		0.002		-0.006		-0.006***		-0.006**
		(0.01)		(0.00)		(0.00)		(0.00)
Altitude	1.4***	2.1*	0.5*	0.2	0.8***	0.2	0.5**	-0.4*
	(0.36)	(1.00)	(0.26)	(0.30)	(0.16)	(0.33)	(0.23)	(0.21)
Altitude^2		-0.2		0.06		0.2*		0.1**
		(0.25)		(0.06)		(0.09)		(0.06)
Rainfall	0.1	0.5	-0.10	0.1	0.3	1.8***	-0.2*	0.2
	(0.17)	(0.41)	(0.13)	(0.27)	(0.19)	(0.33)	(0.09)	(0.13)
Rainfall^2		-0.09		-0.05		-0.4***		-0.05***
		(0.05)		(0.03)		(0.08)		(0.02)
Constant	-8.3***	-8.3***	-7.7***	-10.1***	-4.2***	-6.4***	-5.0***	-8.8***
	(1.37)	(1.48)	(1.48)	(1.96)	(0.98)	(1.00)	(1.33)	(1.26)
N	330	330	330	330	330	330	330	330
R^2	0.376	0.413	0.688	0.703				

Note: Regression of sub national Pre-colonial Population Density on locational fundamentals. Estimation by OLS and robust MS regression with country fixed effects. Pre-colonial Population Density is the log of the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Population Density in 2000 and Pre-colonial Population Density (country by country)

	N	β Pop. Density		Rank
		Log-Log	Level-Level	Correlation
Argentina	24	0.29**	-602.5	0.61***
		(0.12)	(637.67)	
Brazil	27	0.81***	7.34	0.63***
		(0.20)	(5.29)	
Bolivia	9	0.85***	5.16**	0.68**
		(0.28)	(2.02)	
Chile	13	0.61***	19.9*	0.84***
		(0.08)	(11.47)	
Canada	13	-0.86***	-3.70***	-0.69**
		(0.28)	(1.17)	
Colombia	30	1.64***	108.1**	0.70***
		(0.32)	(51.20)	
Ecuador	22	0.50***	3.84*	0.49**
		(0.10)	(2.24)	
El Salvador	14	2.79**	61.4***	0.79**
		(0.67)	(21.40)	
Guatemala	8	1.98***	20.9	0.83**
		(0.38)	(14.85)	
Honduras	18	0.79***	21.2**	0.47**
		(0.13)	(10.11)	
Mexico	32	0.65***	9.09***	0.68***
		(0.12)	(2.32)	
Mexico[1]	25	0.80***	9.18***	0.65***
		(0.17)	(2.34)	
Nicaragua	17	0.67***	2.99***	0.80***
		(0.08)	(1.10)	
Panama	9	0.034	-0.31	0.08
		(0.14)	(1.11)	
Paraguay	18	1.37***	-12.3	0.34
		(0.51)	(22.14)	
Peru	24	0.70***	1.11**	0.74 ***
		(0.11)	(0.52)	
Peru[2]	23	0.73***	2.00*	0.70***
		(0.12)	(1.05)	
US	48	0.44***	276.9***	0.37***
		(0.15)	(71.65)	
Uruguay	19	-0.16	-41.3	-0.25
		(0.13)	(35.27)	
Venezuela	19	0.70***	1.11**	0.76***
		(0.11)	(0.52)	

Note: Beta from OLS regression of Current Population Density on Pre-colonial Population Density in both Log-Log and Level-Level forms. Final column is Spearman rank correlation coefficient. Current Population Density is the log of the total population in 2000 divided by the area of the state or province in square kilometers, from national censuses, and Bruhn and Gallego (2010). Pre-colonial Population Density is the log of the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. 1. Mexico without border states. 2 Peru without Lambayeque. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Population Density in 2000, Pre-colonial Population Density, and Locational Fundamentals (pooled)

	(1) OLS	(2) Between	(3) Within FE	(4) Within FE	(5) Within FE	(6) MS FE	(7) MS FE
Pre-colonial Density	7.2***	1.9	8.6***	8.8***	8.8***	3.0***	0.6***
	(1.37)	(3.80)	(0.73)	(0.57)	(0.68)	(0.11)	(0.13)
Agriculture					-4.3		0.3
					(8.42)		(0.41)
Agriculture^2					8.4		0.1
					(11.90)		(0.48)
Rivers					0.2		0.10
					(2.89)		(0.11)
Rivers^2					-0.2		-0.02*
					(0.39)		(0.01)
Landlocked					-1.6		-0.1**
					(2.03)		(0.05)
Temperature					0.6		0.03
					(0.38)		(0.02)
Temperature^2					-0.02*		-0.0009
					(0.01)		(0.00)
Altitude					-0.8		-0.04
					(1.28)		(0.06)
Altitude^2					0.3		0.010
					(0.40)		(0.02)
Rainfall					2.0*		0.10*
					(1.12)		(0.05)
Rainfall^2					-0.3**		-0.04***
					(0.14)		(0.01)
Constant	1.1*	1.3**	0.9***	1.0***	-4.2	0.07***	-0.3***
	(0.53)	(0.54)	(0.07)	(0.05)	(7.31)	(0.01)	(0.11)
N	365	365	365	330	330	330	330
R^2	0.045	-0.045	0.057	0.060	0.068		

Note: Regression of Current Population Density against Pre-colonial Population Density. Estimation by OLS and robust MS regression with country fixed effects. Current Population Density is the total population in 2000 divided by the area of the state or province in square kilometers, from national censuses, and Bruhn and Gallego (2010). Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Log Population Density in 2000, Log Pre-colonial Population Density, and Locational Fundamentals (pooled)

	(1) OLS	(2) Between	(3) Within FE	(4) Within FE	(5) Within FE	(6) MS FE	(7) MS FE
Pre-colonial Density	0.3***	0.3**	0.4***	0.5***	0.3**	0.5***	0.4***
	(0.10)	(0.12)	(0.14)	(0.13)	(0.11)	(0.06)	(0.05)
Agriculture					2.1		0.3
					(1.63)		(1.15)
Agriculture^2					-0.2		0.3
					(1.59)		(1.20)
Rivers					-0.3		0.7***
					(0.38)		(0.24)
Rivers^2					-0.07		-0.2***
					(0.05)		(0.03)
Landlocked					-0.1		-0.2
					(0.25)		(0.14)
Temperature					0.4***		0.2***
					(0.08)		(0.04)
Temperature^2					-0.01***		-0.006***
					(0.00)		(0.00)
Altitude					-0.3		-0.3*
					(0.42)		(0.16)
Altitude^2					0.1		0.05
					(0.08)		(0.05)
Rainfall					0.3		1.0***
					(0.26)		(0.23)
Rainfall^2					-0.06		-0.2***
					(0.04)		(0.05)
Constant	0.10	0.1	0.6	1.1*	-2.2	0.6	-2.4***
	(0.36)	(0.55)	(0.59)	(0.55)	(1.37)	(0.41)	(0.79)
N	365	365	365	330	330	330	330
R^2	0.136	0.282	0.147	0.206	0.432		

Note: Regression of the Log of Current Population Density against the Log of Pre-colonial Population Density. Estimation by OLS and robust MS regression with country fixed effects. Current Population Density is the log of the total population in 2000 divided by the area of the state or province in square kilometers, from national censuses, and Bruhn and Gallego (2010). Pre-colonial Population Density is the log of the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Log Income per Capita in 2005 and Pre-colonial Population Density (country by country)

	N	β Pop. Density		Rank
		Log-Log	Level-Level	Correlation
Argentina	24	-0.11***	-27.7***	-0.53**
		(0.04)	(8.25)	
Brazil	27	-0.082	-3.73	-0.22
		(0.07)	(2.84)	
Bolivia	9	0.11*	7.86	0.47
		(0.06)	(5.58)	
Chile	13	-0.070***	-6.57***	-0.55***
		(0.02)	(2.44)	
Canada	13	0.029	6.74*	0.14
		(0.02)	(3.76)	
Colombia	30	0.19***	4.91***	0.75***
		(0.03)	(1.07)	
Ecuador	22	-0.019	0.31	0.01
		(0.04)	(1.32)	
El Salvador	14	0.62**	2.60***	0.45
		(0.25)	(0.80)	
Guatemala	8	0.071	0.62	-0.07
		(0.19)	(1.65)	
Honduras	18	-0.034	-0.46	-0.04
		(0.04)	(0.55)	
Mexico	32	-0.060	0.059	-0.40***
		(0.04)	(0.04)	
Mexico[1]	25	0.020	0.11***	-0.12
		(0.05)	(0.03)	
Nicaragua	17	0.058**	0.46***	0.36**
		(0.03)	(0.16)	
Panama	9	0.014	-0.70	-0.07
		(0.04)	(1.31)	
Paraguay	18	-0.012	0.75	0.02
		(0.06)	(5.86)	
Peru	24	0.041	0.39	0.13
		(0.05)	(0.36)	
Peru[2]	23	0.054	1.12***	0.11
		(0.06)	(0.38)	
US	48	0.045***	10.9***	0.31**
		(0.02)	(3.22)	
Uruguay	19	-0.030	-0.69	-0.38
		(0.02)	(9.80)	
Venezuela	19	0.041	0.39	0.10
		(0.05)	(0.36)	

Note: Beta from OLS regression of Income per capita in 2000 (PPP 2005 US dollars) on Pre-colonial Population Density in both Log-Log and Level-Level forms. Income per capita is taken from national censuses. Final column is Spearman rank correlation coefficient. Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. 1. Mexico without border states. 2 Peru without Lambayeque. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Log Income per Capita in 2005, Pre-colonial Population Density, and Locational Fundamentals (pooled)

	(1) OLS	(2) Between	(3) Within FE	(4) Within FE	(5) Within FE	(6) MS FE	(7) MS FE
Pre-colonial Density	-0.4	-2.8	0.1**	0.09**	0.09***	0.06***	0.1***
	(0.58)	(1.70)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)
Agriculture					-0.4		0.3
					(0.23)		(0.30)
Agriculture^2					0.2		-0.3
					(0.24)		(0.31)
Rivers					-0.04		0.0003
					(0.10)		(0.04)
Rivers^2					-0.0004		-0.004
					(0.01)		(0.01)
Landlocked					0.01		0.01
					(0.05)		(0.03)
Temperature					0.02		0.006
					(0.02)		(0.01)
Temperature^2					-0.0008		-0.0003
					(0.00)		(0.00)
Altitude					-0.02		-0.1*
					(0.09)		(0.07)
Altitude^2					-0.03		-0.02
					(0.02)		(0.02)
Rainfall					-0.05		-0.2***
					(0.04)		(0.04)
Rainfall^2					-0.004		0.01***
					(0.01)		(0.00)
Constant	9.1***	9.1***	9.0***	9.0***	9.4***	9.5***	9.1***
	(0.28)	(0.24)	(0.00)	(0.00)	(0.21)	(0.17)	(0.14)
N	365	365	365	330	330	330	330
R^2	0.010	0.093	0.004	0.003	0.128		

Note: Regression of the Log of Income per capita in 2000 (PPP 2005 US dollars) against the Log of Pre-colonial Population Density. Estimation by OLS and robust MS regression with country fixed effects. Income per capita (in logs) is taken from national censuses. Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Log Income per Capita in 2005, Log Pre-colonial Population Density, and Locational Fundamentals (pooled)

	(1) OLS	(2) Between	(3) Within FE	(4) Within FE	(5) Within FE	(6) MS FE	(7) MS FE
Pre-colonial Density	-0.2**	-0.2**	-0.01	-0.02	-0.02	0.003	-0.03**
	(0.08)	(0.09)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Agriculture					-0.3		-0.4
					(0.19)		(0.39)
Agriculture^2					0.2		0.2
					(0.20)		(0.35)
Rivers					-0.03		-0.06
					(0.10)		(0.09)
Rivers^2					-0.002		0.005
					(0.01)		(0.02)
Landlocked					0.005		-0.1***
					(0.05)		(0.05)
Temperature					0.02		-0.009
					(0.02)		(0.02)
Temperature^2					-0.0009		-0.0001
					(0.00)		(0.00)
Altitude					-0.01		0.2***
					(0.08)		(0.06)
Altitude^2					-0.03		-0.09***
					(0.02)		(0.01)
Rainfall					-0.05		-0.009
					(0.04)		(0.07)
Rainfall^2					-0.004		-0.01*
					(0.01)		(0.01)
Constant	8.3***	8.0***	9.0***	8.9***	9.3***	9.5***	9.3***
	(0.28)	(0.39)	(0.08)	(0.09)	(0.32)	(0.17)	(0.24)
N	365	365	365	330	330	330	330
R^2	0.193	0.240	0.002	0.009	0.129		

Note: Regression of the Log of Income per capita in 2000 (PPP 2005 US dollars) against the Log of Pre-colonial Population Density. Estimation by OLS and robust MS regression with country fixed effects. Income per capita (in logs) is taken from national censuses. Pre-colonial Population Density is the log of the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: Log Income per Capita in 2005, Pre-colonial Population Density, and Locational Fundamentals (pooled without Argentina and Chile)

	Log-Level				Log-Log			
	(1) FE	(2) FE	(3) MS FE	(4) MS FE	(5) FE	(6) FE	(7) MS FE	(8) MS FE
Pre-colonial Density	0.09**	0.09***	0.06***	0.1***	0.0003	0.003	0.02	-0.004
	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
Agriculture		-0.2		0.5*		-0.2		0.5
		(0.27)		(0.29)		(0.26)		(0.33)
$Agriculture^2$		0.04		-0.5*		0.06		-0.5
		(0.24)		(0.32)		(0.23)		(0.34)
Rivers		-0.1		-0.04		-0.1		-0.05
		(0.07)		(0.05)		(0.07)		(0.06)
$Rivers^2$		0.01		-0.0008		0.01		0.002
		(0.01)		(0.01)		(0.01)		(0.01)
Landlocked		0.03		0.02		0.03		-0.02
		(0.05)		(0.05)		(0.05)		(0.08)
Temperature		0.02		-0.003		0.02		-0.004
		(0.02)		(0.04)		(0.02)		(0.03)
$Temperature^2$		-0.0007		-0.00004		-0.0008		-0.0001
		(0.00)		(0.00)		(0.00)		(0.00)
Altitude		0.03		-0.1		0.03		-0.1
		(0.07)		(0.09)		(0.06)		(0.15)
$Altitude^2$		-0.04**		-0.02		-0.04**		-0.02
		(0.02)		(0.03)		(0.02)		(0.04)
Rainfall		-0.05		-0.2***		-0.05		-0.2***
		(0.05)		(0.06)		(0.05)		(0.05)
$Rainfall^2$		-0.004		0.010		-0.004		0.007
		(0.01)		(0.01)		(0.01)		(0.01)
Constant	9.0***	9.5***	8.0***	8.7***	9.0***	9.5***	8.1***	9.4***
	(0.00)	(0.24)	(0.10)	(0.52)	(0.08)	(0.26)	(0.10)	(0.34)
N	293	293	293	293	293	293	293	293
R^2	0.004	0.129			-0.003	0.122		

Note: Regression of Income per capita in 2000 (PPP 2005 US dollars) against Pre-colonial Population Density. Excluding two countries with prominent negative correlations: Chile and Argentina. Specifications in Log-Level and Log-Log form. Estimation by OLS and robust MS regression with country fixed effects. Income per capita (in logs) is taken from national censuses. Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Log Income per Capita in 2005, Pre-colonial Population Density, and Slavery (Brazil, Colombia and United States)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) MS	(7) MS
Pre-colonial Density	2.9**	1.9	2.6**	5.5***	2.5*	6.5***	8.6***
	(1.16)	(1.33)	(1.27)	(1.45)	(1.46)	(1.56)	(1.65)
Brazil	-1.9***	-2.0***	-1.6***	-1.6***	-1.5***	-2.0***	-2.1***
	(0.09)	(0.11)	(0.21)	(0.20)	(0.23)	(0.07)	(0.05)
Colombia	-2.5***	-2.4***	-2.4***	-2.6***	-2.3***	-2.6***	-2.9***
	(0.07)	(0.09)	(0.08)	(0.08)	(0.23)	(0.08)	(0.16)
South	-0.09**	-0.1***	0.2	0.09	0.09	-0.01	0.1***
	(0.04)	(0.04)	(0.13)	(0.13)	(0.14)	(0.07)	(0.03)
Slavery			-0.009**	-0.006	-0.006*	-0.002	-0.006***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Slavery*Pop				-0.1**	-0.09	-0.1***	-0.1***
				(0.05)	(0.05)	(0.04)	(0.02)
Agriculture					-0.08		0.5***
					(0.89)		(0.18)
Agriculture^2					-0.1		-0.4**
					(0.75)		(0.18)
Rivers					-0.002		0.09*
					(0.17)		(0.05)
Rivers^2					-0.009		-0.02***
					(0.02)		(0.01)
Landlocked					0.02		0.01
					(0.10)		(0.03)
Temperature					0.04		-0.01
					(0.03)		(0.01)
Temperature^2					-0.001		0.0006
					(0.00)		(0.00)
Altitude					0.3		0.4***
					(0.20)		(0.03)
Altitude^2					-0.1		-0.2***
					(0.08)		(0.01)
Rainfall					-0.004		0.1***
					(0.10)		(0.02)
Rainfall^2					-0.007		-0.02***
					(0.01)		(0.00)
Constant	10.7***	10.7***	10.7***	10.7***	10.7***	10.7***	10.4***
	(0.02)	(0.03)	(0.03)	(0.02)	(0.32)	(0.04)	(0.09)
N	105	78	78	78	78	78	78
R^2	0.937	0.940	0.947	0.953	0.953		

Note: Dependent variable is the Log Income per capita in 2000 (PPP 2005 US dollars). Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus. Estimation by OLS and robust MS regression with country fixed effects. Income per capita (in logs) is taken from national censuses. Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Dummies for Brazil, Colombia, and the US South (according to the US Census). Slavery is measured as a fraction of the population and is taken from Bergad (2008) and Nunn (2008). Interaction of slavery with Pre-colonial population density. Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a duMSy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 13: Log Income per Capita in 2005, Log Pre-colonial Population Density, and Slavery (Brazil, Colombia and United States)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) MS	(7) MS
Pre-colonial Density	0.05**	0.04	0.06*	0.08***	0.05*	0.06*	0.02**
	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.01)
Brazil	-2.0***	-2.0***	-1.6***	-1.6***	-1.5***	-2.0***	-1.3***
	(0.10)	(0.12)	(0.20)	(0.20)	(0.23)	(0.17)	(0.03)
Colombia	-2.5***	-2.4***	-2.5***	-2.5***	-2.3***	-2.3***	-2.1***
	(0.08)	(0.10)	(0.09)	(0.09)	(0.19)	(0.09)	(0.04)
South	-0.07	-0.1**	0.2	0.2	0.2	0.2	0.07**
	(0.04)	(0.05)	(0.15)	(0.15)	(0.17)	(0.20)	(0.03)
Slavery			-0.009**	-0.007*	-0.006*	-0.007	-0.003***
			(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Slavery*Pop				-0.07	-0.06	-0.002	-0.04***
				(0.04)	(0.05)	(0.04)	(0.01)
Agriculture					-0.5		1.0***
					(0.91)		(0.21)
Agriculture^2					0.2		-0.7***
					(0.77)		(0.16)
Rivers					0.006		-0.2***
					(0.17)		(0.03)
Rivers^2					-0.009		0.01***
					(0.02)		(0.00)
Landlocked					0.05		-0.006
					(0.10)		(0.01)
Temperature					0.04		0.02**
					(0.03)		(0.01)
Temperature^2					-0.001*		-0.0008***
					(0.00)		(0.00)
Altitude					0.3		0.1***
					(0.20)		(0.02)
Altitude^2					-0.1*		-0.03**
					(0.08)		(0.01)
Rainfall					-0.04		0.2***
					(0.10)		(0.04)
Rainfall^2					-0.003		-0.2***
					(0.01)		(0.02)
Constant	11.0***	11.0***	11.1***	11.2***	11.1***	11.1***	11.0***
	(0.14)	(0.16)	(0.17)	(0.14)	(0.39)	(0.18)	(0.09)
N	105	78	78	78	78	78	78
R^2	0.935	0.940	0.947	0.948	0.953		

Note: Dependent variable is the Log Income per capita in 2000 (PPP 2005 US dollars). Pre-colonial Population Density is the number of indigenous people per square kilometer before the arrival of Columbus. Estimation by OLS and robust MS regression with country fixed effects. Income per capita (in logs) is taken from national censuses. Pre-colonial Population Density is the log of the number of indigenous people per square kilometer before the arrival of Columbus, from Denevan (1992), and Bruhn and Gallego (2010). Dummies for Brazil, Colombia, and the US South (according to the US Census). Slavery is measured as a fraction of the population and is taken from Bergad (2008) and Nunn (2008). Interaction of slavery with Pre-colonial population density. Agriculture is an index of probability of cultivation given cultivable land, climate and soil composition, from Ramankutty, Foley and McSweeney (2002). Rivers captures the density of rivers as a share of land area derived from HydroSHEDS (USGS 2011). Landlocked is a dummy variable for whether the state has access to a coast or not; temperature is a yearly average in °C; altitude measures the elevation of the capital city of the state in kilometers; and Rainfall captures total yearly rainfall in meters, all are from Bruhn and Gallego (2010). More detailed data sources and descriptions in the text. Robust SE for OLS and MS SE are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.