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Easterly, William and Levine, Ross

New York University, University of California, Berkeley, NBER

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William Easterly and Ross Levine*

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Abstract

A large literature suggests that European settlement outside of Europe shaped institutional, educational, technological, cultural, and economic outcomes. This literature has had a serious gap: no direct measure of colonial European settlement. In this paper, we (1) construct a new database on the European share of the population during the early stages of colonization and (2) examine its impact on the level of economic development today. We find a remarkably strong impact of colonial European settlement on development. According to one illustrative exercise, 47 percent of average global development levels today are attributable to Europeans. One of our most surprising findings is the positive effect of even a small minority European population during the colonial period on per capita income today, contradicting traditional and recent views. There is some evidence for an institutional channel, but our findings are most consistent with human capital playing a central role in the way that colonial European settlement affects development today.

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1 Introduction

Countries have followed remarkably divergent paths of economic development since European colonization. Some former colonies, such as the Congo, Ethiopia, Guinea-Bissau, Malawi, and Tanzania, have experienced little economic development over the last few centuries, with real per capita Gross Domestic Product (GDP) of less than $2 per day. Other former colonies are among the richest countries in the world today, including Australia, Canada, and the United States, all of which enjoy real per capita GDP levels of greater than $20,000 per annum. Most former colonies fall along the spectrum between these extremes.

In seeking to explain these divergent paths, influential researchers emphasize that the European share of the population during the early stages of colonization shaped national rates of economic growth through several mechanisms. First, Engerman and Sokoloff (1997) (ES) and Acemoglu, Johnson, and Robinson (2001) (AJR) stress that European colonization had enduring effects on political institutions and hence on economic development. They argue that when Europeans encountered national resources with lucrative international markets and did not find the lands, climate, and disease environment suitable for large-scale settlement, only a few Europeans tended to settle, and they would create authoritarian political institutions to extract and exploit natural resources. The institutions created by Europeans in these "extractive colonies" were ultimately harmful to long-run economic development. But, when Europeans found lands, climate, and disease environments that were suitable for smaller-scale agriculture, they tended to settle, forming "settler colonies." In such colonies, Europeans formed institutions more protective of political and economic rights that fostered long-run economic development. From this perspective, a large proportion of Europeans during colonization is a precursor to successful economic development.

Glaesser, La Porta, Lopez-de-Silanes, and Shleifer (2004) (GLLS) emphasize a second mechanism, arguing that the European share of the population during colonization influenced the rate of human capital accumulation and hence comparative economic development. They argue that Europeans brought human capital and human capital creating institutions, which are essential for economic growth. Since human capital disseminates slowly over generations, more Europeans during the early stages of colonization expedited human capital accumulation across the entire population, not just among those of European descent. Thus, the proportion of Europeans during colonization will be positively related to human capital development and hence overall economic development today. Moreover and critically, this view predicts that the proportion of Europeans during colonization will matter ***more*** for current economic development than the proportion of the population of European descent today because of the slow dissemination of human capital.

Other researchers, either explicitly or implicitly, highlight the colonial origins of comparative economic development. North (1990) argues that the British brought comparatively strong political and legal institutions that were more conducive to economic development than the institutions brought by other European nations. This view stresses the need for a sufficiently strong European presence to instill those institutions, but does not necessarily suggest that the proportion of Europeans during colonization will affect economic development today beyond some initial threshold level. Spolaore and Wacziarg (2009) stress that the degree to which the genetic heritage of a colonial population was similar to that of the economies at the technological frontier positively affected the diffusion of technology and thus economic development, where European migration materially affected the genetic composition of economies. Putterman and Weil (2010) emphasize that the experience with statehood and agriculture of the ancestors of

people currently living within countries help explain cross-country differences in economic success. And, Comin, Easterly, and Gong (2011) likewise find that the ancient technologies of the ancestors of populations today help predict per capita income of those populations. In both of these papers, the ancestral nature of a population helps account for cross-country differences in economic development, where European colonization materially shaped the composition of national populations. Other papers address the role of Europeans in shaping social capital, civic capital, or democratic capital (Luigi Guiso, Paola Sapienza, Luigi Zingales, 2010, Persson, Torsten and Guido Tabellini 2010.) Although these researchers stress alternative mechanisms through which European colonization shaped comparative economic development, they all emphasize that the nature of European settlements had long run consequences. Although we do not examine the specific mechanisms underlying each theory, we do assess the broad, common question: What was the impact of European settlement during the colonial period on economic development today?

The purposes of this paper are (1) to construct a new database on the European share of the population during the early stages of colonization and (2) to examine its impact on the level of economic development today. While a considerable body of research emphasizes the role of European colonization on subsequent rates of economic development, what has been missing in the empirical literature is the key intermediating variable: colonial European settlement. We believe that we are the first to explicitly measure the European share of the population during colonization for a broad cross-section of countries and assess its impact on long-run economic growth.

To identify the impact of the European share of the population during colonization on economic development today, we compile data on the historical determinants of European

settlement to use as instrumental variables. We employ a very simple model of the cost and benefits of European settlement to select possible instruments. Some determinants have already been discussed in the literature, such as (1) pre-colonial population density, (2) latitude, and (3) the disease environment facing Europeans. Pre-colonial population density raises the costs to Europeans of obtaining and securing land for new settlers. Latitude raises the benefits of simply transferring European technologies (such as for agriculture) to the newly settled areas. A harsh disease environment facing Europeans obviously raises the expected costs of settlement.

To this list of common determinants of European settlement, we add one very important new variable: indigenous mortality from European diseases. Indigenous mortality from European diseases is a tragic natural experiment that is a very good predictor of European settlement, since it removed or weakened indigenous resistance to Europeans invading new lands, and made plenty of fertile land available to settlers. The phenomenon is limited to lands that had essentially zero contact with Eurasia for thousands of years, since even a small amount of previous contact was enough to share diseases and develop some resistance to them. For example, trans-Sahara and trans-Indian Ocean contacts were enough to make Africa part of the Eurasian disease pool (McNeil 1976, Karlen 1995, Oldstone 1998). Historical studies and population figures show that only the New World (the Americas and Caribbean) and Oceania (including Australia and New Zealand) suffered large-scale indigenous mortality due to a lack of resistance to European diseases (McEvedy and Jones 1978). Thus, we use measures of the historical determinants of European settlement, such as pre-colonial population density and indigenous mortality, to identify the impact of colonial European settlement on economic development today.

We find that the European share of the population during colonization helps explain economic development today, with effects of surprisingly large magnitudes. The proportion of

colonial Europeans is strongly and positively associated with current levels of economic development after accounting for (i) British legal heritage, (ii) the percentage of years the country has been independent since 1776, (iii) the ethnic diversity of the current population, and (iv) current institutions. Moreover, all of these results hold when using instrumental variables for the proportion of Europeans during colonization. The relationship between economic development today and the proportion of Europeans during colonization does weaken when controlling for a measure of current human capital, which is consistent with the view that human capital was a key intermediating channel through which colonial settlement shaped current levels of economic development.

Another important result is that the European share of the population during the early stages of colonization is more strongly associated with economic development today than the percentage of the population today that is of European descent. Europeans during the colonization era seem to matter more for economic development today than Europeans today. This finding is consistent with the view that Europeans brought growth-promoting characteristics—such as institutions, human capital, connections with international markets, and cultural norms—that diffused to the rest of the population over generations. This result de-emphasizes the importance of Europeans per se and instead emphasizes the impact of what Europeans brought to economies during colonization.

Perhaps the most novel result is that the positive marginal impact of the European share of the population during colonization on economic development today becomes larger—not smaller or negative—when examining only former colonies with very few European settlers. ES and AJR stress that a small proportion of Europeans during colonization harmed development by establishing extractive institutions, but a large settlement of Europeans spurred economic

development by creating egalitarian institutions. Thus, creating a small European settlement in a region with no Europeans could actually curtail economic development by encouraging the establishment of extractive institutions (Acemoglu and Robinson 2012). To assess these views, we examine only economies with a small proportion of Europeans during the colonial period, which we define as economies with less than 15 percent Europeans, including those that had essentially zero Europeans. Even among these countries, more Europeans during colonization are associated with greater economic development today; indeed, the estimated coefficient on the European share of the colonial population increases in size in this subsample of countries. Thus, the positive relationship between Europeans and economic development today is not just about the difference between settler and extractive colonies. We do not confirm the prediction that colonies with essentially no Europeans performed better than (or even as well as) those colonies with a small group of Europeans.

Ample qualifications temper our conclusions. First, we do not identify a single mechanism through which the European share of the population during colonization shaped long-run economic development. We show that European share is strongly associated with human capital and democratic political institutions today, but we do not trace the impact of Europeans on human capital and political institutions over time, nor do we exclude other potential mechanisms through which the European share of the population during colonization might influence economic development.

Second, we do not assess the welfare implications of European settlement during colonization; we only assess the income effect under conditions where welfare and income are clearly not identical. Europeans often cruelly oppressed indigenous populations, as well as the people that they brought as slaves (see Acemoglu and Robinson 2012 for compelling examples).

Thus, GDP per capita today cannot measure the welfare effects of European settlement; it can only measure economic activity within a particular geographical area. Although there is no question about European oppression, the effect of European colonization on long-run economic development remains an open question. In this paper, we examine the relationship between European settlement during the colonial period and economic development today to help inform debates about the sources of the divergent paths of economic development taken by countries around the world since the colonial period.

The remainder of the paper is organized as follows. Section 1 defines and discusses the data, while Section 2 provides preliminary evidence on the determinants of human settlement prior to European colonization and the factors shaping European settlement. Section 3 presents the paper's core results on the effect of colonial European share, considering the controls mentioned above. Section 4 reports an exercise in development accounting to calculate what share of global development can be attributed to Europeans. Section 5 concludes.

1. Data

To assess the independent impact of the European share of the population during the early stages of colonization on the level of economic development today, we need data on (1) the European share of the population during colonization, (2) instrumental variables for the European share of the population to mitigate potential biases associated with measurement error and reverse causality, (3) other exogenous determinants of economic development, so that we can isolate the independent association between the European share of the population during colonization and economic development, and (4) measures of economic development today.

This section describes only the two data series that we construct: (1) the European share of the population during colonization and (2) the degree to which a region experienced large scale indigenous mortality due to the diseases brought by European explorers in the 15th and 16th centuries. Since the other data that we employ in our analyses are taken from readily available sources, we define those variables when we present the analyses below.

1.1 Euro share

We compile data on the European share of the population during the early stages of colonization (*Euro share*) from several sources. Since colonial administrators were concerned about documenting the size and composition of colonial populations, there are abundant—albeit disparate—sources of data. Of course, there was hardly anything like a modern statistical service in colonial times, so that different administrators across different colonies in different time periods used different and often undocumented methods for assembling population statistics. Thus, we use a large variety of primary and secondary sources on colonial history to piece together data on the European share of the population.

Although the Data Appendix provides detailed information on our sources, the years for which we compiled data on each country, and discussions about the quality of the data, it is worth emphasizing a few points here. First, we face the tricky issue of choosing a date to measure European share. We would like a date as early as possible after initial European contact to use European settlement as an initial condition affecting subsequent developments. At the same time, we do not want to pick a date that is too early after European contact since it is only after some process of conquest, disease control, and building of a rudimentary colonial infrastructure that it became possible to speak of a European settlement. Given these considerations, we try to choose a date at least a century after initial European contact, but at least 50 years before independence, which means that for conceptual reasons we do not seek to use a uniform date across all colonies. Given these broad objectives for choosing a date, we must nevertheless select dates under severe data limitations. In particular, we do not have a continuous time series for each country; rather, the data reflect dates when colonial administrators in particular locals happened to measure or estimate populations. The Data Appendix provides the precise dates for each country and notes that the results are robust to using other methods for selecting a particular date for the European share of the population during colonization.

Second, we adopt a "dog did not bark" strategy for recording zero European settlement. If we find no historical sources documenting any European settlement in a particular colony, we assume that there were no such settlers. This procedure runs the risk of biasing downward European settlement. However, we believe colonial histories (which are virtually all written by European historians) are extremely unlikely to fail to mention significant European settlements.

We checked and confirmed the validity of this procedure using the Acemoglu et al. (2001) data appendix, which gives the share of Europeans in the population in 1900.

1.2 Indigenous mortality

As instruments for European share of the population during the colonial period, we use several predetermined factors—including the degree to which Europeans brought diseases that wiped out the indigenous population. Others have carefully documented this tragic experience, but we believe that we are the first to use it to explain the nature of colonization and its effect on subsequent economic development.

Although Europeans established at least a minimal level of contact with virtually all populations in the world during the colonial period, this contact had truly devastating effects on indigenous populations in some regions of the world but not in others. Some regions had been completely isolated from Eurasia for thousands of years, and thus had no previous exposure or resistance to Eurasian diseases. When Europeans then made contact with these populations—which typically occurred during the initial stages of global European exploration and hence long before anything resembling "European settlements," European diseases such as smallpox and measles spread quickly through the indigenous population, decimating the indigenous people. For example, when the Pilgrims arrived in New England in 1620, they found the indigenous population already very sparse because European fisherman had occasionally landed along the coast of New England in the previous decades. Similarly, De Soto's expedition through the American South in 1542 spread smallpox and wiped out large numbers of indigenous people long before British settlers arrived.

Thus, we construct a dummy variable, *Indigenous mortality*, which equals one when a region experienced large-scale indigenous mortality due to the spread of European diseases during the initial stages of European exploration. To identify where Europeans brought diseases that caused widespread fatalities, we use the population data of McEvedy and Jones (1978) and three epidemiological world histories (McNeil 1976, Karlen 1995, Oldstone 1998). Diseases had circulated enough across Eurasia, Africa and the sub-continent, so that indigenous mortality did not shoot up with increased exposure to European explorers, traders, and slavers during the early stages of European colonization. The New World (Americas and Caribbean) and Oceania (the Pacific Islands, Australia, and New Zealand) were different. When European explorers and traders arrived, the microbes that they brought triggered extremely high mortality rates, which accords with their previous isolation from European diseases. The evidence suggests that mortality rates of 90 percent of the indigenous population after European contact were not unusual. Although we originally thought in terms of a country-by-country variable for large-scale indigenous mortality, our review of the evidence indicates little measurable variation within the New World and Oceania. Consequently, *Indigenous mortality* is a simple dummy for countries in the New World and Oceania.

The *Indigenous mortality* indicator has characteristics that make it a good instrument for *Euro share*. History suggests that the key determinant of the indigenous mortality effects of European's making contact with other populations during the colonization period is the region's previous degree of isolation from Europe, not the extent of subsequent European settlement. Hence, we do not believe that there is reverse causality running from European settlement to *Indigenous mortality*.

2 Preliminaries

2.1 Where Did People Settle?

European settlers confronted a non-European world of very uneven population density. The pre-existing density had at least two material— but opposing—effects on European settlement. First, indigenous population density probably reflected the attractiveness of the land for human settlement, including Europeans. Second, indigenous population density probably reflected the potential for the indigenous people to resist European settlers. We will use the set of variables described below to separate these two effects on European settlement during the colonial period in the next section.

Table 1a examines the determinants of population density in 1500, drawing on a rich and multidisciplinary literature. The dependent variable is the logarithm of population density in 1500, which we call *Population density 1500* and is taken from Acemoglu et al (2002).

We examine five potential determinants of population density in 1500. First, *Biogeography* is an index of the prehistoric (about 12,000 years ago) availability of storable crops and domesticable animals, where large values signify more mammalian herbivores and omnivores weighing greater than 45 kilograms and more storable annual or perennial wilds grasses, which are the ancestors of staple cereals (e.g., wheat, rice, corn, and barley).[1] We expect that *Biogeography* is positively associated with *Population density 1500*. Second, *Latitude* measures the absolute value of the distance of the colony from the equator. Third, *Malaria ecology* is an ecologically-based spatial index of the stability of malaria transmission in a region, where larger valued signify a greater propensity for malaria transmission. The index is based on

[1] Taken from Hibbs and Olsson (2004), *Biogeography* equals the first principal component of (a) the number of annual perennial wild grasses known to exist in the region in prehistoric times with mean kernel weight of greater than ten milligrams and (b) the number of domesticable large mammals known to exist in the region in prehistoric times with a mean weight of more than 45 kilos.

jointly assessing the impact of climate and the proportion of land area infected with malaria.[2] We do not have strong priors on the relationship between population density in 1500 and either *Latitude* or *Malaria ecology*. While *Latitude* or *Malaria ecology* might influence the suitability of a region to European settlement, it is not clear that they will shape population density before European colonization. Fourth, *Indigenous mortality* is a dummy variable that equals one if the region experienced a large drop in the indigenous population from diseases brought by Europeans. As defined above, we constructed this variable from historical sources. Fifth, *Settler mortality* equals historical deaths per annum per 1,000 European settlers (generally soldiers, or bishops in Latin America) and is taken from AJR's (2001) highly influential study of comparative economic development. Though Albouy (forthcoming) has challenged the validity of this indicator, we use *Settler mortality* to assess the association between European mortality after colonization and population density prior to their arrival. Since *Settler mortality* occurs after 1500, we do not expect this to exert an independent, causal effect on population density in 1500.

We find that population density in 1500 was greater in environments that were more conducive to the domestication of animals and the cultivation of storable plants as measured by *Biogeography*, confirming the findings in Diamond (1997). These results are robust to including the other explanatory variables. Thus, unsurprisingly, human settlement was denser in areas where it was easier to produce food.

Several other characteristics do not have a robust, independent link with population density in 1500. Features such as the *Malaria ecology* and *Latitude* are not associated with pre-Columbian population density in 1500. And, *Settler mortality* is not significantly correlated with population density in 1500 after controlling for other characteristics of the country. This is

[2] The Malaria ecology index is from Kiszewski et al (2004) and captures of the stability of malaria transmission based biological characteristics of mosquitoes such the proportion of blood meals taken from human hosts, daily survival of the mosquito, and duration of the transmission season and of extrinsic incubation.

consistent with the view that although characteristics like the prevalence of malaria, distance from the equator, and the extent of European mortality might have shaped European settlement during colonization, these characteristics did not affect the population density of former colonies *before* Europeans arrived.

It is curious that *Indigenous mortality*, which occurred after colonization, is negatively associated with population density in 1500. This finding indicates that areas that were isolated from Europeans prior to colonization and hence more susceptible to European-borne diseases had lower population density in 1500 AD. This may be related to Spolaore and Wacziarg's (2009) result on diffusion of technology as a function of when different branches of humanity became separated. Populations in Oceania and the Western Hemisphere had been isolated from the rest for a very long time, and hence they did not get either (1) the more advanced technology originating in the Old World that would have helped support a larger population or (2) the exposure to European diseases before colonization that would have them more resistant to European diseases and hence to European settlement. We will see that this combination of low density and vulnerability to European diseases plays a large role in accounting for where Europeans settled.

2.2 Where Did Europeans Settle?

We now turn from the question of what shaped the settlement of humans before 1500 to the question of what shaped the settlement of Europeans during the early stages of colonization. Table 1b provides regression results concerning which factors shaped European settlement during colonization, where the dependent variable is the proportion of Europeans in the colonial population (*Euro share*).

The regressors in Table 1b are as follows. First, we include *Population density 1500*. Since the regressions also include other variables to control for the attractiveness of the land for settlement, we examine the relationship between *Euro share* and population density in 1500 conditional on the generalized attractiveness of the land for human settlement. A plausible interpretation of the conditional impact of *Population density 1500* on *Euro share* is that it gauges the ability of the indigenous population to resist European settlement. Second, *Indigenous mortality* provides additional information on the inability of the indigenous population to resist European settlers. If European diseases eliminate much of the indigenous population, this would clearly reduce their ability to oppose European settlement. Third, *Latitude* might have special relevance for European settlers, who might be especially attracted to lands with the same temperate climate as in Europe. Fourth, *Precious Metals* is an indicator of whether the region has valuable minerals since this might have affected European settlement. Fifth, one cost of settling in a particular country might be its distance from Europe, so we use the distance from London as a gauge (*London*). Finally, we examine other possible determinants of the attractiveness of the land for settlement from Table 1a, including *Biogeography, Maria ecology*, and *Settler Mortality*.

The results show that three factors account for the bulk of cross-country variation in European settlement during the colonial period. First, the density of the indigenous population matters. In regions with a high concentration of non-Europeans who had already occupied the land and could supply forces of resistance, Europeans comprised a much smaller fraction of the colonial population than in other lands. Second, indigenous mortality matters. Where the indigenous population fell drastically because of European diseases, European settlers were more likely to settle. Third, many of the regressions also suggest positive relationship between *Euro share* and *Latitude*, even when conditioning on *Population density 1500* and *Indigenous mortality*. In general, Europeans were a larger proportion of the colonial population in higher (temperate) latitudes, plausibly because of the similarity with the climate conditions to their home region. However, *Latitude* does not enter significantly when also controlling for *Biogeography*.

None of the other possible determinants are significant after controlling for these three determinants. The differences between 1a and 1b are important, because they might affect the plausibility of the exclusion restrictions below when we use *Population density 1500* and *Indigenous mortality* as instruments for European settlement. European colonial settlement, unlike pre-Columbian population, was NOT driven by the intrinsic, long-run potential of the land—as measured especially by *Biogeography*.

Three factors, *Population density 1500*, *Indigenous mortality*, and *Latitude* help explain in a simple way the big picture associated with European settlements, or the lack thereof, in regions around the world. Where all three factors were favorable for European settlement, such as Australia, Canada, New Zealand, and the United States, the European share of the colonial population was very high. When only some of the three factors were favorable, there tended to

be a minority share of European settlers. Latin America suffered large-scale indigenous mortality, but only some regions were temperate, and most regions had relatively high pre-Columbian population density (which is why more people of indigenous origin survived in Latin America compared to North America, even though both regions experience high indigenous mortality rates when exposed to European diseases). Southern Africa was temperate and had low population density, but did not experience large-scale indigenous mortality. These factors can also explain where Europeans did not settle. The rest of sub-Saharan Africa was tropical and again did not experience much indigenous mortality from exposure to the microbes brought by Europeans during colonization. And, most of Asia had high population density, did not suffer much indigenous mortality from European borne diseases, and is in or near the tropics, all of which combine to explain the low values of *Euro share* across much of Asia.

One of the most famous variables in the literature on explaining European settlement is the *Settler mortality* measure calculated by AJR. Our collection of actual data on colonial settlement allows this explanatory value to be tested for the first time. This variable does have a significant simple correlation with European settlement, confirming the prediction in AJR. But, when entered with the three variables that we found most robust in other specifications, the settler mortality variable becomes insignificant and does not materially alter the statistical significance of the other variables (though it does reduce the magnitude of their estimate coefficients). Apparently, *Settler mortality* does not exert an independent effect on *Euro share*, but *Indigenous mortality* does.

3 Results: Do Europeans Matter?

3.1 Do Europeans Matter? Introductory thoughts

We begin by assessing the relationship between *Euro share* and the current level of economic development as measured by the average of the log of real per capita GDP over the decade from 1995 to 2005 (*Current income*). Using data averaged over a decade reduces the influences of business cycle fluctuations on our measure of current economic development. We condition on a range of national characteristics to assess the independent relationship between *Current income* and *Euro share*. Controlling for an array of other potential determinants of economic development also provides some suggestive evidence on the channels linking *Euro share* and *Current income*.

We consider the following cross-country regression:

$$\textit{Current income} = \alpha * \textit{Euro share} + \beta' \boldsymbol{X} + u, \quad (1)$$

where $\boldsymbol{X}$ is a matrix of national characteristics that we define below, and u is an error term, potentially reflecting economic growth factors that are idiosyncratic to particular countries, as well as omitted variables, and mis-specification of the functional form. Different theories provide distinct predictions about (a) the coefficient on *Euro share* (α), (b) whether α changes when conditioning on particular national characteristics, and (c) how α changes across sub-samples of countries.

We get some insight into the channels connecting *Euro share* and *Current income* by examining how α changes when controlling for the different potential channels discussed above: political institutions and human capital. Thus, if *Euro share* is related to current levels of economic development through its effect on the formation of enduring political institutions, then *Euro share* will not enjoy an independent relationship with economic development today when

controlling for political institutions. And, if *Euro share* is related to economic development today through its effect on the spread of human capital, then *Euro share* will not enter significantly when controlling for educational attainment today. We examine these issues below.

3.2 Do Europeans Matter? OLS Results

We begin by evaluating equation (1) while conditioning on an array of national characteristics (***X***). *Legal origin* is dummy variable that equals one if the country has a common law (British) legal tradition. This dummy variable both captures the argument by North (1990) that the United Kingdom instilled better growth-promoting institutions than other European powers and the view advanced by La Porta et al (2008) that the British legal tradition was more conducive to the development of growth-enhancing financial systems than other legal origins, such as the Napoleonic Code passed on by French and other European colonizers. *Education* equals the average gross rate of secondary school enrollment from 1995 to 2005 and is taken from the World Development Indicators. *Independence* equals the fraction of years since 1776 that a country has been independent. As in Beck, Demirguc-Kunt, and Levine (2003) and Easterly and Levine (2003), we use this to measure the degree to which a country has had the time to develop its own economic institutions. *Government quality* is an index of current level of government accountability and effectiveness and is taken from Kaufman et at (2002). *Ethnicity* is from Easterly and Levine (1997) and measures each country's degree of ethnic diversity. In particular, it measures the probability that two randomly selected individuals from a country are from different ethnolinguistic groups. Finally, as defined above, *Settler mortality* measures the degree to which European mortality during the colonial period. Since the purpose of our research

is to examine the impact of European settlement outside of Europe, all of the regressions exclude European countries.

Using ordinary least squares (OLS), Table 2a shows that there is—with a few notable exceptions—a positive, significant relation between *Current income* and *Euro share*. For example, regression (1) indicates that an increase in *Euro share* of 0.1 (where the mean value of *Euro share* is 0.07 and the standard deviation is 0.07) is associated with an increase in *Current income* of 0.36 (where the mean value of *Current income* is 8.2 and the standard deviation is 1.3). The strong positive link between the European share of the population during colonization and current economic development holds when conditioning on different national characteristics, with two key exceptions. The coefficient on *Euro share* falls drastically and becomes insignificant when conditioning on either *Government quality* or *Education*. These findings are consistent with—though by no means a definitive demonstration of—the views that the share of Europeans in the population during colonization shaped long-run economic development by affecting political institutions and human capital accumulation.

These results could be driven by a few former colonies in which Europeans were a large fraction of the population during the early stages of economic development and that just happen to be well-developed former colonies today. Thus, we conduct the analyses for a sample of countries in which *Euro share* was less than 15 percent.[3] The goal of restricting the sample to only those countries where Europeans account for a small proportion of the population is to assess whether the relation between *Euro share* and *Current income* holds when there is only a small minority of Europeans. While there is no formal definition of what constitutes a "minority

[3] We also considering entering Euro Share in a quadratic function, in a spline regression, or in some other nonlinear function. However, these functional forms do not lend themselves to the IV techniques we will use in the next section, so we chose instead to stick with the procedure of a restricted sample in which Euro Share was less than .15.

European colony," we use less than 15 percent European as a conservative benchmark of a non-settler colony.

As shown in Table 2b, however, the coefficient on *Euro share* actually becomes larger when restricting the sample to those countries in which *Euro share* is less than 15 percent. The increase in the coefficient on *Euro share* when restricting the sample to former colonies with small values of *Euro share* suggests that the relationship between the European share of the population during colonization and the level of economic development does not simply represent the economic success of "settler colonies." Rather, a marginal increase in *Euro share* has a bigger effect on subsequent economic development in colonies with only a few Europeans—there seems to be diminishing marginal long-run development product to *Euro share*. A marginal increase in *Euro share* is associated with an especially large boost to long-run economic growth in former colonies with only a small share of Europeans.

The relationship between *Current income* and *Euro share* is sensitive to controlling for political institutions and especially to controlling for human capital accumulation. As shown in Table 2b, the size of the economic association between *Current income* and *Euro share* shrinks and becomes insignificant when conditioning on educational attainment (regression 3), and the association between *Current income* and *Euro share* shrinks though remains significant at the 10 percent level when conditioning on political institutions (regression 5).

The coefficient on British legal origin is never significant (nor will it be in the rest of the paper). It is also of interest that many of the colonies with Euro Share < .15 were Spanish colonies. Hence we find no evidence for the popular view that British colonization or legal origin led to more development than Spanish colonization or legal origin.

3.3 Do Europeans Matter? 2SLS

To control for potential simultaneity bias, we seek to employ instrumental variables that are correlated with the proportion of Europeans during colonization but that are unlikely to explain current levels of economic development beyond their effect on *Euro share*. Based on the evidence presented in Table 1b concerning the determinants of *Euro share*, we use *Population density 1500* and *Indigenous mortality* as instruments for *Euro Share*. Although *Latitude* also helps explain *Euro share* in Table 1b, it is more difficult to argue that *Latitude* only influences economic development today through its effect on *Euro share*. *Latitude* might also have affected the ability of Europeans to transfer technologies from Europe to other parts of the globe, with long-term ramifications on economic development beyond its effects on *Euro share*. Latitude is indeed one of the most common instruments in the entire cross-country literature, suggestive of many other postulated channels by which it affects development. Thus, we do not include *Latitude* as an instrument.[4]

Standard specification tests support the validity of the instruments. First, the first-stage regression, which is presented in column 1 of Table 1b, is powerful. It has a high F-statistic that makes weak instruments unlikely to be a problem. Furthermore, we show that the instruments reject the Kleibergen Paap (2006) LM test of weak instruments in Tables 3a and 3b. Second, we use a standard over-identification (OIR) test of whether the instruments—*Population density 1500* and *Indigenous mortality*—explain *Current income* beyond their effect on *Euro share*. As shown in Tables 3a and 3b, the instrumental variables do not reject the OIR test that the instruments are valid. Although we are aware that exclusion restrictions in macro regressions are seldom completely credible, and that OIR tests suffer from low power, the OIR test is not

[4] When including *Latitude* as an instrument, the coefficient estimate on *Euro share* changes little, but the OIR-test is sometimes rejected, suggesting that indeed *Latitude* explains economic development today beyond its ability to account for cross-country differences in the European share of the population during colonization.

rejected and there are sound conceptual reasons for using *Population density 1500* and *Indigenous mortality* as excluded instruments.

The impact of *Euro share* on *Current income* is economically large, especially when restricting the analyses to former colonies in which Europeans were a small minority of the population (less than 15%) during the early stages of colonization. For example, again consider an increase in *Euro share* of 0.10. The estimated coefficient on *Euro share* in regression 1 of Table 3b (21) indicates that an increase in the proportion of Europeans during colonization of ten percentage points will translate into an increase in real per capita income today of 2.1. This is large. For example, consider just a one percentage point increase in Euro share in the case of Brazil. The estimated coefficients suggest that if Brazil had a *Euro share* of 0.084 rather than 0.074, then its average GDP per capita over the period from 1995 to 2005 would have been $9,798 instead of $7,942.

The instrumental variable results again emphasize a key, and surprising, finding: far from being attenuated, the economic development effect of an additional percentage point of European population during the colonial period is much larger in minority European colonies than in a majority European colony. While an enormous body of research documents and emphasizes the exploitative behavior of minority white populations around the world, the regressions suggest that Europeans brought factors of production that boosted long-run economic development, especially among colonies with a only a few Europeans. As we emphasized in the introduction, this is not a welfare calculation—GDP per capita today does not measure the welfare effects of colonization. We are simply observing that contrary to some theories, and consistent with others, a marginal increase in European settlement in a geographic area during colonization had an especially positive effect on the level of economic development today within that geographic

region, especially in places that had only a small, minority of Europeans living in the area during colonization.

The relationship between *Current income* and *Euro share* weakens appreciably when conditioning on *Education* and weakens slightly when controlling for Government quality, especially when focusing on the sample of countries with less than 15 percent *Euro share*. In Table 3b, the estimated coefficient on the exogenous component of *Euro share* drops by about two-thirds and become significant at only the 10 percent level when controlling for *Education*, suggesting that the relation between *Euro share* and *Current income* is not independent of its association with *Education*. The relationship between *Current income* and *Euro share* also changes when conditioning on *Government quality*. In Table 3b, controlling for *Government quality* reduces the size of the estimated coefficient on *Euro share* by about one-third, although it remains significant at the one percent level.

This is suggestive again that the human capital and institutional channels are important for the effect of colonial European settlement on development today, with stronger evidence for the human capital channel. Of course, we do not control for the potential endogenous determination of education and political institutions (an important but inescapable caveat given the usual inability to develop a full identification strategy covering three endogenous regressors). And, so we simply provide these analyses as suggestive of the potential channels, without nailing them down empirically—a nontrivial task left for future research.

Overall, the IV findings are suggestive of a causal impact of colonial European settlement on per capita income today. We are of course aware of the many plausible criticisms of the internal validity of causal effects in cross-country macro regressions. The OLS results would still remain of considerable interest in establishing a robust correlation between European settlement

a long time ago and outcomes today. Along with a wide array of recent research, our results indicate that historical factors play an enduring role in shaping economic development.

3.4 Is it Europeans during Colonization or Europeans today?

Euro share might proxy for the proportion of the current population that is of European descent. Figure 1 shows there is indeed a positive association between colonial *Euro share* and European share in modern times (measured in 2000 from Putterman and Weil 2010). Consequently, it may be inappropriate to interpret the results on *Euro share* as reflecting the enduring impact of Europeans during the colonization period on economic development. Rather, Europeans might have simply migrated to economically successful countries after colonization.

To assess the strength of the independent relationship between the level of economic development today and the European share of the population during the early stages of the colonial, we therefore control for the proportion of the population today that is of European descent (Tables 4a and 4b). We would like to use instrumental variables for both *Euro share* and the fraction of the population today that is of European descent and therefore separately identify the impact of each on *Current income*. But, we faced a weak instruments problem: we could not find instrumental variables that separately explained *Euro share* and the current European share of the population, while also satisfying the exclusion restriction. Since the standard errors of the IV regressions are not reported correctly with a weak instruments problem, we do not report them. Instead, we use OLS regressions to produce suggestive partial correlations between *Current income* and *Euro share* while controlling for the proportion of Europeans today (*Euro 2000 P-W*) and other explanatory variables.

We find a positive relationship between *Current income* and *Euro share* even when controlling for the current proportion of the population of European descent. *Euro 2000 P-W* is usually significant, but *Euro share* remains significant in the same regressions as in earlier results. That is, the significance (of both old and current Euro share) vanishes when we control for the channels of human capital or institutions, but is significant in other regressions. These results are robust to limiting the sample to having the colonial *Euro share* less than .15.

A graph helps understand whether the proportion of Europeans during the colonization period is more strongly associated with current economic development than the proportion of the population today that is of European descent. Examining the scatter plot in Figure 1, consider three groups of countries: (1) countries in which Euro share was high both in colonial times and today (e.g. North America), (2) countries in which Euro share was low both in colonial times and today (e.g. South Africa), and (3) countries in which Euro share today is much higher than it was in colonial times (e.g. some Central and South American countries). If colonial Euro share did not matter independently for income today, then we would expect group (3)'s income to be more like group (1)'s income. But, this is not what we find. In contrast, if colonial Euro share does matter independently for income today, then we would expect group (3)'s income to have lower income than group (1) and to have similar income to group (2). This is what we observe, illustrating the finding that the proportion of Europeans during the colonization period is independently associated with economic development today, and the results are not driven by the proportion of Europeans today.

4. How much development is attributable to Europeans?

In this section, we do some global development accounting to illustrate how much of development might be associated with European settlers. This exercise uses the estimated equation for *Euro share* with no controls

(1) $\ln(CurrentIncome_i) = \alpha + \beta EuroShare_i + \varepsilon_i$

Next, define the counterfactual $CurrentIncome^{CF}$ for every country outside of Europe by removing the European effect:

(2) $CurrentIncome_i^{CF} = CurrentIncome_i \cdot e^{-\beta \cdot EuroShare_i}$

Of course, $CurrentIncome_i = CurrentIncome^{CF}_i$ for any country i where $Euroshare_i = 0$.

The counterfactual population-weighted global mean is then simply the weighted mean across all non-European countries of $CurrentIncome^{CF}_i$, where P_i is population in country i, and P is total global population (we have data on 139 non-European countries).

(3) $\tilde{y}^{CF} = \sum_i \left(\frac{P_i}{P}\right) CurrentIncome_i^{CF}$

The global population-weighted per capita income $\tilde{y}_i$ is

(4) $\tilde{y} = \sum_i \left(\frac{P_i}{P}\right) CurrentIncome_i$

The share of development attributed to European settlement is then $s_e = \left(\frac{\tilde{y} - \tilde{y}^{CF}}{\tilde{y}}\right)$

As an illustrative exercise, we use regression (1) of Table 3a, which is the simplest instrumental variable regression. It includes all countries outside of Europe. The coefficient estimate is $\beta = 7.8$.

Using the 2000 population weights, the data and estimated coefficients indicate that 47% of the development outside of Europe is attributed to the share of European settlers during the

early stages of colonization $\left(\frac{\tilde{y}-\tilde{y}^{CF}}{\tilde{y}}\right)$. We repeat our frequent caveat that global per capita income is not a welfare measure, especially in light of the history of European exploitation of non-Europeans. As an exercise in positive analysis, however, it is striking how much of global development is associated with Europeans (not even considering the development of Europe itself).

5. Conclusions

The results are consistent with the view that the proportion of Europeans during the early stages of colonization exerted an enduring, positive impact on economic development. These findings hold when (1) restricting the sample to non-settler colonies, (2) conditioning on the current proportion of the population of European descent, and (3) using instrumental variables to extract the exogenous component of *Euro share*.

These results relate to theories of the origins of the divergent paths of economic development followed since Europeans colonization. Engerman and Sokoloff (ES) (1997) emphasize that agricultural, mineral, the size and robustness of the indigenous population, and other endowments encountered by Europeans affected the formation of institutions, including political institutions, with long-run effects on economic development. ES emphasize that the degree of European settlement reflects these endowments, but Europeans per se are not a causal, independent explanation of the divergent paths of economic development since colonization. In the findings presented above, however, the proportion of Europeans during the early colonial period had a lasting effect beyond endowments and political institutions—Europeans brought factors that fostered long-run economic development. ES also suggested a negative effect of minority European settlement, but we find no evidence of this. We find the positive effect of

Europeans during colonization on economic development today becomes larger—not smaller or negative—when examining only former colonies with a very few European settlers.

Similarly, AJR stress that when endowments lead to the formation of settler colonies, this produced more egalitarian, enduring political institutions that fostered long-run economic development. We have shown nothing to contradict this view. But, it is not the full story. The institutional measure does not robustly win a horse race with the European share of the population during the early stages of colonization. Furthermore, our results are also not consistent with the "Northian" (1990) view that British institutions independently account for a large proportion of comparative economic development.

In contrast, a measure of education today does consistently win a horse race with colonial European share. Although hardly definitive, the results are more consistent with the GLLS argument that Europeans brought human capital and human capital creating institutions and the Galor and Weil (2000) and Galor, Moav, and Vollrath (2008) emphasis on the role of human capital accumulation in explaining the divergence of economies in the long-run.

The previous literature was correct to focus on colonial settlement by Europeans as one of the pivotal events in the history of economic development. We confirmed it in this paper by directly measuring this colonial European settlement for the first time and showing it to have dramatic effects on outcomes today.

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Table A: Descriptive Statistics

	(1)	(2)	(3)	(4)	(5)	(6)
	Obs	Mean	Std. Dev.	Min	Max	Median
Euro Share	130	0.07	0.17	0	0.905	0.00
Euro 2000 Putterman-Weil	116	0.13	0.24	0	0.9	0
Current Income	124	8.18	1.25	5.48	11.04	8.13
Population density 1500	95	0.50	1.52	-3.83	4.61	0.41
Indigenous Mortality	128	0.29	0.46	0	1	0
Latitude	130	0.20	0.12	0.01	0.67	0.18
Malaria Ecology	115	5.20	7.29	0	31.55	1.47
Settler Mortality	81	4.71	1.19	2.15	7.99	4.54
Biogeography	79	-0.51	0.98	-3.37	1.71	-0.97
Legal Origin	130	0.40	0.49	0	1	0
Education	123	57.36	30.58	5.60	152.84	60.19
Independence	90	0.31	0.34	0	1	0.10
Government Quality	129	-0.51	1.96	-4.91	4.62	-0.63
Ethnicity	116	0.38	0.32	0	1	0.34

Table B: Variable Definitions

	Definition	Source
Euro Share	Proportion of Europeans in colonial population	Constructed. See Appendix for details.
Euro 2000 P-W	Proportion of Europeans in 2000 population. Constructed from Putterman and Weil's (2010) migration database by (for each country in the sample) adding the proportion of ancestors coming from each European country.	Putterman and Weil (2010)
Current Income	Ln average of GDP per capita over 1995-2005 (PPP, Constant 2005 International $)	World Bank World Development Indicators
Population density 1500	Log Population per square km in 1500	AJR (2002)
Indigenous Mortality	Dummy variable reflecting high rates of indigenous mortality from European diseases.	McEvedy and Jones (1978), McNeil (1976), Karlen (1995), Oldstone (1998)
Latitude	The absolute value of latitude in degrees, divided by 90 to be between 0 and 1	CIA World Factbook
Malaria Ecology	An index of the stability of malaria transmission based biological characteristics of mosquitoes such the proportion of blood meals taken from human hosts, daily survival of the mosquito, and duration of the transmission season and of extrinsic incubation.	Kiszewski et al (2004)
Settler Mortality	Log of potential settler mortality, measured in terms of deaths per annum per 1,000 "mean strength" (constant population)	AJR (2001)
Biogeography	The first principal component of log of number of native plants species and log number of native animals specifics, where plants are defined as " storable annual or perennial wild grasses with a mean kernel weight exceeding 10 mg (ancestors of domestic cereals such as wheat, rice, corn, and barley)" and animals are defined denotes the number of species of wild terrestrial mammalian herbivores and omnivores weighing >45 kg that are believed to have been domesticated prehistorically in various regions of the world." Hibbs and Olsson (2004) p2	Hibbs and Olsson (2004)
British Legal Origin	A dummy variable indicating British legal origin.	La Porta et al (1999)
Education	Average rate of gross secondary school enrollment from 1995-2005	World Bank World Development Indicators
Independence	The fraction of years since 1776 that a country has been independent	Easterly and Levine (1997)
Government Quality	The first principal component of the six governance indicators from the 2002 vintage of Kaufman et al	Kaufman et al (2002)
Ethnicity	An index of ethnic diversity (updated).	Easterly and Levine (1997)

Table 1a: Human Settlement before European Colonization

The sample is non-European countries. The dependent variable the log of population density in 1500. Biogeography is an index of domesticable animals and plants existing prior to colonization. Indigenous mortality is a dummy variable which is positive if a substantial number of natives died due to initial contact with Europeans. *Maria ecology* is an ecologically-based spatial index of the stability of malaria transmission. All specifications are estimated using OLS with heteroskedasticity-consistent standard errors. The null hypothesis of the F test is that the coefficients on all the explanatory variables equal zero. P values are reported in parentheses. ***, ** and * represent significance at 1, 5 and 10% level respectively. Detailed variable definitions and sources are in the appendix.

	(1)	(2)	(3)	(4)	(5)
	Population density 1500	Population density 1500	Population density 1500	Population density 1500	Population density 1500
Biogeography	0.609**				0.696**
	(0.0152)				(0.0482)
Latitude		-3.084			-3.103
		(0.101)			(0.170)
Malaria ecology			0.0275		0.00749
			(0.105)		(0.746)
Indigenous mortality				-1.361***	-0.603
				(8.64e-06)	(0.136)
Observations	69	96	90	96	69
R-squared	0.110	0.053	0.017	0.182	0.207
Prob>F	0.0152	0.101	0.105	8.64e-06	0.0360
F test:	6.211	2.750	2.681	22.16	2.743

Table 1b: What Determined the Degree of European Settlement?

The sample is non-European countries. The dependent variable *Euro share* is the proportion of Europeans in the colonial population. *Population density 1500* is the log of population density in 1500. Indigenous mortality is a dummy variable which is positive if a substantial proportion of natives died due to initial contact with Europeans. Latitude is the absolute value of distance from the equator. P values are reported in parentheses. ***, ** and * represent significance at 1, 5 and 10% level respectively.

	(1)	(2)	(3)	(4)	(5)	6)	(7)
	Euro share	*Euro share*	*Euro share*	*Euro share*	*Euro share*	*Euro share*	*Euro share*
Population density 1500	-0.0357**	-0.0275***	-0.0277***	-0.0269**	-0.00376	-0.0272***	-0.0324**
	(0.0249)	(0.00744)	(0.00706)	(0.0129)	(0.152)	(0.00774)	(0.0140)
Indigenous mortality	0.156***	0.141***	0.141***	0.136***	0.0737***	0.144***	0.0865**
	(1.04e-05)	(9.54e-06)	(1.58e-05)	(2.94e-05)	(5.80e-05)	(0.000413)	(0.0332)
Latitude		0.661***	0.664***	0.686***	0.0780	0.680***	0.674***
		(9.36e-05)	(9.59e-05)	(7.18e-05)	(0.102)	(0.000132)	(0.000195)
Precious metals			-0.00370				
			(0.897)				
London				6.58e-08			
				(0.993)			
Biogeography					-0.000861		
					(0.828)		
Malaria ecology						0.000988	
						(0.405)	
Settler Mortality							-0.0150
							(0.195)
Observations	95	95	95	91	68	89	73
R-squared	0.375	0.544	0.544	0.547	0.486	0.541	0.582
Prob>F	1.32e-05	5.59e-07	2.17e-06	2.28e-06	3.51e-06	1.12e-05	8.19e-06
F test:	12.73	12.64	9.392	9.430	9.709	8.277	8.850

Table 2a: Does the degree of European settlement explain per capita income today?

The sample is non-European countries. Current income is the log of average of per capita income over 1995-2005 *Euro share* is proportion of Europeans in the colonial population. Legal origin is a dummy variable which is positive if a country's laws are based on the United Kingdom's legal system. Current education is the average rate of secondary school enrollment from 1998 to 2002. Independence is the fraction of years since 1776 that a country has been independent. Government quality is an index of measures of current government accountability and effectiveness. Ethnicity is a measure of a country's ethnic diversity. All specifications are estimated using OLS with heteroskedasticity-consistent standard errors. The null hypothesis of the F test is that the coefficients on all the explanatory variables equal zero. P values are reported in parentheses. ***, ** and * represent significance at 1, 5 and 10% level respectively. Detailed variable definitions and sources are in the appendix.

	(1)	(2)	(3)	(4)	(5)	(6)
	Current income	Current income	Current income	Current income	Current income	Current income
Euro share	3.622***	3.625***	0.617	3.339***	0.641	3.430***
	(0.000)	(6.30e-11)	(0.230)	(1.49e-09)	(0.209)	(0.00)
British Legal origin		-0.00406				
		(0.986)				
Education			0.0308***			
			(0.000)			
Independence				0.830**		
				(0.0252)		
Government Quality					0.407***	
					(1.07e-09)	
Ethnicity						-1.326***
						(1.60e-05)
Observations	124	124	120	89	124	112
R-squared	0.166	0.166	0.636	0.302	0.433	0.372
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000
F test:	63.64	31.59	105.4	37.50	80.72	86.11

Table 2b: Does the degree of European settlement explain per capita income today?

The sample is countries with *Euro share* values of less than 0.15. Current income is the log of average of per capita income over 1995-2005. *Euro share* is proportion of Europeans in the colonial population. Legal origin is a dummy variable which is positive if a country's laws are based on the United Kingdom's legal system. Current education is the average rate of secondary school enrollment from 1998 to 2002. Independence is the fraction of years since 1776 that a country has been independent. Government quality is an index of measures of current government accountability and effectiveness. Ethnicity is a measure of a country's ethnic diversity. All specifications are estimated using OLS with heteroskedasticity-consistent standard errors. The null hypothesis of the F test is that the coefficients on all the explanatory variables equal zero. P values are reported in parentheses. ***, ** and * represent significance at 1, 5 and 10% level respectively. Detailed variable definitions and sources are in the appendix.

	(1)	(2)	(3)	(4)	(5)	(6)
	Current income	Current income	Current income	Current income	Current income	Current income
Euro share	8.492***	8.500***	-0.571	10.05***	4.073*	9.605***
	(0.000107)	(0.000111)	(0.785)	(0.000230)	(0.0648)	(3.21e-05)
British Legal origin		-0.0402				
		(0.868)				
Education			0.0325***			
			(0)			
Independence				0.801*		
				(0.0543)		
Government Quality					0.402***	
					(1.91e-08)	
Ethnicity						-1.196***
						(0.000318)
Observations	112	112	110	80	112	100
R-squared	0.055	0.055	0.601	0.191	0.347	0.252
Prob>F	0.000107	0.000550	0	7.47e-07	3.53e-10	0
F test:	16.16	8.046	100.9	17.04	26.75	41.06

Table 3a: Using instrumental variables, does European settlement explain per capita income today?

The sample is non-European countries. Current income is the log of average of per capita income over 1995-2005. *Euro share* is proportion of Europeans in the colonial population. Legal origin is a dummy variable which is positive if a country's laws are based on the United Kingdom's legal system. Current education is the average rate of secondary school enrollment from 1998 to 2002Independence is the fraction of years since 1776 that a country has been independent. Government quality is an index of measures of current government accountability and effectiveness. Ethnicity is a measure of a country's ethnic diversity. All specifications are estimated using 2SLS, with *Population density 1500* and indigenous mortality instrumenting for *Euro share*, and with heteroskedasticity-robust standard errors. The OIR p-value refers to the J statistic from the Hansen-Sargan test, with null hypothesis that instruments are uncorrelated with the error term. The LM p-value refers the LM Kleibergen-Paap (2006) rk statistic, which is a generalization to non-iid errors of the LM version of Anderson canonical correlations likelihood-ratio test, with null hypothesis that the first-stage regression is underidentified. P values are reported in parentheses. ***, ** and * represent significance at 1, 5 and 10% level respectively. Detailed variable definitions and sources are in the appendix.

	(1)	(2)	(3)	(4)	(5)	(6)
	Current income	Current income	Current income	Current income	Current income	Current income
Euro share	7.775***	7.882***	3.270***	7.739***	6.885***	6.959***
	(5.60e-06)	(1.67e-06)	(0.00546)	(0.000136)	(0.00139)	(7.84e-05)
British Legal origin		-0.186				
		(0.379)				
Education			0.0218***			
			(1.01e-10)			
Independence				-0.110		
				(0.820)		
Government Quality					0.0863	
					(0.561)	
Ethnicity						-0.700*
						(0.0611)
Observations	92	92	89	78	92	91
OIR p-value:	0.813	0.887	0.966	0.934	0.597	0.714
LM p-value	4.01e-05	2.67e-05	0.0237	0.0162	0.000405	0.000622

Table 3b: Using instrumental variables, does European settlement explain per capita income today?

The sample is non-European countries with Euro Share<.15. Current income is the log of average of per capita income over 1995-2005. *Euro share* is proportion of Europeans in the colonial population. Legal origin is a dummy variable which is positive if a country's laws are based on the United Kingdom's legal system. Current education is the average rate of secondary school enrollment from 1998 to 2002. Independence is the fraction of years since 1776 that a country has been independent. Government quality is an index of measures of current government accountability and effectiveness. Ethnicity is a measure of a country's ethnic diversity. All specifications are estimated using 2SLS, with *Population density 1500* and indigenous mortality instrumenting for *Euro share*, and with heteroskedasticity-robust standard errors. The OIR p-value refers to the J statistic from the Hansen-Sargan test, with null hypothesis that instruments are uncorrelated with the error term. The LM p-value refers the LM Kleibergen-Paap (2006) rk statistic, which is a generalization to non-iid errors of the LM version of Anderson canonical correlations likelihood-ratio test, with null hypothesis that the first-stage regression is underidentified. P values are reported in parentheses. ***, ** and * represent significance at 1, 5 and 10% level respectively. Detailed variable definitions and sources are in the appendix.

	(1)	(2)	(3)	(4)	(5)	(6)
	Current income	Current income	Current income	Current income	Current income	Current income
Euro share	21.14***	21.24***	6.812*	25.56***	14.95***	18.75***
	(0)	(0)	(0.0751)	(1.46e-06)	(1.19e-06)	(5.16e-06)
British Legal origin		0.114				
		(0.632)				
Education			0.0251***			
			(9.85e-11)			
Independence				-0.288		
				(0.515)		
Government Quality					0.306***	
					(0.000537)	
Ethnicity						-0.521
						(0.164)
Observations	81	81	79	69	81	80
OIR p-value:	0.295	0.274	0.238	0.252	0.930	0.174
LM p-value	2.10e-05	1.95e-05	0.00374	0.00652	4.55e-05	4.07e-05

Table 4a: Which has more of an effect on per capita income today, colonial or recent European settlement?

The sample is non-European countries Current income is the log of average of per capita income over 1995-2005. *Euro share* is proportion of Europeans in the colonial population. Euro 2000 P-W is the proportion of Europeans in the 2000 population (using Putterman and Weil's (2010) migration database). Legal origin is a dummy variable which is positive if a country's laws are based on the United Kingdom's legal system. Current education is the average rate of secondary school enrollment from 1998 to 2002. Independence is the fraction of years since 1776 that a country has been independent. Government quality is an index of measures of current government accountability and effectiveness. Ethnicity is a measure of a country's ethnic diversity. All regressions are OLS; P-values are reported in parentheses. ***, ** and * represent significance at 1, 5 and 10% level respectively. Detailed variable definitions and sources are in the appendix.

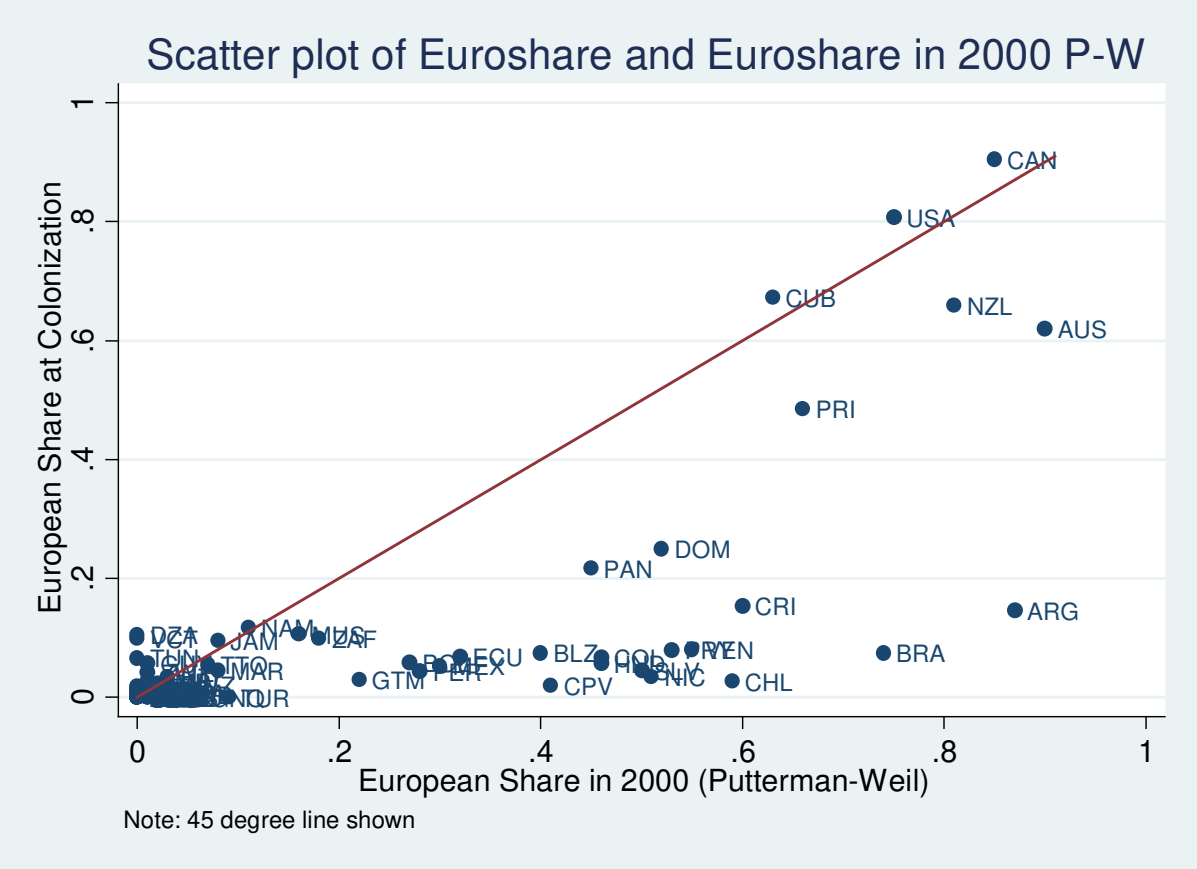
	(1)	(2)	(3)	(4)	(5)	(6)
	Current Income	Current Income	Current Income	Current Income	Current Income	Current Income
Euro Share	1.907***	1.688***	0.419	2.105***	-0.232	2.107***
	(2.31e-06)	(0.00376)	(0.473)	(5.58e-05)	(0.706)	(3.30e-08)
Euro 2000 P-W	1.352***	1.465***	0.152	1.054	0.890**	1.106***
	(0.000198)	(0.000378)	(0.682)	(0.116)	(0.0192)	(0.00547)
British Legal Origin		0.124				
		(0.634)				
Education			0.0315***			
			(0)			
Independence				0.628		
				(0.228)		
Government Quality					0.379***	
					(1.68e-07)	
Ethnicity						-1.104***
						(0.00141)
Observations	113	113	111	86	113	103
R-squared	0.187	0.189	0.637	0.320	0.418	0.371
Prob>F	0	0	0	0	0	0
F test:	69.52	47.48	61.98	53.00	52.77	99.03

Table 4b: Which has more of an effect on per capita income today, colonial or recent European settlement?

The sample is non-European countries with Euro Share<.15. Current income is the log of average of per capita income over 1995-2005. *Euro share* is proportion of Europeans in the colonial population Euro 2000 P-W is the proportion of Europeans in the 2000 population (using Putterman and Weil's (2010) migration database). Legal origin is a dummy variable which is positive if a country's laws are based on the United Kingdom's legal system. Current education is the average rate of secondary school enrollment from 1998 to 2002. Independence is the fraction of years since 1776 that a country has been independent. Government quality is an index of measures of current government accountability and effectiveness. Ethnicity is a measure of a country's ethnic diversity. All regressions are OLS. P values are reported in parentheses. ***, ** and * represent significance at 1, 5 and 10% level respectively. Detailed variable definitions and sources are in the appendix.

	(1)	(2)	(3)	(4)	(5)	(6)
	Current Income	Current Income	Current Income	Current Income	Current Income	Current Income
Euro Share	6.246**	5.895**	-1.604	9.285***	2.494	8.386***
	(0.0212)	(0.0391)	(0.522)	(0.00420)	(0.408)	(0.00182)
Euro 2000 P-W	0.948**	1.050**	0.317	0.193	0.728	0.592
	(0.0272)	(0.0302)	(0.456)	(0.824)	(0.123)	(0.170)
British Legal Origin		0.0961				
		(0.719)				
Education			0.0331***			
			(0)			
Independence				0.778		
				(0.183)		
Government Quality					0.384***	
					(3.85e-07)	
Ethnicity						-1.087***
						(0.00172)
Observations	106	106	104	79	106	96
R-squared	0.078	0.080	0.601	0.193	0.343	0.258
Prob>F	1.85e-05	5.74e-05	0	1.18e-06	1.04e-09	0
F test:	12.14	8.250	64.94	12.36	18.62	27.45

Figure 1: Colonial European Share and European Share Today



Data Appendix

This appendix describes the construction of the dataset on the European share of the population in countries around the world during the early stages of colonization. The primary goal is to define what we did, so that the numbers are transparent and replicable. At the end of the appendix, we list some of the problems that we encountered in constructing the database, and the difficulties that we faced in choosing which years to use in defining a country's "European share of the population during the early stages of colonization." The dataset and other key information are contained in the excel workbook titled "Appendix_Europeans," which is available on request. In this Appendix when discussing details of the dataset, we refer to specific worksheets within this workbook.

Data sources and definitions

We primarily rely on 46 sources, which are listed in the worksheet titled "bibliography" and the worksheet titled "web." Many of these are scholarly books about particular regions or countries and some are atlases. As a few examples, Robert Wells wrote *The Population of the British Colonies in America before 1776*; Simeon Ominde wrote *The Population of Kenya, Tanzania, and Uganda*; and, McEvedy and Jones assembled *Atlas of World Population History*. We also use primary sources (such as national and colonial censuses) to both check these sources and to expand the number of countries and data points. Besides the books and official documents listed in the worksheet "bibliography," some datasets are provided online. We list these in the worksheet "web."

In terms of defining "European settlers," we strive in collecting the data to identify Europeans as people from the geographic region of Europe; it is NOT a racial or ethnic description. So, some observers might consider the populations of some countries outside of Europe as racially or ethnically equivalent to Europeans, but that is irrelevant to us. We are only concerned with resettlement from Europe to outside Europe, defined geographically. Furthermore, in assembling the data on settlers, we strive to exclude colonial officials or business people that are temporarily stationed abroad; we strive to only include Europeans who permanently resettle outside of Europe.

Data: By country, year, and source

For each country, we provide an entry for each year for which we found information on the European share of the population. For each data point, we provide the source of the information (including the page number) and brief notes about the data, whenever relevant. Some of these notes are important. For example, the 1744 and 1778 values for Argentina are based only on the population around Buenos Aires, for the country as a whole. Similarly, one of the values for Ecuador in 1781 measures only the population around Quito. These notes, the data, and the sources of each data point are listed in the worksheet, "country_year_source."

For example, Lyle N. McAlister, in Spain and Portugal in the New World, 1492 -1700, (University of Minnesota Press, 1984) provides data on page 131 on the population of Argentina in 1570. He notes that there are 2000 whites, 4000 blacks, 300,000 "others" in Argentina. Since whites are typically used to describe people of European descent, we calculate European share in Argentina in 1570 as 0.0065.

In some cases, the data sources provide a range of years (rather than a single year) corresponding to data on the share of the population that is European. For example, one of the observations on Mexico is listed as 1568-1570 in the underlying data. In these cases, we choose the average of the range and enter this as the year for the observation. Thus, for the Mexico example, we choose the year 1569 when entering the data. All of these cases are separately identified in the worksheet "periods." This has no bearing on our analyses, but might be relevant for others that use these data.

In a few cases, we found two data sources that provide information on the same year (or range of years) for the same country. In some cases, these two data sources agree, in which case we simply report both observations within the worksheet "country_year_sources." In a few cases, the data sources give different numbers for the share of Europeans in a country in a given year. In this case, we report both numbers in the worksheet "country_year_sources" and use the average of the two observations when constructing the data on which we conduct our analyses.

Data: Share of Europeans used in the analyses

From these data scattered over many years since the 16th century, we construct several measures of the share of Europeans during colonization for each country, where we have one measure per country. To do this, we arrange the data in a manner that is amenable for the construction of a single measure of the share of Europeans during colonization for each country. In the worksheet "euro share," each row is a country. The columns provide possible data entries for many years running from 1540 (which is our first observation, for Chile) through to the late 20th century. We do not include all years as column headings; rather, we only include years for which we have at least one non-missing value for one country.

First, we construct simple, objective measures that average the value of each country over particular periods. For example, we average each country's entries over the period from 1500 to 1801; and, we average values over the period from 1700 to 1950. These measures are provided in the worksheet titled "euro share." Other researchers can obviously take these data and use whichever periods they find most appropriate.

These simple, objective measures for computing the share of Europeans during colonization, however, have some limitations. Specifically, averaging over uniform time periods for all countries might not create accurate measures for each particular country of the proportion of the population that is European during a colony's formative period—the period when a colony was creating an initial set of (potentially enduring) political, educational, and cultural institutions. We fully recognize that there is not a precise definition of "the" formative period of colonization. Nevertheless, influential studies of comparative economic development emphasize the potential role of Europeans during a colony's history when it establishes major institutional norms. This motivates our efforts to give empirical substance to this amorphous notion. From this perspective, using the European share of the population of Mexico in 1650 might be more appropriate than using the share in 1850, but using the European share of the population in 1650 in some parts of Sub-Saharan Africa (or other parts of the world) might be inappropriate because European colonization evolved differently there. Thus, we face a challenging goal: account for these historical differences in the timing and process of colonization to construct a more conceptually useful measure of "euro share" for each country. We face this challenge while operating under severe data constraints.

Thus, the second method for constructing a measure of each country's European share of the population during the formative years of colonization attempts to select the best year, or

range of years, given the particulars of the country and data availability. We would like a date as early as possible after initial European colonization to use European settlement as an initial historical condition affecting subsequent developments. At the same time, we can't pick a date that is too early after the start of European colonization. It was only after some process of conquest, disease control, and building rudimentary colonial infrastructure that it becomes possible to speak of a European community that might influence economic, political, and cultural conditions. Given these considerations, it would not make sense to use a uniform date across all colonies.

Thus, we formulated the following "guidelines." Subject to data limitations, we tried to constrain the timing of the European measure to be at least a century after initial European contact. Furthermore, we tried to choose a date that was at least 50 years before independence to measure the colonial period. Finally, if there were a few measures close together, we took the average.

In the worksheet "euro share," we provide a measure of each country's European share of the population – *euro share*—that represents our assessment of the best year, or range of years, for measuring European share during the formative years of colonization for each particular country, where this assessment is almost always done subject to extreme data constraints. When using a range of years, we average to compute *euro share*. The worksheet also provides the year, or range of years, used to compute *euro share*. This second method is neither simple nor fully objective. Though we do our best to follow the guidelines outlined above, data limitations and the idiosyncrasies of colonial histories make things complex and subjective. Nevertheless, we believe *euro share* is a more accurate representation of the share of Europeans during the

formative years of colonization that simply averaging over a uniform time period for all former colonies.

Though the excel spreadsheet "euro share" provides the details for each country, it is valuable to illustrate some of the constraints that we face and the choices that we made. For much of Latin America, Angel Rosentblat (1954) provides detailed estimates of the composition of the population in 1650. We have used these estimates when available. In many countries, the next available observation is not until a century (or more) later. For example, after 1650, the next observation is not until 1798 in Brazil, 1940 in Bolivia, 1777 in Mexico, and 1744 in Argentina. For some of these countries, we have earlier population estimates that are reported in the excel file. For example, we have observations in 1570 for Argentina, Bolivia, Brazil, and Mexico. But, following the guidelines sketched above, we determined that this was too early after Europeans first arrived.

There are other problems, some of which force us to break with the "guidelines" sketched above. For example, the first number that we have for the United States is the 1790 census, which is obviously not fifty years before the country became independent. Similarly, we do not have data on the composition of the population before 1950 for several countries in Africa, including the Democratic Republic of Congo, Djibouti, Gabon, Sao Tome and Principe, Senegal, Tunisia, and Rwanda. Jamaica and El Salvador provide some particular challenges. For Jamaica, the numbers on European share of the population show considerable variability over the period from 1570 to 1673; but then, the numbers (provided by various sources) are quite consistent from 1700 through 1943. So, to compute *euro share*, we take the average over the period from 1700-1750. For El Salvador, there is one extremely large observation in 1796 (0.48) that deviates from other estimates in nearby years (e.g., 0.03 in 1807) provided by the same source (Baron Castro,

1942). Since (1) the estimates for *euro share* over the entire period with available data from 1551 to 1950 are reasonably constant except for this one observation 1796 and (2) there seems to be a change in the definition of "white" for this particular year, we decided not to include this observation in the "euro share" worksheet. For El Salvador, therefore, we compute the average over the period from 1551-1807, excluding this 1796 outlier because of the change in definition.

Data: Countries in which Europeans did not settle

There are many countries in which Europeans did not settle to any appreciable degree. In these countries, unsurprisingly, we do not find historical sources documenting the share of Europeans during the colonial period. Thus, we face a problem: We do not want eliminate these countries from the sample when we know that European settlers were not a material part of their history, but we do not have documentation to that effect. Thus, although we cannot strictly prove that there were no Europeans, available evidence suggests that Europeans did not settle everywhere and we can incorporate this information into our analyses.

We follow the following procedure. We conduct a worldwide search for colonial data on European settlement. Besides the sources listed in the workbook, we examine many additional sources in search of data. When we fail to find any mention of European settlement in any of these sources for a given nation, we coded that country as having zero European settlement. This procedure runs the risk of biasing downward European settlement for these countries. But, colonial histories seem unlikely to ignore material European settlement. We confirm our data using information from Acemoglu et al. 2001 on the European share of the population in 1900.

Problems: A brief discussion of a few of the problems

There are many challenges associated with constructing this database on the European share of the population during the period of colonization. First, although colonists did document the number of Europeans in the total population at various points during colonization, the processes and periodicities were not standardized. We just do not know if the same colonial power used the same methods in different countries in different years, not to mention differences across European powers. For example, different colonial powers probably used different methods to estimate population numbers. In a census-based method, there could be an undercount of non-European populations, which would bias population numbers downward and European shares upward. In a sampling methodology, there is zero expected bias only if the samplings were random. Unfortunately, we have almost no information on methods followed to get these population numbers. Put simply, we do not have a continuous time series of data collected using similar measures by a centralized coordinating entity.

Second, most of the cells in the data running from the 16th century to the 20th century are empty. This means that for many countries we cannot get measures of the share of Europeans in the population within decades of the years that we would ideally want to measure *euro share*. Although most countries do not experience huge changes in the share of Europeans, some experience substantial changes, so this is another challenge facing the construction of the database.

Third, the basic conceptual predictions about the role of Europeans during colonization and their enduring influence on economic development do not provide a concrete definition of when to measure the share of Europeans during colonization. We try to measure the share of Europeans about a century after the start of colonization and 50 years before independence, but

this simply represents the articulation of a hopefully helpful empirical guideline to measure a still vague concept. Without ignoring these—and other—challenges, we constructed the database and use it to provide empirical evidence on the relationship between the share of Europeans during colonization and comparative economic development.