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NATIONAL INSTITUTIONS AND AFRICAN DEVELOPMENT: EVIDENCE FROM PARTITIONED ETHNICITIES

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ABSTRACT

We investigate the role of national institutions on regional development in a novel framework. We exploit the fact that the arbitrary political boundaries in the eve of African independence partitioned more than two hundred ethnic groups across different countries subjecting similar cultures, residing in homogeneous geographic areas, to different formal institutions. Using both a matching-type and a regression discontinuity approach we show that differences in countrywide institutional structures across the national border do not explain within-ethnicity differences in economic performance, as captured by satellite light density at night. Despite some evidence of heterogeneity, for the overwhelming majority of groups the relationship is economically and statistically insignificant. While our results do not necessarily generalize to areas far from the national borders, close to the capital cities or to other parts of the world, they suggest that the cross-country positive correlation between formal national institutions and economic development has to be carefully interpreted.

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1 Introduction

The inquiry on the fundamental determinants of economic development has been an incessant enterprise in social sciences. In recent years there has been a burgeoning empirical literature trying to shed light on this question employing ingenious identification schemes in a cross-country setting.[1] The predominant institutional view asserts that poorly performing national institutional structures, such as lack of constraints on the executive, poor property rights protection, as well as inefficient legal and court systems are the ultimate causes of underdevelopment (see Acemoglu, Johnson, and Robinson (2005) for a review). Yet other works downplay the role of formal institutions, emphasizing instead the importance of geography, informal cultural norms, genetic and epidemiological traits, and important historical events, such as the slave trades in the context of Africa (see Spolaore and Wacziarg (2012) for a review). Isolating empirically the effect of national institutions from other societal and human traits is, however, challenging, because these features are conceptually hard to measure and most importantly because they closely interact. For example, cultural attributes, such as beliefs, trust, and risk taking that matter for economic development may both be an outcome and a driver of formal institutions.

In this paper we contribute to the literature on the role of national institutions on comparative development employing a novel methodology that exploits in a (quasi)-experimental setting the artificial design of African borders, which took place in the European capitals in the late 19^{th} century (mainly in the Berlin Conference in $1884-5$ and subsequent treaties in the $1890's$), well before African independence and at a time when Europeans had hardly settled in the regions whose borders were designing.[2] The drawing of colonial boundaries partitioned in the eve of African independence more than 200 ethnicities across (two or more) countries. Taking advantage of this historical accident, we compare economic performance in (adjacent) regions belonging to the historical homeland of the same ethnic group, but falling in different countries and are thus subject to different formal institutions. Thus our method accounts both for local common-border features and for ethnic-specific cultural, geographic and societal traits.

Our approach entails two major empirical challenges. First, one needs to identify ethnic homelands that have been partitioned by the artificial border drawing that endured African independence. Second, we need proxy measures of economic performance at the country-ethnicity level. On the first issue we exploit anthropological data from the pioneering work of George Peter Murdock (1959) that has produced a map portraying the spatial distribution

[1] See, for example, La Porta *et al.* (1997, 1998), Acemoglu *et al.* (2001, 2002), and Nunn (2008). We discuss in detail the relation of our paper with previous works below.

[2] There is no ambiguity among African scholars and historians that almost all African borders were artificially drawn. See for example the case study evidence in Asiwaju (1985) and Michalopoulos and Papaioannou (2011) for an empirical investigation of the artificial drawing of borders in Africa.

of African ethnicities in the mid/late 19th century (Figure 1a). Projecting Murdock' map on contemporary national boundaries (Figure 1b), allows us to identify in a systematic manner ethnic groups that have been partitioned by the national border. On the second issue, to overcome the paucity of economic indicators across African region, we build on the recent contribution of Henderson, Storeygard, and Weil (2012) and measure regional development at the ethnicity-country level using images of satellite light density at night, which are available at a fine grid.

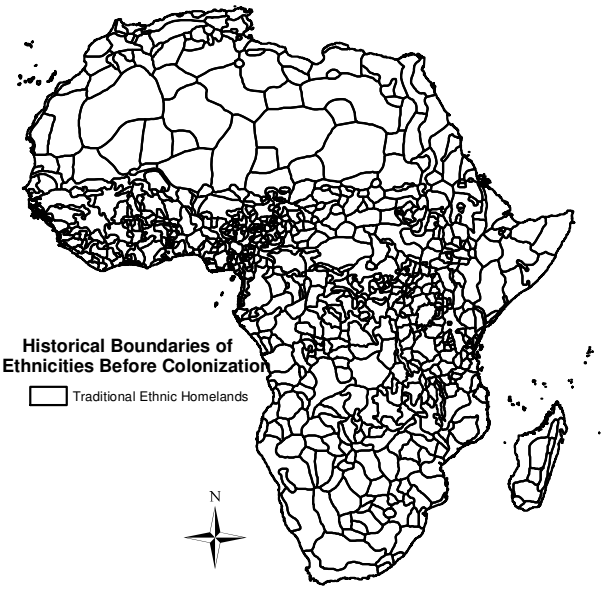

Figure 1a: Ethnic Boundaries

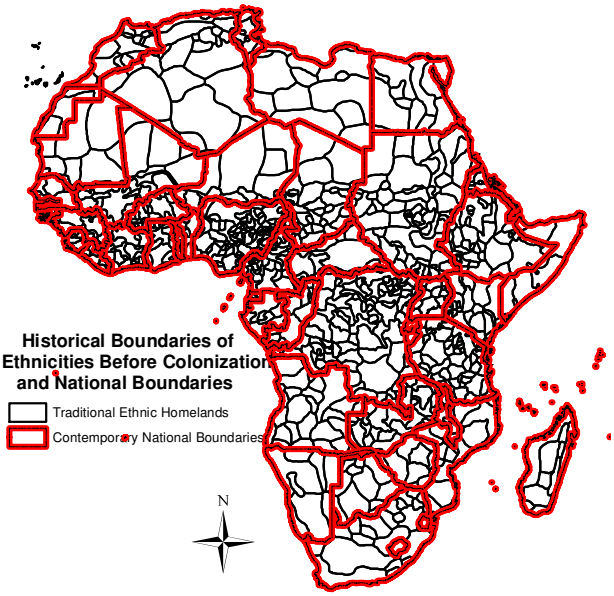

Figure 1b: Ethnic and Country Boundaries

Figures $2a - 2d$ illustrate our approach using as examples the Ababda and the Ewe that have been partitioned by the Egypt-Sudan and the Togo-Ghana border, respectively. In our empirical analysis we investigate whether differences in formal national institutions between neighboring countries explain differences in economic performance (as proxied by luminosity) within ethnic groups found on both sides of the national boundary.

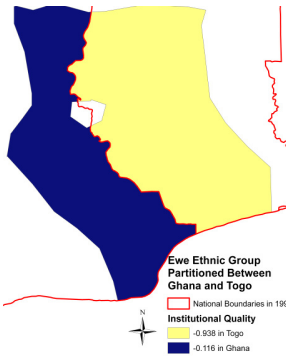

Figure 2*a*

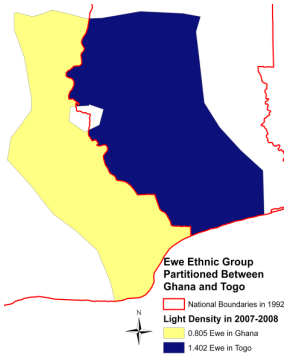

Figure 2*b*

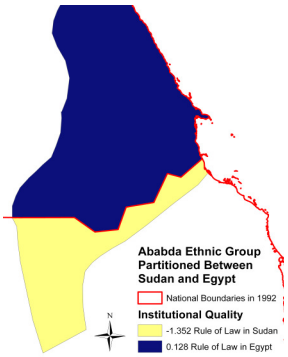

Figure 2*c*

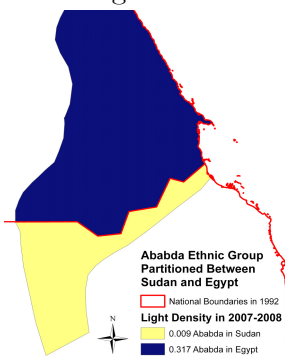

Figure 2*d*

Results Summary Our analysis uncovers new empirical regularities that stand in contrast to most previous works that have mainly relied on cross-country methods. While there is a significant positive correlation between national institutions and development across ethnic homelands, once we properly account for geographic and ethnic-specific differences via the inclusion of ethnicity fixed effects, the correlation weakens considerably and becomes insignificant. This pattern holds both when the unit of analysis is a partition of a historical ethnic homeland (e.g. the homeland of the Ababda in Egypt or the region where the Ewe reside in Togo) and when we take advantage of the finer structure of the luminosity data to obtain multiple observations within each ethnic partition conducting a regression discontinuity (RD) analysis that identifies the (local) effect of national institutions at the border. We obtain similar results for a subset of partitioned ethnic homelands where we have micro-level data from the Afrobarometer surveys on electrification, access to clean water, access to a sewage system, and education.

The lack of a systematic association between national institutions and regional development within partitioned African homelands cautions against extrapolating from the positive correlation found in a cross-country setting. While our results tend to go against the conventional wisdom in economics on the causal impact of national institutional on development,

our findings are consistent with the African historiography that downplays the importance of colonial and contemporary formal institutions and stresses instead the inability of African governments to broadcast power (e.g. Herbst (2000)). Moreover, our results are in line with the recent works of Gennaioli, La Porta, Lopez-de-Silanes, and Shleifer (2012) and Tabellini (2010) who exploit within-country variation across administrative regions and cities and find that human capital and social capital -rather than institutions- are the most robust correlates of regional development.

A nice feature of our approach is that we may examine the role of national institutions for each partitioned ethnicity separately and thus explore in detail heterogeneity. We find that the average (and the median) effect of national institutions across each of the partitioned ethnicities is economically negligible and for two thirds of the groups this correlation is also statistically indistinguishable from zero. Yet for few groups, consisting of approximately 20% of the sample, a significant positive association between national institutions and development emerges, whereas for the remaining groups the within-ethnicity association between institutions and development turns significantly negative. When we search for potential factors explaining heterogeneity, we find some suggestive evidence of a positive relationship between national institutions and economic performance in regions close to the capital cities; yet the positive correlation sharply decays once we move away from the capitals. This finding relates to works on state capacity that emphasize the inability of weak states to broadcast power, enforce contracts and the rule of law, and collect taxes (e.g. Tilly (1985); Migdal (1988); Acemoglu (2005); Besley and Persson (2011)).[3]

Related Literature Our research nests and advances over many strands of literature that examine the political economy of global and African development.

First, an influential body of research asserts that through persistence, the institutions that European powers established during colonization are the deep roots of contemporary economic performance (e.g. La Porta *et al.* (1997, 1998); Acemoglu *et al.* (2001, 2002)). Yet in spite of the ingenious instrumental variables identification schemes employed in the cross-country literature, omitted variables and heterogeneity are major concerns (see Glaeser, LaPorta, de Silanes, and Shleifer (2004), La Porta, Lopez-de-Silanes, and Shleifer (2008), and Nunn (2012), among others). The micro approach of our study enables us to overcome problems inherent to the cross-country framework adding to works that examine the impact of national and historical institutions across regions (e.g. Banerjee and Iyer (2005); Iyer (2010); Dell

[3] Our finding that the positive correlation between national institutions and regional development weakens in border areas far from the capital cities has also implications for the literature on optimal country size (e.g. Alesina and Spolaore (2003); Spolaore and Wacziarg (2005)).

(2010); Long and Shleifer (1993); Tabellini (2010); Gennaioli, La Porta, Lopez-de-Silanes, and Shleifer (2012)).

Second, our identification scheme that exploits discontinuities in development and institutions across country borders within partitioned ethnicities relates to case studies that examine the role of various national policies at a particular border. In an early contribution Miguel (2004) compares public policies in health and education across the Kenya-Tanzania border to examine the effect of Tanzanian nation-building policies. Using a similar to ours methodology, Bubb (2012) investigates how differences in de jure property rights between Ghana and Ivory Coast affect development in border areas. He finds that, despite large differences in de jure property rights between the two countries, there are no differences in de facto property rights across the border.[4] The political science literature has also employed case studies to investigate the impact of national factors at the border. For example, Miles (1994) studies the development of the Hausa after their partitioning (at the Niger-Nigeria border), documenting that different French and British policies (mainly regarding the role of local chiefs) endured after independence and had long-lasting effects. Our study, rather than focusing on the effect of national policies at a specific border or within a single partitioned ethnic group, examines in a comprehensive manner the role of national institutions on development across the universe of Africa's partitioned ethnicities. This is useful since it makes our results less sensitive to the usual external validity arguments readily invoked in the context of case-studies; moreover, our expansive focus allows a detailed exploration of heterogeneity regarding the association between national institutions and regional economic performance.

Third, our results contribute to the large literature on African political economy (see Bates (2008) and Dowden (2008) for eloquent narratives). In particular, our results are in line with recent empirical studies that stress the role of other than national institutions features on African development, such as the slave trades (Nunn (2008)), colonial investments in education, health and infrastructure (e.g. Huillery (2009)), ethnic partitioning (e.g. Englebert, Tarango, and Carter (2002) and Michalopoulos and Papaioannou (2011)), fractionalization (e.g. Easterly and Levine (1997) and Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg (2003)), geography (e.g. Nunn and Puga (2012)), and ethnic institutions (Gennaioli and Rainer (2006), Michalopoulos and Papaioannou (2012)), to name a few.

Finally, our paper makes contact with a recent strand of the political economy literature that emphasizes the role of deeply-rooted geographic, cultural, and genetic features on long-run development (see Ashraf and Galor (2012), Guiso, Sapienza, and Zingales (2006), and Spolaore

[4] Some recent works, explore discontinuities across administrative units within particular countries. For example, Berger (2009) and Arbesu (2011) explore discontinuities across administrative colonial boundaries within Nigeria to study the long-run effects of the different colonial tax systems.

and Wacziarg (2009), among others). In particular our results showing a lack of correlation between national institutions and regional development within partitioned ethnic homelands lends support to theories emphasizing the importance of cultural norms and geographic endowments for development (e.g. Diamond (1997) and Landes (1998)).

Paper Structure In the next section we describe how we identify partitioned ethnicities and discuss the luminosity data that we use to proxy regional economic development. In section 3 we report our results on the role of contemporary national institutions on regional development within partitioned ethnic homelands. In section 4 we proceed to the pixel-level regression discontinuity analysis that allows us to estimate the local effect of national institutions at the border. In section 5 we present our analysis on the heterogeneous role of national institutions on development. In section 6 we summarize and discuss possible avenues for future research.

2 Data

2.1 Identifying Partitioned Ethnicities

Murdock's map (Figure 1*a*) portrays the spatial distribution of ethnicities across Africa in the mid/late 19^{th}; it depicts 834 inhabited upon colonization ethnic areas, while 8 regions are classified as "uninhabited".[5] Intersecting the pre-colonial map with the 2000 Digital Chart of the World (Figure 1*b*) that portrays contemporary national boundaries we obtain $1,247$ country-ethnic observations. We classify an ethnicity as partitioned when at least 10% of the historical homeland belongs to more than one contemporary state. In the empirical analysis we focus on partitions of at least 100 square kilometers as tiny partitions are most likely due to the lack of precision in the underlying mapping of ethnicities.

Our procedure identifies 526 partitions that belong to the historical homeland of 227 ethnic groups. Appendix Table *A* lists the partitioned ethnicities. For example, the Ewe have been partitioned between Ghana and Togo (shares 44% and 56%, respectively), the Esa between Ethiopia and Somalia (shares 52% and 44% while a small faction resides in Djibouti), and the Yao (Wayao) between Mozambique (65%), Malawi (13%), and Tanzania (22%). According to our estimates the median country in Africa has 43% of its population belonging to partitioned ethnicities. This magnitude is similar to that of Asiwaju (1985) and Alesina, Easterly, and Matuszeski (2011), who using alternative sources and techniques estimate that on average 40% of the African population comes from partitioned ethnic groups. Thus our analysis, while

[5] Nunn and Wantchekon (2011) show that there is high persistence between the historical homeland of ethnic groups and contemporary location across many African countries. Glennerster, Miguel, and Rothenberg (2010) report similar results in Sierra Leone.

focusing on border regions where partitioned ethnicities are located, captures a significant fraction of the African population (Figure 3*a*).

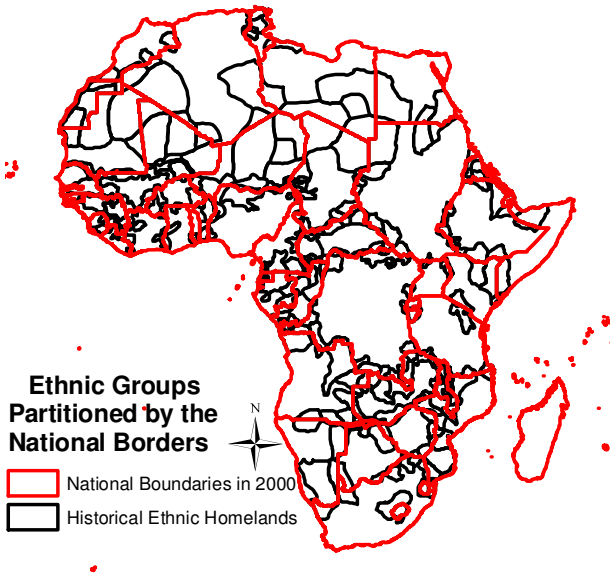

Figure 3*a*

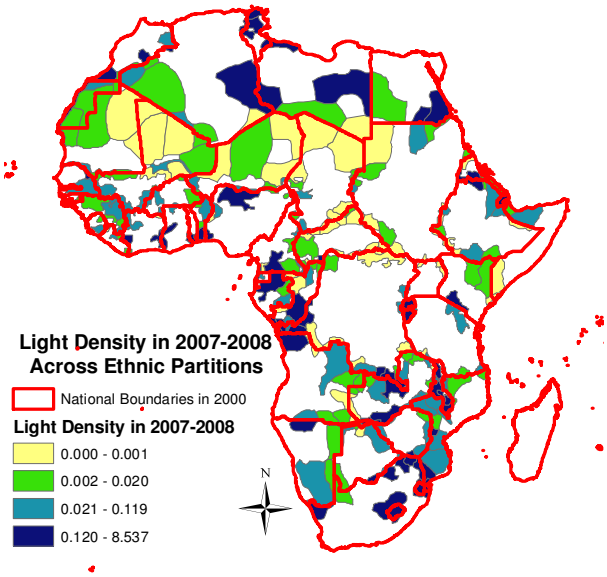

Figure 3*b*

2.2 Satellite Light Density at Night

The nature of our study requires detailed data on economic development at the country-ethnic homeland level. Since there are limited geocoded measures of economic development in Africa, we build on the recent contribution of Henderson, Storeygard, and Weil (2012) and use satellite images on light density at night to proxy for local economic activity.

Data come from the Defense Meteorological Satellite Program's Operational Linescan System (DMSP-OLS) that reports time-stable images of the earth at night captured from 20 : 00 to 21 : 30. The measure ranges from 0 to 63 and is available for every 30-second area pixel (approximately 1 square kilometer). The annual composite measure is created by overlaying all daily images captured in a year, dropping images where lights are shrouded by cloud cover or overpowered by the aurora or solar glare (near the poles), and after removing ephemeral lights (like fires, lightning and other noise).[6] Using these data we construct light density per square kilometer for 2007 and 2008 averaging across pixels that fall within the

[6] See Henderson, Storeygard, and Weil (2012), Min (2008), Chen and Nordhaus (2011) and the references therein for technical details on the measurement error of the light data. Satellite data on lights are subject to overglow/blooming; this emerges because lights tend to appear larger than they are, especially for bright lights and over water and snow. While this issue is not particularly important in our application as we do not have observations near the poles and covered with snow, we control in many specifications for water area and distance to the sea. Another issue is top coding - that usually emerges in the capitals of developed countries. Yet, in Africa there are rare instances of top-coding.

historical homeland of each ethnic group in each country (using the median value yields similar results).

Besides its availability at a very fine geographic level, luminosity is well suited to spatial analyses of development in Africa for some additional reasons. First, most African countries have low quality income statistics, even at the national level.[7] Second, we lack data on regional income or value added for many African countries; and while there are some regional proxies of poverty and health, these data do not map to our ethnic-homeland unit of analysis. Henderson, Storeygard, and Weil (2012) show that light density at night provides a good proxy of economic activity (see also Elvidge, Baugh, Kihn, Kroehl, and Davis (1997), Doll, Muller, and Morley (2006), Sutton, Elvidge, and Ghosh (2007), Min (2008), Michalopoulos and Papaioannou (2012), and Pinkovskiy (2011), among others). These works establish a strong within-country correlation (both across time and across regions) between light density at night and GDP and consumption. There is also a strong association between luminosity and public goods provision, especially among low income countries (e.g. Chen and Nordhaus (2011)).

Satellite Light Density and Economic Development within Ethnic Homelands
While a plethora of recent works shows that luminosity is a significant correlate of economic development both across and within countries, one may wonder whether differences in economic development within ethnic groups are captured by differences in luminosity. Despite the limited data coverage we cross-validated the luminosity data using comparable across countries survey-level data from the 2005 Afrobarometer Surveys on household's access to electrification, access to piped water, presence of a sewage system, and years of schooling. The Afrobarometer surveys are based on interviews conducted in a random sample of either $1,200$ or $2,400$ individuals of voting age in 17 Sub-Saharan African countries.[8] We assign each respondent's current residence area (Afrobarometer's enumeration area) to one of the 834 homelands in Murdock's (1959) tribal map and then examine the association with luminosity.

Table 1 reports in a regression framework the within-ethnicity correlation between the four proxy measures of development and log light density. Besides the inclusion of ethnicity fixed effects, in all specifications we condition on log population density to account for differences in urbanization (as we do in most of our empirical specifications). Columns (1), (4), (7), and (10) show that there is a strong and highly significant association (at the 99% confidence level) between luminosity and these four proxies of development. We also estimate specifications focusing on enumeration areas within partitioned groups (in (2), (5), and (8), and (11)) and

[7] For example, the codebook of the Penn World Tables assigns the lowest two scores (out of four possible ratings) on data quality to all African countries.

[8] These countries are: Benin, Botswana, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mozambique, Namibia, Nigeria, Senegal, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe.

within non-split ones (in (3), (6), (9), and (12)), respectively. The positive correlation between luminosity and development is strong in both samples suggesting that luminosity is a reliable proxy of economic performance within both split and non-split groups.

We also investigated how differences in luminosity across the national border within the same ethnicity reflect differences in economic development averaging the individual responses at the level of each ethnic partition (that serves as the unit of analysis in Section 3). There are 32 ethnic groups split in different countries whose individual partitions have at least one enumeration area. We then examined the within-ethnicity across-the-national-border association between log light density and each of the four development proxies. Figures $3a - 3d$ depict the respective scatter-plots partialling out differences in log population density. Ethnic partitions with higher light density are populated by individuals enjoying higher access to public goods (electrification, sewage system, and piped water) and are on average more educated.

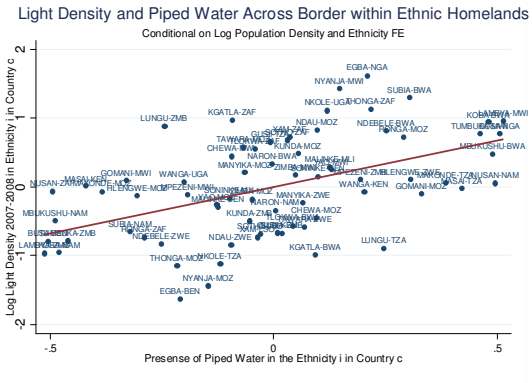

Figure 4a

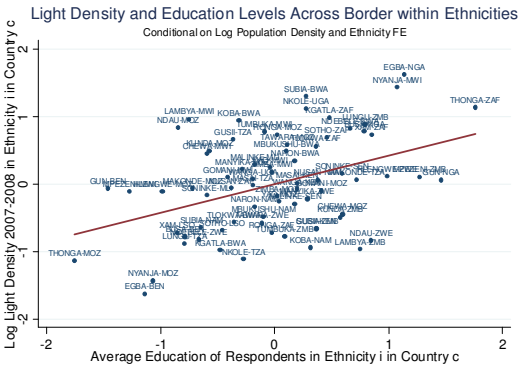

Figure 4b

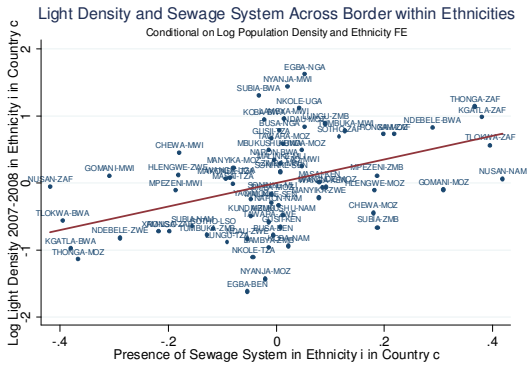

Figure 4*c*

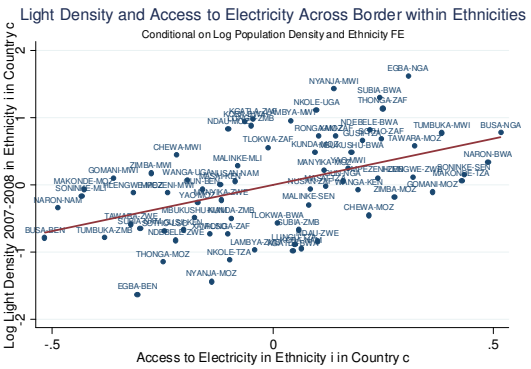

Figure 4*d*

2.3 National Institutions

We measure national institutions using data from World Bank's Governance Matters Database (Kaufmann, Kraay, and Mastruzzi (2005)). The World Bank assembles numerous de facto institutional quality measures (originally compiled by various non-governmental organizations and risk assessment agencies) and aggregates them into six categories via a principal component analysis. We mainly use the rule of law index between $1996-2004$ that reflects the effectiveness of the judiciary and the quality of property rights protection. As many studies on African development focus on graft, we also report results using the control of corruption index. Both variables have a theoretical minimum and maximum of -2.5 and $+2.5$, respectively, with higher values indicating better functioning institutions and less corruption.[9] In our sample the countries with the lowest rule of law are Somalia (-1.91) and the Democratic Republic of Congo (-1.84), while Namibia (0.64) and Botswana (0.71) are the most institutionally developed countries in Africa.

2.4 Data Patterns

There is significant variation in both national institutional quality and luminosity across African borders (Figure 3*b*). Sharp border discontinuities in the rule of law appear in several parts of Africa. For example, in the Botswana and Zimbabwe border (where the Hiechware, the Subia, and the Tlokwa are partitioned); across the Namibia and Angola border (where the Ambo are split); between Kenya and Somalia (where the Bararetta group and other Somali tribes reside); and between Gabon and Congo (where the Duma live). Likewise, there are evident changes in luminosity across the border within the historical homeland of the same ethnic group. On the one hand, in around 25% of the sample there are negligible differences in light density across the border within ethnic groups. On the other hand, in about 40% of the partitions there are more than one log point differences in luminosity. For example, large jumps in luminosity appear in the Egypt-Sudan border (where the Ababda and the Barabra groups are partitioned), in the border between Ghana and the Ivory Coast (where the Assini reside), and between Benin and Togo (where the Popo are split). To the extent that national institutions affect regional development, one would expect the part of the ethnic group belonging to the relatively more institutionally advanced country to outperform economically the part of the group that is subject to the relatively worse institutions of the neighboring country.

[9] The results are similar if we use alternative measures of national institutions, such as the ICRG risk of expropriation index or Polity's executive constraints index.

3 Country-Ethnic Homeland Analysis

3.1 Estimating Framework

Our analysis on the relationship between national institutions and regional development is based on variants of the following specification:

$$y_{i,c} = \gamma IQL_c + X'_{i,c}\Phi + \lambda PD_{i,c} + a_i + \varepsilon_{i,c}. \quad (1)$$

The dependent variable, $y_{i,c}$, reflects the level of economic activity in the historical homeland of ethnic group i in country c, as proxied by light density at night. Since a significant fraction (around 30%) of the (country-ethnicity) observations takes on the value of zero, we use as the dependent variable the log of light density adding a small number ($(y_{i,c} \equiv \ln(0.01 + LightDensity_{i,c})$).[10] The logarithmic transformation is useful both because we use all observations and because we account for some extreme values in luminosity (outliers). To show that our results are not sensitive to this transformation, we also report estimates using the level of luminosity as the dependent variable and estimates focusing at the "intensive" margin of luminosity. Moreover, for the pixel-level analysis (in Section 4) we use as the dependent variable a dummy that takes on the value one when the pixel is lit and zero otherwise, further accounting for the non-linear nature of the lights data.

IQL_c denotes institutional quality of country c, as reflected in the rule of law and the control of corruption measures. For partitioned ethnicities, each area of the group is assigned to the corresponding country c. For example, regional light density in the part of the Egba in Benin is matched to the institutional quality of Benin, while the adjacent region of the Egba in Nigeria is assigned the value of Nigeria.

In most specifications we control for log population density ($PD_{i,c}$), because in this case the association between luminosity and economic development strengthens and because the estimates capture the role of national institutions beyond the effect on population density. Vector $X_{i,c}$ includes control variables, capturing location (distance to the sea coast, distance to the capital city, distance to the national border), geography-ecology (elevation, area under water, malaria prevalence, land quality), and natural resources (diamond mines and petroleum fields). Table 2-Panel A reports summary statistics for all variables employed in the empirical analysis at the ethnicity-country level.

The key in the estimating equation is the inclusion of ethnicity fixed effects (a_i) that allow us to focus on partitioned by-the-national-border groups comparing economic development at the two (or more for some groups) sides of the border.

[10] A zero level of light density occurs either because the area is extremely sparsely populated without any electricity or because the satellite sensors cannot capture dimly lit areas. In the previous draft of the paper we added one (rather than 0.01) to the luminosity data before taking the logarithm finding similar results.

3.2 Validity of the Econometric Design

Comparing economic development of the same ethnicity in different countries is conceptually similar to "matching" estimators, which usually match observations based on observable features (see Angrist and Pischke (2008)).[11] In our case, by focusing on neighboring regions where people from the same ethnic group reside, we neutralize biases from omitting relevant observable or unobservable features, related to geography-ecology as well as culture.

Despite the artificial nature of African borders and the fact that ethnic groups tend to occupy geographically homogenous territories (Michalopoulos (2012)), a potential concern is that geographical or historical characteristics of ethnic partitions falling in the relatively low institutional quality countries are systematically different from the respective traits on the other side of the border. In this case, the two (or more) partitions of each ethnicity might not be appropriate counterfactuals.

In Table 3 we investigate whether differences in institutional quality across the border correlate with differences in various observable characteristics. The results from the "similarity" regressions support our identification strategy. First, differences in geography, the disease environment, location, and natural resources across the border within ethnicities are economically small and not systematically linked to differences in national institutions. Second, there is no statistical difference in population density around independence across adjacent partitions of the same ethnic group. In a Malthusian regime where wealthier regions are more densely populated, this finding implies that there were no systematic differences in economic performance within split ethnicities whose partitions following independence would come to be subject to different national institutions. Third, the only covariate that is significantly correlated with national institutions is distance from the capital city. Partitions falling in the relatively high rule of law countries are closer to the capital city of that country. This correlation is driven by Sudan and the Democratic Republic of Congo, two of the largest in terms of size countries in Africa that also score very low in institutional development.

3.3 Cross-sectional Analysis: Preliminary Evidence

Before we report the baseline ethnicity fixed effects estimates, we examine the cross-sectional patterns running simple LS specifications that associate ethnicity-country development with national institutions. Although due to omitted variables these specifications do not identify causal effects, they are useful in describing the cross-sectional correlations.

Table 4 reports the results. Below the estimates we report double-clustered standard

[11] See Huillery (2009) and Acemoglu, García-Jimeno, and Robinson (2012) for analogous "matching-type" identification schemes comparing nearby regions differing in colonial investments and slavery, respectively.

errors at the country and at the ethnic-family level using the multi-clustering approach of Cameron, Gelbach, and Miller (2011) (Murdock assigns the 834 groups into 96 ethnolinguistic clusters/families). Double-clustering accounts both for the fact that within each country we have several ethnicities where the country-level institutions take the same value (Moulton (1986)) and for spatial correlation (Cameron, Gelbach, and Miller (2011) explicitly cite spatial correlation as an application of the multi-clustering approach). We also estimated standard errors accounting for spatial correlation of an unknown form using Conley's (1999) method.

As can be seen from Table 4 both approaches produce quite similar standard errors.[12] Column (1) shows that there is a positive and significant correlation between the rule of law index and regional development. In column (2) we add population density, whereas in column (3) we control for distance to the capital city, distance to the national border, and distance to the coast ("location controls"). While all distance terms enter with significant coefficients, the estimate on rule of law retains its economic and statistical significance. In column (4) we control for population density, location, and a rich set of geographic controls.[13] Conditioning on geography reduces the magnitude of the coefficient on national institutions; yet the estimate retains significance at conventional levels.[14] The results are similar when we use the control of corruption index to capture the quality of national institutions (in columns (5)-(8)). Overall, these correlations echo the findings of cross-country works; although the association between institutional quality and development weakens when one accounts for geography, it remains highly significant. The coefficient in column (4) implies that a one-point-increase in the rule of law index (roughly 2 standard deviations, see Table 2), which corresponds to moving approximately from the institutional quality of Angola to that of Gabon, is associated with a 0.70 log points increase in regional luminosity (approximately half a standard deviation). In-

[12] Conley's correction method requires a cut-off distance beyond which the spatial correlation is assumed to be zero; we experimented with various cutoff values between $100km$ and $3,000km$ choosing the cutoff of $2,000km$ which delivers the largest in magnitude standard errors.

[13] Specifically, we control for average elevation, as this factor has affected African development both via goods and slave trades (e.g. Nunn and Puga (2012)). We also control for area under water to account for blooming in the light image data and for the potential positive effect of water streams on development via trade. Moreover, we control for malaria prevalence since many studies document its detrimental role for development (e.g. Gallup and Sachs (2001)). We also include indicators for the existence of oil and diamonds fields to account for the "natural resource" curse (e.g. Ross (2006)). Finally, we add a set of controls measuring the distance of the centroid of each ethnic group i in country c from the capital city, the national border, and the coast, respectively. The coefficient on distance from the capital may reflect the impact of colonization. Distance to the border captures the potentially lower level of development in border areas. Distance to the sea coast captures the effect of trade, but to some extent also the penetration of colonization. This is because during the colonial era (and the slave trades) Europeans mainly settled in coastal areas.

[14] Land suitability for agriculture, which reflects climatic (temperature and precipitation) conditions, enters most models with a positive and significant estimate. The malaria stability index enters in all specifications with a statistically negative estimate. The coefficient on land area under water is positive and in many specifications significant. Elevation enters with a negative estimate which is significant in some models. The petroleum dummy enters always with a significantly positive coefficient. The diamond dummy enters with a negative coefficient that is significant in some permutations.

terestingly, the size is similar in magnitude to cross-country studies associating log per capita GDP with national institutions (for example Acemoglu, Johnson, and Robinson (2001) report "standardized" beta coefficients in the range of $0.30 - 0.60$).

3.4 Baseline Partitioned Ethnic Homeland Analysis

Having established that regions across the national border that are part of the historical homeland of the same ethnicity are reasonable counterfactuals (in Table 3) and having explored the cross-sectional patterns (in Table 4), we now examine the correlation between institutions and luminosity within partitioned ethnic homelands. Table 5 presents the baseline estimates. For comparability, in odd-numbered columns we report cross-sectional estimates, while in the even-numbered specifications we add ethnicity fixed effects. The cross-sectional estimates in columns (1) and (5) echo the results of Table 4. Border areas that belong to countries with higher institutional quality display higher levels of development. Yet when we solely exploit within-ethnicity variation (i.e. estimating equation (1) with a_i), the coefficients on rule of law and control of corruption drop sizably (from 0.66 to 0.12 and from 0.78 to 0.09, respectively) and become statistically indistinguishable from zero. The insignificance is not driven by a decrease in the precision of the estimated coefficients since the standard errors remain largely unchanged; it is the coefficient drop that it is sizable. We investigated formally whether the estimates on national institutions are statistically different between the cross-sectional and the within-ethnicity models performing a Hausman-like test;[15] the latter suggests that the difference in the coefficients is statistically significant at standard confidence levels. The "standardized" beta coefficient of the within-ethnicity models for the rule of law and the control of corruption measures is 0.045 and 0.027, respectively, suggesting an economically small effect.

In columns (3)-(4) and (7)-(8) we repeat estimation focusing solely on groups whose partitions are lit ($y_{i,c} \equiv \ln(LightDensity_{i,c})$). Ignoring unlit areas is useful as in this case the dependent variable is normally distributed. Moreover, looking at the "intensive margin" guarantees that we investigate institutions' role across densely populated regions. Non-lit areas have a median population density of roughly 9 people per square kilometer whereas regions with positive light density have a median of 23. The cross-sectional estimates show that across lit areas there is a strong correlation between institutional quality and regional development. Yet in the within-ethnicity models the coefficients on rule of law and control of corruption drop

[15] First, we jointly estimate the specification with and without the ethnicity constant terms (with standard errors double-clustered at the country and the ethnic family level). Then we examine whether the difference in the coefficient of the rule of law or the control of corruption between the cross-sectional and the within-ethnicity model is significant at standard confidence levels. Under the null hypothesis the ratio of the squared difference in the coefficient estimate to the joint variance is distributed as a χ^2 with $n = 1$ degrees of freedom. In Tables 5 and 6 we report the Hausman-like test (χ^2 and corresponding p-values) that compares the between to the within-ethnicity estimate of national institutions.

by more than a half and become insignificant.[16]

Figures 5*a*-5*b* below illustrate the lack of a systematic within-ethnicity correlation between light density and institutional quality at the national level. As can be seen, the insignificance is not driven by a few (influential) observations.

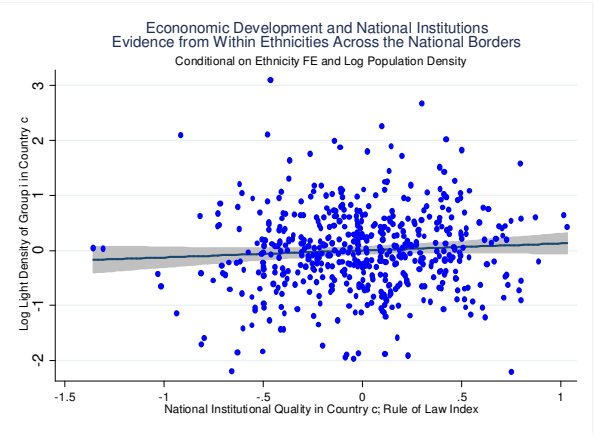

Figure 5*a*

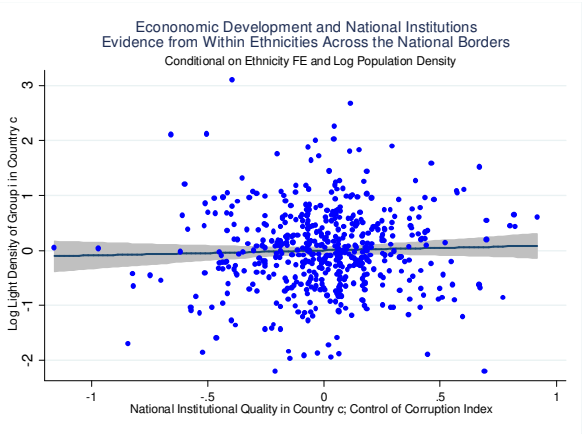

Figure 5*b*

In Table 6 we restrict estimation to areas close to the border in columns (1)-(2) and (5)-(6) focusing on 25 kilometers from each side of the border (total 50 kilometers), while in columns (3), (4), (7), and (8) we focus on regions within 50 kilometers of each side of the border (total 100 kilometers). Figure 6*a* shows the case of the Ambo which have been partitioned between Angola and Namibia. The idea of this approach (which is similar in spirit to local regressions in regression discontinuity designs) is that by focusing on areas close to the border, one neutralizes the effect of unobservable factors (see Imbens and Lemieux (2008)).

[16] In Supplementary Appendix Table 1 we report estimates expressing luminosity in levels. To account for the highly non-linear nature of the data, we report both LS and negative binomial maximum likelihood estimates that are better suited to account for extreme values and the large number of zeros (Wooldridge (2002) and Silva and Tenreyro (2006)). The coefficient on the national institutions measures in the ethnicity fixed effects models is small (even negative) and statistically indistinguishable from zero.

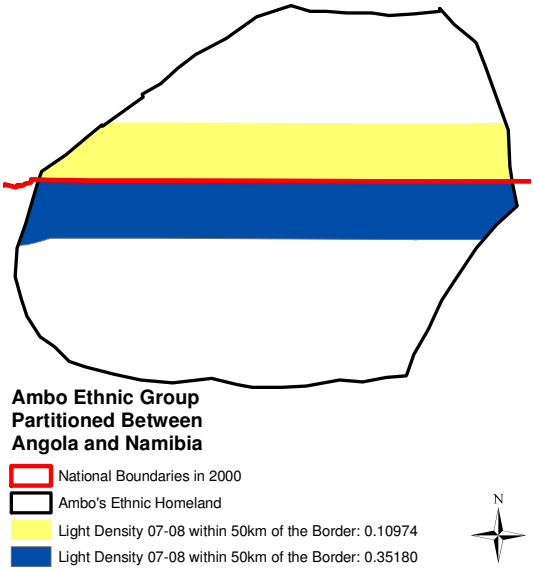

Figure 6*a*

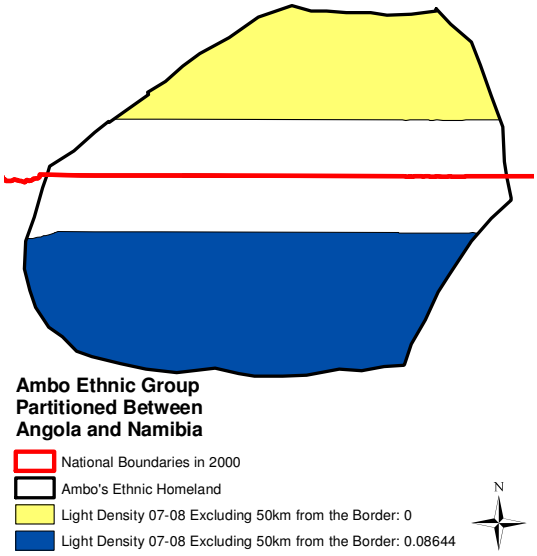

Figure 6*b*

The estimates in Table 6 are similar to those in Table 5 where we used the area of each ethnic partition as the unit of analysis. While in the cross section there is a strong positive association between national institutions and regional development, the within-ethnicity coefficients of rule of law and control of corruption are statistically indistinguishable from zero. For example, the cross-sectional estimate in the rule of law index is around $0.68 - 0.70$ when we focus on the areas within $25km$ and within $50km$ from the national borders. Its magnitude drops by more than two thirds once we add ethnicity fixed effects. The lack of significance is not driven by an increase in the standard errors. In all permutations two-standard-error bands in the within-ethnicity estimates reported in the even-numbered columns exclude the analogous cross-sectional ones in the odd-numbered columns. The insignificance of the estimate casts doubt on the causal interpretation of the simple cross-sectional association between national institutional quality and African regional development.

3.5 Migration

Anecdotal evidence suggests that many national boundaries across Africa are poorly enforced due to the lack of border patrolling, poor demarcation, and geographic conditions (desert areas in the North, rainforest in Central Africa). If people migrate to take advantage of higher incomes in regions with higher levels of institutional quality, mobility across national boundaries may attenuate income differences at the two sides of the border. Nevertheless, as a result of migration towards the partitions enjoying relatively better institutions, population density should differ systematically between partitions. Alternatively, it may be the case that population in the

low institutional quality country clusters near the border to migrate daily to the part of the border with better institutions to work.[17] We explore in detail the issue of migration with two different approaches.

First, in Table 7*A* we directly examine the effect of national institutions on population density using geo-referenced population estimates from the United Nations Environmental Programme.[18] There is no systematic association between the quality of national institutions and log population density in border areas where partitioned ethnicities reside; the coefficient is small and changes sign across specifications. This suggests that the insignificant within-ethnicity relationship between country-level institutions and regional development is less likely to be driven by migration. Moreover, to the extent that population density itself reflects regional development, the insignificant coefficients of rule of law and control of corruption provide additional evidence that national institutions are not systematically linked to regional economic performance.

Second, we re-estimated our benchmark specifications associating log light density with national institutions excluding areas close to the border (see Figure 6*b* for an example). Doing so, we account for potential temporary migration and for local trade. By excluding areas close to the national border we also mitigate concerns related to light stealing and bleeding (and/or blooming) in the luminosity data. Table 7*B* reports cross-sectional (in odd-numbered columns) and within-ethnicity specifications (in even-numbered columns). In columns (1), (2), (5), and (6) we exclude areas within 25 kilometers from each side of the national border (total 50 kilometers), while in columns (3), (4), (7), and (8) we exclude regions within 50 kilometers of each side of the border (total 100 kilometers). The results are similar to the estimates in Tables 5 and 6. In the cross section there is a strong positive correlation between institutional quality and luminosity; however, the coefficient drops sizably and becomes statistically indistinguishable from zero when we add ethnicity fixed effects, suggesting that national institutions exert a negligible role once we properly account for local geography, ethnic-specific traits, and common-border effects.[19]

[17] Note that the ease of migration might not necessarily lead to attenuation bias. In fact, migration might accentuate the importance of institutions if firms relocate to take advantage of the better institutional environment on the other side of the border. Hence, as a result of migration of firms and people this would imply that *aggregate* economic activity, captured by luminosity and/or population density, would be magnified in the partition enjoying better national institutions. The results below suggest that this is not the case.

[18] The UNEP dataset imputes population at the grid level using information on roads, railroads and navigable rivers as well as information on urban centers (see details at: http://na.unep.net/siouxfalls/globalpop/africa/part2.html#construct). To assuage concerns related to measurement error in the population estimates, in the Supplementary Appendix Table 3 we report analogous specifications using an alternative measure of population from the Gridded Population of the World database (http://sedac.ciesin.columbia.edu/gpw/). In line with Table 7*A* we fail to find a systematic association between national institutional quality and population density.

[19] In supplementary Appendix Table 3 we explored the sensitivity of our results dropping each time a different

4 Pixel-level Analysis

In this section we report the results from the regression discontinuity (RD) approach that identifies the effect of national institutions at the border. To perform a "standard" RD analysis we exploit the finer structure of the luminosity data using pixels of $0.125 * 0.125$ decimal degrees as the unit of analysis (approximately $12.5km\ x\ 12.5km$). So, compared to our previous estimates where we carried the empirical analysis at the partitioned ethnic homeland level, we now have multiple observations within an ethnic partition (Figure 7 illustrates the case of the Ambo). Since there are several unpopulated pixels (in the Sahara or in the rainforests) and to make sure that we examine the role of national institutions on development properly, we exclude pixels of zero population.[20]

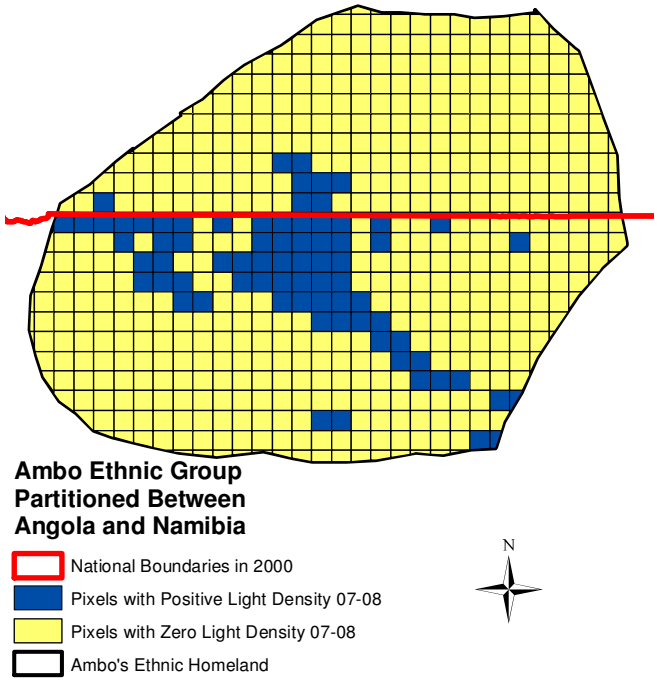

Figure 7

4.1 Cross-Sectional and Ethnicity Fixed Effects Specifications

Our pixel-level specification takes the following form:

$$y_{p,i,c} = a_0 + \gamma IQL_c + \lambda_1 PD_{p,i,c} + \lambda_2 AREA_{p,i,c} + a_i + \zeta_{p,i,c}. \quad (2)$$

The dependent variable, $y_{p,i,c}$, is a dummy that takes on the value of one if pixel p is

African region. The pattern is unchanged.

[20] The coefficient estimates are similar when we also consider unpopulated pixels and/or if we construct pixels of alternative size.

lit. Each pixel, p, falls in the historical homeland of partitioned ethnicity i located in country c. We also control for log pixel population density ($PD_{p,i,c}$) and log pixel area ($AREA_{p,i,c}$).[21] Table 2-Panel B reports summary statistics for all pixel-level variables.

Before presenting the RD results, we report in Table 8 - Panel A simple LS estimates at the pixel level. This allows us to examine the robustness of our previous results to the alternative transformation of the dependent variable. In line with the results at the country-ethnicity level, the cross-sectional coefficients on the rule of law and the control of corruption in columns (1) and (5) are positive and significant. The estimates imply that a one-point increase (roughly two standard deviations) in either of the two measures of national institutions is associated with an increase in the likelihood that a pixel is lit by approximately $11\% - 14\%$. This magnitude is large as on average only 12 percent of all (populated) pixels falling in the historical homeland of partitioned ethnicities are lit (see Table 2-Panel B). Yet once we include ethnicity fixed effects (in (2) and (6)) the coefficients on national institutions become statistically indistinguishable from zero. The insignificance is not driven by a decrease in the precision of the estimates since the standard errors also decline. It is the coefficient that drops considerably; from 0.11 to 0.022 in the case of rule of law and from 0.138 to 0.029, in the case of control of corruption.[22] In columns (3)-(4) and (7)-(8) we use as the dependent variable the log luminosity plus a small number (0.01). The pattern is similar.[23] Moreover, the standardized "beta" coefficient in the within-ethnicity specifications ranges from 0.025 to 0.045, implying quite small (and statistically insignificant) economic magnitudes.

In Table 8 - Panel B we focus on the two major adjacent partitions of each group and restrict estimation of the linear probability models to pixels close to the national border (using two thresholds). Both the cross-sectional and the within-ethnicity estimates are quantitatively similar to (the more efficient) coefficients in the full sample. In line with the evidence presented above, the role of national institutions within ethnicities is both economically small and statistically insignificant. The within-group estimates imply that one-standard-deviation increase in rule of law is associated with an increase in the likelihood that a pixel is lit by just 1 percent (a twelfth of the mean).

[21] While most pixels are of the same size, pixels intersected by the coast line and the national border are smaller. We also estimated specifications controlling for geographical, ecological, and location variables. Since there is no statistical association between institutions and geography at the pixel-level within partitioned ethnic homelands (see Appendix Table 4), the coefficient on the national institutions is almost identical.

[22] A Hausman-like test that compares the cross-sectional and the ethnicity fixed-effects estimates of the rule of law and the control for corruption index, shows that the difference is statistically significant at standard confidence levels.

[23] The results are also comparable when we use the level of luminosity at the pixel-level as the dependent variable. In the analogous to columns (1) and (5) cross-sectional models the estimate (standard error) on the national institutions measures is 0.2849 (0.1273) and 0.3480 (0.1437). Once we include ethnicity fixed effects the estimates (standard error) turn negative to -0.0166 (0.1214) and -0.0396 (0.2249).

4.2 RD Analysis

Our RD specification within the two major partitions of each group takes the following form:

$$y_{p,i,c} = a_0 + \gamma IQL_c^{HIGH} + f(BD_{p,i,c}) + \lambda_1 PD_{p,i,c} + \lambda_2 AREA_{p,i,c} + a_i + \zeta_{p,i,c}. \quad (3)$$

The difference with specification (2) is that since we aim at identifying the effect of national institutions on regional development at the border, we add RD-polynomials of the distance from the centroid of each pixel to the national border ($f(BD_{p,i,c})$), allowing the coefficients on the polynomial terms to be different for each side of the boundary. IQL_c^{HIGH} is a dummy variable that takes on the value one for pixels falling in the country with the relatively higher score in institutional quality, as reflected either in the rule of law or in the control of corruption index.[24]

This RD-type design (see Imbens and Lemieux (2008); Lee and Lemieux (2010)) exploits the discontinuity in the quality of national institutions at the border to identify institutions' local (at the border) average (treatment) effect. The underlying idea is that by comparing pixel-level economic development across the national border within the same ethnic group, one accounts for all ethnic characteristics that may affect regional development. The results from Table 3 suggest that there are no differences in geography, ecology, and natural resources within ethnic partitions. Similarly, when we compare geographic, ecological, and other features at the pixel level within partitioned ethnicities we find that pixels within the same ethnicity across the national border are proper counterfactuals (see Appendix Table 4).

Previous research has employed variants of the above regression equation using different control functions of the running variable (distance to the border) and limiting estimation close to the discontinuity using different bandwidths. Some researchers control for high-order polynomials in the forcing/running variable using all observations, both far and close to the discontinuity, as this approach maximizes the sample and is more efficient (e.g. Lee, Moretti, and Butler (2004)). Others estimate local regressions limiting their analysis to an area close to the discontinuity either including or excluding the polynomial control function (e.g. Dell (2010), Angrist and Lavy (2001)). For completeness we employ all approaches.

RD Estimates Table 9 - Panel *A* reports the RD results that identify the effect of national institutions at the national border. In columns (1)-(2) we use all populated pixels across the two major partitions of split-by-the-border ethnic homelands, controlling flexibly for

[24] The results are similar if we use the level of the rule of law or the control for corruption. We prefer the binary classification into a high and a low institutional quality country because it is more in line with the spirit of RD designs.

the distance to the discontinuity using a cubic RD polynomial and a fourth-order RD polynomial, respectively. On average the likelihood that a pixel is lit is just 1 percent higher in the country with the relatively better national institutions. Thus the local average treatment effect of the homeland falling in the country with the relatively more advanced national institutions is quite similar to the magnitudes found for the entire homeland of partitioned groups (Table 8). The results are similar when we use the control of corruption index (in (7)-(8)) to identify countries with the relatively higher quality institutions. The other specifications (in (3)-(6) and (9)-(12)) report local-linear regression results narrowing estimation to pixels within 25 or 50 kilometers from each side of the border while also including RD polynomials of distance to the border. The coefficient on the high institutions country is close to zero (in some specifications is negative) and statistically insignificant, suggesting that national institutions play no role in explaining differences in economic development across the national border within the homeland of partitioned ethnic groups.

Panel B reports otherwise identical to Panel A estimates, but rather than including a common for all partitioned ethnicities RD polynomial, we now include ethnic-specific polynomial terms on distance to the border (i.e. allowing for the effect of the running variable to be different for each ethnic group). These specifications that further account for unobserved factors and heterogeneity capture the average (across all partitioned ethnicities) effect of national institutions at the national border. The RD estimates on the national institutions are statistically indistinguishable from zero across all perturbations. Moreover, the implied economic effect is quite small, as on average the likelihood that a pixel is lit in the country with the relatively better institutions is higher by approximately $0.5\% - 1.5\%$.

RD Approach - Graphical Illustration Figures 8a and 8b provide a visual illustration of the RD results. The solid line represents predicted luminosity at the pixel level from a non-parametric fourth-order local mean smoothing polynomial regression within split ethnicities fitted separately for pixels in the partitions that fall in the relatively high institutional quality country (where distance to the national border takes on positive values) and pixels falling in the relatively low institutional quality country (where distance takes on negative values). In line with the RD estimates in Table 9 and the simple within-ethnicity results in Table 8 there is no discernible jump in luminosity crossing the national boundary towards the more

institutionally developed country.

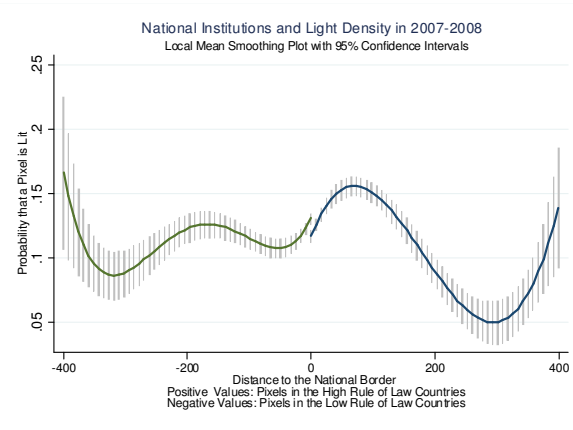

Figure 8*a*

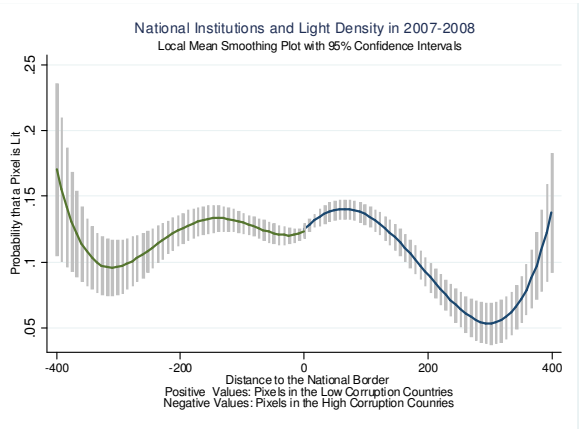

Figure 8*b*

4.3 Sensitivity Analysis

We perturbed the empirical model in various ways to investigate the robustness of our pixel-level findings.

Migration First, to account for temporary migration, trade across the national border and blooming in the luminosity data we re-estimated the specifications dropping pixels close to the national border. Appendix Table 5 presents the cross-sectional and the ethnicity fixed effects estimates on the two proxies of national institutions excluding pixels within 25 kilometers and within 50 kilometers from the national border. The within-ethnicity coefficient is small and statistically indistinguishable from zero, assuaging concerns that our results were driven by the porousness of African borders and lights bleeding.

Regional Effects Second, we rerun all specifications excluding each time a different African region. Appendix Table 6 reports simple ethnicity fixed effects estimates (in Panel *A*) and RD specifications with a fourth order polynomial on distance to the national border (in Panel *B*) excluding each time a different African region. The coefficient on the national institutions proxy (in Panel *A*) or the indicator for the relatively high institutional quality country (in Panel *B*) is small and in all but one specifications statistically indistinguishable from zero.

Large Differences in Institutional Quality Third, we examined whether the lack of within-ethnicity correlation between national institutions and regional development is driven by the (relatively) small differences in institutional quality across African countries. In Appendix

Table 7 we report RD specifications (with a fourth-order polynomial in distance to the national border) estimated for the two-major partitions of groups residing along the border of country pairs with large (defined as higher than the median or larger than the 75% percentile) differences in rule of law or in graft. Once again we fail to find a significant correlation between national institutions and pixel-level development.

Results with Afrobarometer Fourth, we repeated our analysis using data from the 2005 Afrobarometer household surveys on public goods provision and education as the dependent variable. Due to limited coverage, the sample reduces to 32 partitioned ethnic groups with at least one enumeration area in each of the partitions across the countries that the Afrobarometer surveys cover. In spite of the reduction in sample size, it is useful repeating the analysis with survey data both for cross-validation of the luminosity data and because one of the primary channels associating national institutions with development is the provision of public goods. Our specification reads:

$$y_{e,i,c} = \gamma IQL_c + \lambda PD_{e,i,c} + a_i + \varepsilon_{e,i,c}. \tag{4}$$

The dependent variable, $y_{e,i,c}$, reflects average household's access to an electricity grid, access to piped water, access to a sewage system, and average years of schooling in each Afrobarometer's enumeration area, e, that falls in the historical homeland of partitioned ethnicity i in country c. In each enumeration area (town, village) we use the average value of public goods provision measures across surveyed households.

Table 10 reports the results. We start our analysis replicating our previous results with luminosity. Columns (1)-(2) report estimates associating national institutions and luminosity across Afrobarometer's enumeration areas (luminosity is calculated within a $10km$ radius from each enumeration area's centroid). Column (1) shows that there is a highly significant positive association between rule of law (or the control of corruption index) and luminosity across border cities/villages. Yet the correlation weakens considerably and even changes sign when we include ethnicity fixed effects (in (2)).[25]

In columns (3)-(4) we use as the dependent variable household's access to an electricity grid (the average is 53.5%). The cross-sectional estimates show that electrification is greater in towns/villages falling in countries with better institutions. Yet once we focus within the same historical ethnic homeland to examine whether households' access to an electricity grid is higher in countries with more developed national institutions, the correlation weakens considerably

[25] We cannot estimate local (close to the national border) regressions with the Afrobarometer data because the sample size of Afrobarometer enumeration areas drops considerably when limiting attention to areas close to the national border.

and loses significance. In columns (5)-(6) we associate national institutions with household access to piped water across Afrobarometer's enumeration areas (the mean is 0.49). While the cross-sectional correlation is positive, adding ethnicity fixed effects to exploit across-the-border variation in villages/towns of the same ethnic group, makes the coefficient quantitatively insignificant. In columns (7)-(8) we examine whether access to sewage system is systematically associated with national institutions (on average access to a sewage system is 0.24) whereas in columns (9)-(10) we use as the dependent variable average years of schooling across respondents within each enumeration area (on average household heads have 3 years of education). The estimates, albeit less precisely estimated, echo our previous results. Across all permutations the within-ethnicity coefficients on rule of law and control of corruption are economically and statistically indistinguishable from zero.

5 Further Evidence

So far we have estimated the average effect of national institutions on development across all partitioned ethnic groups. The advantage of estimating an average effect across all split ethnic homelands is that it summarizes the role of national institutions on African development. Nevertheless, the richness of the underlying dataset and our approach allows us to estimate the role of national institutions on regional development for each of the 220 split ethnicities.[26] This is useful for a couple of reasons. First, moving beyond average effects and examining the distribution of the estimate can shed light on whether the correlation between national institutions and development is economically small in most cases or whether the zero average effect masks important heterogeneity. Second, if heterogeneity is present, we can examine the country, regional, or ethnic-specific features that may explain the observed pattern.

5.1 Heterogeneity

We therefore estimate regression equation (4) separately for each group, obtaining an ethnic-specific estimate on the correlation between national institutions and pixel-level development. Figure 9*a* reports the distribution of the estimated coefficients on the rule of law index of the unconditional specification (i.e. no controls). Figure 9*b* plots the distribution of the rule of law estimates when we condition on log population density and log pixel surface area; in the histogram we are also excluding the (29) ethnicities with zero luminosity on both sides of the

[26] We lose information on 7 groups because: (i) The Ifora, the Kunta, the Berabish, the Atta, the Teda, and the Asben have zero population in 2000 across all pixels in one of the two partitions; and (ii) we do not have information on national institutions from the World Bank database for Western Sahara so the Imragen, which are partitioned between Morocco, Western Sahara and Mauritania, are dropped.

national border (since for these groups we cannot quantify the role of national institutions).[27]

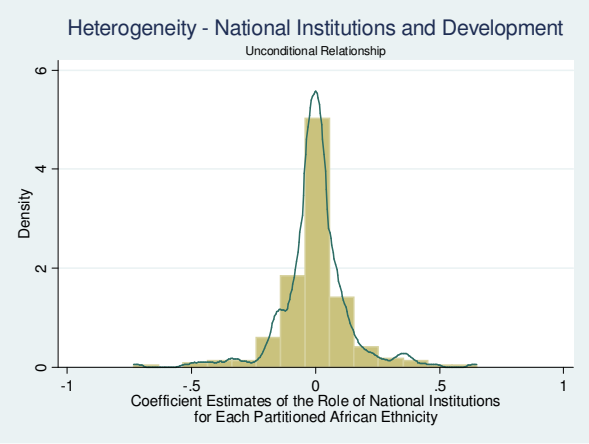

Figure 9*a*

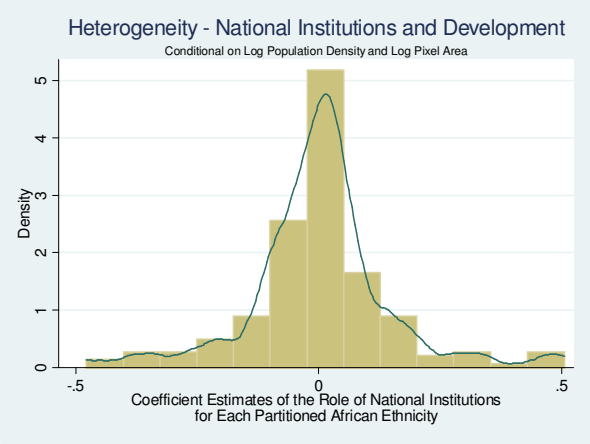

Figure 9*b*

A couple of interesting patterns emerge from the estimates' histograms. First, the average and the median value of the estimate across all partitioned groups is zero; this applies both to the unconditional and to the conditional coefficients. Moreover, the mass of the distribution is near zero and there are only a few outliers. For the majority of groups the estimated coefficient on national institutions is statistically indistinguishable from zero; not only the coefficient is small but for $119 - 127$ groups ($62.5\% - 66.5\%$ of the all split groups) the absolute value for the t-statistic is less than 1.65/1.95.

Second, a higher quality of national institutions translates into a significantly higher (at least at the 90% level) level of regional development in 37 cases (around 20% of the sample). For example, in the homeland of the Ambo in Namibia, where the rule of law index equals 0.64, 25% of pixels are lit, while in Angola, where the rule of law index equals -1.44, only 9.2% of pixels are lit. Similarly, while in the homeland of the Duma in Congo, where the rule of law index equals -1.22, all (127) populated pixel areas are unlit, in the much more institutionally developed Gabon, where the rule of law index equals -0.43, 9.8% of all populated pixels are lit.

Third, for 32 groups the coefficient on the high institutional quality country is significant but with the "wrong" sign; so in roughly 17% of the sample of partitioned ethnicities, we get the counter-intuitive result of development being higher in the country with the relatively worse national institutions. For example, in the homeland of the Anyi in Ivory Coast 64% of populated pixels are lit (rule of law index -0.88), while in the more institutionally advanced Ghana (rule of law index -0.12), only 29% of all populated pixels are lit.

[27] The estimates when we include additional set of controls or when we include RD polynomials are similar. For brevity we report the more parsimonious ones.

Overall, the uncovered heterogeneity provides a useful reminder that extrapolating from the findings of an analysis that focuses on a single border discontinuity can be quite misleading. Yet the uncovered heterogeneity suggests that case studies may be useful for shedding light on the specific circumstances that allow countrywide policies to shape regional economic differences.

5.2 Penetration of National Institutions

One may wonder whether there are common features across ethnic homelands that explain the observed heterogeneity in the role of national institutions on regional development. Although a comprehensive analysis of how ethnic-specific traits interact with national policies is beyond the scope of the present study, we explore how the proximity to the capital city of each ethnic partition may be important for understanding the penetration of national institutions in Africa.

Europeans' presence in Africa was (with some exceptions) limited to the coastline and the capital cities (e.g. Herbst (2000)). Hence, colonial institutional arrangements, reflected through persistence on today's national institutional quality, would have limited reach far from the capital cities.[28] Along the same lines, several African scholars have argued that due to the lack of infrastructure (roads, transportation system) and limited state capacity, nationwide institutions have minimal impact far from the capital cities.

In Table 11 we formally explore this hypothesis utilizing the fact that our sample includes partitioned ethnicities differing in their proximity to the capital city. In Panel *A* we augment the empirical model (equation (2)) with distance from the centroid of each pixel to the capital city and an interaction term between distance to the capital and national institutions; thus the coefficient on the national institutions index captures their role at the capital. In columns (1)-(2) we use all pixels falling in the historical homeland of partitioned ethnicities, while in columns (3)-(4) and columns (5)-(6) we restrict estimation to areas (pixels) close to the national border using two different bandwidths (50 kilometers from each side of the border and 25 kilometers, respectively). The coefficients on the rule of law and the control of corruption measures are larger than the analogous specifications in Table 8 (on average 0.04 as compared to 0.02) though in most specifications the estimates are statistically insignificant. The coefficients turn significant only when we zoom in on areas very close to the national border.

In Panel *B* we use relative rather than absolute distance to the capital (i.e. we standardize

[28] Herbst (2000; pp. 16) notes that "*rather systematically, Europeans created capitals that moved power toward the ocean and away from the interior centers of power that Africans had slowly created*". Herbst lists many examples where colonizers decided to ignore local needs and established capital cities outside preexisting polities. As extreme examples he lists Mauritania and Bechunaland (Botswana) that were ruled during colonization by capitals outside their nominal territories (Saint-Louis and Mafeking, respectively). Moving the location of the capital was a key question for African leaders at independence. Yet with a few exceptions (Tanzania, Malawi, and Nigeria), most countries did not relocate the capital city.

by dividing absolute distance to the capital with the maximum distance to the capital in each country).[29] Across all specifications the coefficient on the national institutions is positive (around 0.08 in the full sample and 0.13 when we focus on pixels close to the national border); and in all but one model the coefficient is also statistically significant at standard confidence levels. This implies that national institutions in Africa, while immaterial for the development in border areas relatively far from the capital, they do correlate with development in areas close to the capitals. Moreover, the coefficient on the interaction term between relative distance and national institutions enters with a negative and highly significant estimate suggesting that any benefits of better national institutions quickly dissipate for regions further from the capital.

The evidence in Table 11 offers tentative support to the African historiography that stresses the limited penetration of colonial and national institutions beyond the capital cities. Moreover, the evidence that the positive (and in some specifications significant) correlation between national institutional quality and regional development declines when we move further away from the capital is in line with an emerging strand of literature on state capacity that emphasizes the inability of weak states to broadcast power (e.g. Acemoglu (2005); Besley and Persson (2010)).[30]

6 Conclusion

We study the role of formal national institutions in shaping regional development in Africa employing a novel approach that allows accounting for unobserved geographical and hard-to-account-for ethnic features. We take advantage of the fact that the arbitrarily drawn colonial and national boundaries across the African landscape partitioned many ethnic groups in different countries, thus subjecting identical cultures residing in geographically similar homelands to different country-level institutions. We identify partitioned ethnicities merging historical maps delineating the spatial distribution of African ethnicities at the time of colonization with contemporary country boundaries. To circumvent data unavailability and measure regional development in Africa across partitioned ethnic homelands, we use satellite data on light density

[29] This standardization is motivated by the fact that African states are of different land mass and thus the identification of the interaction term with the absolute distance is driven by observations only from the large countries. The distinction between absolute and relative distance is akin to asking whether the strength of the capital city, where national policies stem from, is proportional to the overall size of the country. Since we are agnostic with respect to the latter we report results using both distance measures.

[30] Measurement error in the proxy measures of national institutions may also explain the weakening correlation with development in areas far from the capital. Since most institutional variables capture the formal rules governing activities of the formal economy, they might not reflect accurately the relevant institutional features in rural areas (Pande and Udry (2006)). Another interpretation of the positive correlation between national institutions and development at the capital city is that capital cities are naturally hosting a mix of different ethnicities, making the use of ethnicity fixed effects less vital. Moreover, geography may be less important for determining economic performance of capital cities.

at night that are available at a very fine resolution.

We start our analysis showing that in line with cross-country works there is a strong positive correlation between national institutions and regional development, as reflected in luminosity, across ethnic homelands. Yet when we account for ethnic-specific features, local geography and common-border effects with the inclusion of ethnicity fixed effects, the cross-sectional correlation weakens and becomes statistically indistinguishable from zero. Differences in economic performance within ethnicities partitioned across different countries cannot be explained by differences in national institutions. This applies both when we perform the analysis at the partitioned ethnic homeland level and when we utilize the richness of the luminosity data to obtain multiple observations within each ethnic area and perform a regression discontinuity analysis that identifies the effect of national institutions at the border. We obtain similar results for a subset of partitioned ethnic homelands for which we have survey–level data on household's access to public goods from the Afrobarometer Surveys.

In an effort to move beyond average effects we also examine the association between national institutions and development for each of the approximately two hundred partitioned ethnic homelands. While we document some heterogeneity with institutions and development correlating positively and significantly in about 20% of the groups, in most instances (approximately two-thirds of the groups) the economic magnitude of the implied role of national institutions is economically negligible and statistically insignificant; moreover, for some partitioned groups the correlation turns significantly negative. We also search for factors explaining heterogeneity. In line with works in African historiography emphasizing the inability of most African governments to propagate power outside the capitals, we find some suggestive evidence of a positive relationship between national institutions and economic performance in regions close to the capital cities; yet this effect sharply decays once we move away from the capitals.

While our results do not necessarily generalize to areas far from the national borders, close to the capital cities and to the universe of partitioned groups in other parts of the world, they cast doubt on the causal interpretation of the cross-country positive correlation between institutional quality and economic development in Africa.

Our paper calls for future research. One could employ our methodology focusing on border areas using high resolution proxies of development (such as satellite light density at night) to shed light on the perennial debate regarding the proximate and fundamental determinants (correlates) of comparative economic development across countries; examining, for example, the effect of human capital, financial development, public policies, foreign aid, fragmentation, etc. Moreover, subsequent works could use our codification of partitioned ethnic groups and examine the role of ethnic partitioning on social capital and development. Moreover, follow-up

work could explore the underlying geographic, cultural, national or ethnic-specific features that may attenuate the role of national institutions in promoting regional economic development. Finally, one could use the lights data or other geocoded proxies of development to assess the role of historical and colonial features that discontinuously change both across and within countries. We intend to tackle some of these questions in future work.

7 Data Appendix

Light Density at Night: Light Density is calculated averaging light density observations across pixels that fall within the unit of analysis. We use the average of the values in 2007 and 2008. In the regressions at the ethnic homeland we use Log (0.01 + Average Luminosity) or Log (Average Luminosity). In the Supplementary Appendix we also use the level of luminosity as the dependent variable. In the regressions at the pixel level we use as the dependent variable a dummy variable that takes on the value of one if the area is lit and zero otherwise.
Source: Available at http://www.ngdc.noaa.gov/dmsp/global_composites_v2.html.

Population Density: Log (0.01 + population density per sq. km. in 2000 or in 1960). *Source: Nelson, Andy,* 2004. *African Population Database Documentation, UNEP GRID Sioux Falls. Available at:* http://na.unep.net/siouxfalls/datasets/datalist.php

Water Area: Log (1 + total area covered by rivers or lakes in sq. km.). In the regressions at the pixel level we use a dummy variable that takes on the value of one when some water body (river, lake, or other stream) falls in each pixel and zero otherwise. *Source: Constructed using the "Inland water area features" dataset from Global Mapping International, Colorado Springs, CO, USA. Global Ministry Mapping System.*

Elevation: Average elevation in km of ach ethnicity-country or each pixel. *Source: National Oceanic and Atmospheric Administration (NOAA) and U.S. National Geophysical Data Center, TerrainBase, release 1.0 (CD-ROM), Boulder, Colorado.*
http://www.sage.wisc.edu/atlas/data.php?incdataset=Topography

Land Suitability for Agriculture: Average land quality for cultivation within each ethnicity-country or within each pixel. The index is the product of two components capturing the climatic and soil suitability for farming. *Source: Michalopoulos (2012); Original Source: Atlas of the Biosphere.*
Available at http://www.sage.wisc.edu/iamdata/grid_data_sel.php.

Malaria Stability Index: Average prevalance of malaria within each ethnicity-country or within each pixel. The index takes into account the prevalence and type of mosquitoes indigenous to a region, their human biting rate, their daily survival rate, and their incubation period. *Source: Kiszewski, Mellinger, Spielman, Malaney, Sachs, and Sachs (2004)*

Distance to the Capital City: The geodesic distance from the centroid of each ethnic group (or from each pixel) in a country to the capital city of the country it belongs to, measured in 1000*s* of km's. *Source: Calculated using the Haversine formula.*

Distance to the Sea Coast: The geodesic distance from the centroid of each ethnic group (or from each pixel) in a country to the nearest coastline, measured in 1000*s* of km's. *Source: Global Mapping International, Colorado Springs, Colorado, USA. Series name: Global*

Ministry Mapping System. Series issue: Version 3.0

Distance to the National Border: The geodesic distance from the centroid of each ethnic group (or from each pixel) in a country to the nearest border, measured in 1000*s* of km's. *Source: Calculated using ArcGis.*

Petroleum: Indicator variable that equals one if an oil field is found in the region (or pixel) of ethnic group i in country c. *Source: The Petroleum Dataset v.1.1 contains information on all known on-shore oil and gas deposits throughout the world.*
http://www.prio.no/CSCW/Datasets/Geographical-and-Resource/Petroleum-Dataset/Petroleum-Dataset-v11/

Diamond: Indicator variable that takes on the value of one if a diamond mine is found in the region (or pixel) of ethnic group i in country c. *Source: Map of Diamond Resources. www.prio.no/CSCW/Datasets/Geographical-and-Resource/Diamond-Resources/*

Access to an electricity grid: Average answer across respondent's within Afrobarometer's enumeration areas on "whether in the enumeration area there is an electricity grid that most houses could access". *Source: 2005 Afrobarometer Surveys; available at http://www.economics.harvard.edu/faculty/nunn/data_nunn*

Access to piped water: Average answer across respondent's within Afrobarometer's enumeration areas on "whether in the enumeration area there is a piped water system that most houses could access". *Source: 2005 Afrobarometer Surveys.*

Access to sewage system: Average answer across respondent's within Afrobarometer's enumeration areas on "whether in the enumeration area there is a sewage system that most houses could access". *Source: 2005 Afrobarometer Surveys.*

Schooling: Average years of schooling across respondents within Afrobarometer's enumeration areas. *Source: 2005 Afrobarometer Surveys.*

Rule of Law: The index is "capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence." The standardized index ranges from -2.5 to $+2.5$ with higher values indicating better functioning institutions. We use the average value over the period $1996 - 2004$. *Source: World Bank Governance Matters Indicators Database (Kaufman, Kraay, and Mastruzzi (2005)). available at: http://info.worldbank.org/governance/wgi/index.asp*

Control of Corruption: Index on the control of corruption "capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests." The standardized index ranges from -2.5 to $+2.5$ with lower values indicating a higher degree

of corruption. We use the average value over the period $1996 - 2004$. *Source: World Bank Governance Matters Indicators Database (Kaufman, Kraay, and Mastruzzi (2005)). available at: http://info.worldbank.org/governance/wgi/index.asp*

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Table 1: Satellite Light Density at Night and Proxy Measures of Development within Ethnicities across Afrobarometer Enumeration Areas

	Access to Piped Water			Presence of Sewage System			Presence of Electricity Grid			Schooling Years		
	All	Split	Non-Split	All	Split	Non-Split	All	Split	Non-Split	All	Split	Non-Split
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Using a 10 km radius												
Log Light Density	0.0489***	0.0436***	0.0522***	0.0379***	0.0416***	0.0355***	0.0532***	0.0575***	0.0504***	0.1236***	0.1177***	0.1272***
	(0.0072)	(0.0135)	(0.0078)	(0.0066)	(0.0121)	(0.0111)	(0.0107)	(0.0154)	(0.0136)	(0.0179)	(0.0436)	(0.0212)
Adjusted R-squared	0.363	0.322	0.380	0.326	0.263	0.343	0.393	0.348	0.397	0.541	0.511	0.543
Panel B: Using a 5 km radius												
Log Light Density	0.0433***	0.0367***	0.0477***	0.0356***	0.0425***	0.0304***	0.0491***	0.0508***	0.0478***	0.1028***	0.0997***	0.1045***
	(0.0066)	(0.0124)	(0.0070)	(0.0049)	(0.0085)	(0.0072)	(0.0090)	(0.0135)	(0.0119)	(0.0156)	(0.0330)	(0.0190)
Ethnicity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicities	282	97	185	282	97	185	282	97	185	282	97	185
Enumeration Areas	2241	806	1435	2221	799	1422	2249	805	1444	2268	812	1456
Adjusted R-squared	0.365	0.322	0.384	0.331	0.280	0.346	0.400	0.356	0.403	0.540	0.511	0.542

The table reports ethnicity fixed-effects estimates associating four proxy measures of development (using micro-level data from the Afrobarometer) with log satellite light density at night, log (0.01 + light density). The unit of analysis is the enumeration area of the Afrobarometer Surveys. As within each enumeration area there are several households, we average household responses within the enumeration area and use the respective mean values as the dependent variable. In Panel A light density at night is the average light density in a radius of 10 km from the centroid of Afrobarometer's enumeration area. In Panel B light density at night is the average light density in a radius of 5 km from the centroid of Afrobarometer's enumeration area. The dependent variable is columns (1)-(3) is the average of respondent's answer on "whether in the enumeration area there is a piped water system that most houses could access".

The dependent variable is columns (4)-(6) is the average of respondent's answer on "whether in the enumeration area there is a sewage system that most houses could access". The dependent variable is columns (7)-(9) is the average of respondent's answer on "whether in the enumeration area there is an electricity grid that most houses could access". In columns (9)-(12) the dependent variable is the average years of schooling across respondents within each enumeration area. In all specifications we control for log (0.01 + population density in a radius of 10km or 5km of the enumeration centroid). The regressions in columns (1), (4), (7), and (10) are estimated in the full sample of ethnicities (282 ethnic groups in 17 countries). The regressions in columns (2), (5), (8) and (11) are estimated in the sub-sample of partitioned by the national border ethnic groups. The regressions in columns (3), (6), (9), and (12) are estimated in the sub-sample of non-partitioned ethnic groups. All specifications include ethnicity fixed effects (constants not reported). Below the estimates we report in parentheses double-clustered standard errors at the country and at the ethno-linguistic family dimension. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 2: Summary Statistics

variable	Obs.	mean	st. dev.	p25	median	p75	min	max
			Panel A: Partitioned Ethnic Homelands Sample					
Light Density	524	0.222	0.756	0.000	0.014	0.092	0.000	8.561
Ln (0.01 + Light Density)	524	-3.197	1.576	-4.605	-3.748	-2.286	-4.605	2.148
Ln (Light Density)	372	-3.180	2.187	-4.576	-3.116	-1.761	-10.597	2.147
Ln (0.01 + Population Density)	524	2.453	2.214	1.483	2.876	3.924	-4.605	6.386
Ln (1 + Water Area)	524	0.257	0.430	0.000	0.086	0.298	0.000	2.868
Ln (Area)	524	1.942	1.534	0.819	1.958	3.070	-2.170	6.014
Mean Elevation	524	0.604	0.429	0.283	0.470	0.931	0.000	2.181
Land Suitability For Agriculture	524	0.402	0.231	0.253	0.427	0.569	0.001	0.959
Malaria Stability Index	524	0.726	0.340	0.508	0.894	1.000	0.000	1.000
Oil Deposit Indicator	524	0.061	0.240	0.000	0.000	0.000	0.000	1.000
Diamond Mine Indicator	524	0.097	0.297	0.000	0.000	0.000	0.000	1.000
Distance to the Capital City	524	0.547	0.393	0.281	0.450	0.736	0.013	1.935
Distance to the Sea Coast	524	0.606	0.432	0.232	0.562	0.948	0.000	1.739
Distance to the Border	524	0.041	0.042	0.012	0.029	0.054	0.000	0.304
Rule of Law	524	-0.787	0.566	-1.070	-0.820	-0.442	-1.912	0.708
Control of Corruption	524	-0.721	0.484	-1.016	-0.792	-0.466	-1.590	0.722
			Panel B: Pixel -Level. Partitioned Ethnic Homelands Sample					
Light Density	44508	0.305	2.287	0.000	0.000	0.000	0.000	62.990
Ln (0.01 + Light Density)	44508	-4.116	1.459	-4.605	-4.605	-4.605	-4.605	4.143
Light Density 0-1	44508	0.121	0.326	0.000	0.000	0.000	0.000	1.000
Ln (Population Density)	44508	1.948	1.909	0.638	2.070	3.287	-5.371	8.863
Water Area Indicator	44508	0.133	0.340	0.000	0.000	0.000	0.000	1.000
Ln (Area)	44508	4.897	0.626	4.876	5.211	5.243	2.304	5.259
Mean Elevation	44508	641.330	465.196	295.347	524.423	965.508	-732.000	4138.867
Land Suitability For Agriculture	44441	0.334	0.258	0.093	0.319	0.503	0.001	0.999
Malaria Stability Index	42784	0.699	0.399	0.313	0.981	1.000	0.000	1.000
Oil Deposit Indicator	44508	0.019	0.135	0.000	0.000	0.000	0.000	1.000
Diamond Mine Indicator	44508	0.003	0.054	0.000	0.000	0.000	0.000	1.000
Distance to the Capital City	44508	536.009	367.130	274.672	445.468	718.871	1.179	1926.634
Distance to the Sea Coast	44508	591.933	418.378	239.702	517.102	917.326	0.154	1733.464
Distance to the Border	41935	94.808	104.450	20.836	59.841	130.806	0.256	719.512
Rule of Law	44508	-0.785	0.610	-1.220	-0.820	-0.438	-1.912	0.708
Control of Corruption	44508	-0.701	0.527	-1.025	-0.792	-0.412	-1.590	0.722

The table reports descriptive statistics for all variables employed in the empirical analysis for partitioned ethnic homelands. Panel A reports summary statistics for all variables at the country-ethnicity level. Panel B reports summary statistics for all variables at the pixel level. The Data Appendix gives detailed variable definitions and data sources.

Table 3: Validity of Identification Strategy

	Dependent variable is:										
	Ln (0.01 + population Density 1960)	Ln (Land Area)	Ln (1+Area under Water)	Mean Elevation	Land Suitability	Malaria Stability	Oil Indicator	Diamond Indicator	Distance to the Capital	Distance to the Sea	Distance to the Border
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Panel A: Rule of Law - All Partitions											
Rule of Law	0.1593	-0.0522	0.0465	0.0153	0.0115	-0.0187	0.0298	-0.0133	-0.2510**	0.0001	-0.0034
Double-clustered s.e.	(0.2105)	(0.1930)	(0.0442)	(0.0233)	(0.0179)	(0.0237)	(0.0204)	(0.0453)	(0.1203)	(0.0166)	(0.0070)
Adjusted R-squared	0.817	0.687	0.762	0.962	0.941	0.946	0.728	0.547	0.638	0.983	0.551
Panel B: Control of Corruption - All Partitions											
Control for Corruption	0.0476	-0.0189	0.0592	0.0354	0.0043	-0.042	0.0515	-0.0256	-0.2315	0.0054	-0.0044
Double-clustered s.e.	(0.2692)	(0.2425)	(0.0608)	(0.0305)	(0.0243)	(0.0274)	(0.0345)	(0.0656)	(0.1580)	(0.0215)	(0.0084)
Adjusted R-squared	0.816	0.687	0.762	0.962	0.941	0.946	0.73	0.547	0.606	0.983	0.551
Observations	524	524	524	524	524	524	524	524	524	524	524
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports within ethnicity OLS estimates associating various geographical, ecological, and other characteristics with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in Panel A) and control for corruption index (in Panel B) in areas of partitioned ethnicities. The dependent variable in column (1) is the log (population density in 1960 + 0.01); in column (2) is the log (1+land area); in column (3) is the log (1 + land area under water (lakes, rivers, and other streams)); in column (4) is mean elevation; in column (5) is the an index of land (soil) suitability (quality) for agriculture; in column (6) is the average of a malaria stability index; in column (7) is an indicator for country-ethnic areas with an oil field; in column (8) is an indicator for country-ethnic areas with a diamond mine. In columns (9)-(11) the dependent variable is the distance of the centroid of each country-ethnic area from the capital city, the sea coast, and the national border, respectively. The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and the ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4 - Cross-Sectional Analysis
National Institutions and Regional Development

	Rule of Law				Control of Corruption			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality	0.8525***	0.8807***	0.9205***	0.7396***	1.0877***	1.1464***	1.1455***	0.8656***
Double-clustered s.e.	(0.2760)	(0.2436)	(0.2289)	(0.1699)	(0.3401)	(0.2736)	(0.2436)	(0.2146)
Conley's s.e.	[0.2192]	[0.2022]	[0.1771]	[0.1305]	[0.2730]	[0.2285]	[0.1851]	[0.1721]
Adjusted R-squared	0.085	0.252	0.362	0.465	0.0990	0.2710	0.3730	0.4660
Population Density	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Location Controls	No	No	Yes	Yes	No	No	Yes	Yes
Geographic Controls	No	No	No	Yes	No	No	No	Yes
Observations	1240	1240	1240	1240	1240	1240	1240	1240

The table reports OLS estimates associating regional development with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(4)) and control of corruption index (in columns (5)-(8)). The dependent variable is log (0.01 + light density at night from satellite) at the ethnicity-country level. In the specifications in columns (2)-(4) and (6)-(8) we control for log (0.01 + population density). In columns (3), (4), (7), and (8) we control for location augmenting the specification with distance of the centroid of each ethnicity-country area from the capital city of each country, distance from the closest sea coast, and distance from the national border. The set of geographic controls in columns (4) and (8) includes log (1 + area under water (lakes, rivers, and other streams)), log (surface area), land suitability for agriculture, elevation, a malaria stability index, a diamond mine indicator, and an oil field indicator.

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and ethno-linguistic family dimensions. We also report in brackets Conley's (1999) standard errors that account for 2-dimensional spatial auto-correlation. ***, **, and * indicate statistical significance with the most conservative standard errors at the 1%, 5%, and 10% level, respectively.

Table 5: National Institutions and Regional Development across and within Partitioned Ethnic Groups

	Rule of Law				Control of Corruption			
	All Observations		Intensive Margin (Lit Areas)		All Observations		Intensive Margin (Lit Areas)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality	0.6573***	0.1247	0.8674***	0.3057	0.7809***	0.0934	0.9880***	0.4152
Double-clustered s.e.	(0.2143)	(0.1812)	(0.2644)	(0.2652)	(0.2636)	(0.2364)	(0.3321)	(0.3758)
Conley's s.e.	[0.1917]	[0.1099]	[0.2489]	[0.2103]	[0.2404]	[0.1503]	[0.3149]	[0.2687]
Adjusted R-squared	0.226	0.774	0.289	0.766	0.227	0.774	0.289	0.766
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Population Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	524	524	311	311	524	524	311	311
Test of Coefficient Equality [chi2, p-value]	6.01 [0.01]		3.76 [0.05]		6.14 [0.01]		2.44 [0.12]	

The table reports cross-sectional and within-ethnicity OLS estimates associating regional development with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(4)) and control of corruption index (in columns (5)-(8)) in areas of partitioned ethnicities. The dependent variable in columns (1), (2), (5), and (6) is the log (0.01 + light density at night from satellite) at the ethnicity-country level. The dependent variable in columns (3), (4), (7), and (8) is the log (light density at night from satellite) at the ethnicity-country level. In these specifications we thus ignore unlit areas focusing on the "intensive" margin of luminosity. Odd-numbered columns report cross-sectional specifications. Even-numbered columns report within-ethnicity estimates, where we include a vector of ethnicity fixed effects (constants not reported). In all specifications we control for log (0.01 + population density). The table also reports a Hausman-type test (chi2 and corresponding p-value) of coefficient equality comparing the cross-sectional estimate on national institutions with the within-ethnicity estimate.

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and ethno-linguistic family dimensions. We also report in brackets Conley's (1999) standard errors that account for 2-dimensional spatial auto-correlation. ***, **, and * indicate statistical significance with the most conservative standard errors at the 1%, 5%, and 10% level, respectively.

Table 6: National Institutions and Regional Development in Areas Close to the National Border

	Rule of Law				Control of Corruption			
Bandwidth	25 km		50 km		25 km		50 km	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality	0.6836***	0.1833	0.7039***	0.1223	0.8510***	0.1755	0.8889***	0.0261
	(0.2065)	(0.2051)	(0.2197)	(0.2046)	(0.2524)	(0.2816)	(0.2650)	(0.2638)
Adjusted R-squared	0.206	0.845	0.234	0.838	0.213	0.844	0.244	0.837
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Population Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	452	452	452	452	452	452	452
Test of Coefficient Equality [chi2, p-value]	5.50 [0.02]		4.92 [0.03]		8.37 [0.00]		5.664 [0.02]	

The table reports cross-sectional and within-ethnicity estimates associating regional development in areas of partitioned ethnicities close to the national border with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(4)) and control of corruption index (in columns (5)-(8)). We focus on the two-major partitions of each group. In columns (1), (2), (5), and (6) we focus on ethnic areas within 25 kilometers of each side of the national border (total 50 kilometers). In columns (3), (4), (7), and (8) we focus on ethnic areas within 50 kilometers of each side of the national border (total 100 kilometers). Odd-numbered columns report cross-sectional specifications. Even-numbered columns report within-ethnicity estimates, where we include a vector of ethnicity fixed effects (constants not reported). In all specifications we control for log (0.01 + population density).

The table also reports a Hausman-type test (chi2 and corresponding p-value) of coefficient equality comparing the cross-sectional estimate on national institutions with the within-ethnicity estimate. The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 7: Accounting for Migration

Panel A: National Institutions and Regional Population Density

	Rule of Law			Control of Corruption		
	(1)	(2)	(3)	(4)	(5)	(6)
Institutional Quality	0.1496	-0.105	-0.166	0.0883	-0.1192	-0.2233
	(0.2421)	(0.3094)	(0.3061)	(0.2944)	(0.3799)	(0.3878)
Adjusted R-squared	0.815	0.844	0.854	0.815	0.844	0.854
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Location Controls	No	Yes	Yes	No	Yes	Yes
Geographic Controls	No	No	Yes	No	No	Yes
Observations	524	524	524	524	524	524

The table reports within-ethnicity OLS estimates associating regional population density with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(3)) and control of corruption index (in columns (4)-(6)) in areas of partitioned ethnicities. The dependent variable is log (0.01 + population density at the ethnicity-country level). All include a vector of ethnicity fixed effects (constants not reported). Columns (1), (2), (4), and (5) include as controls the distance of the centroid of each ethnicity-country area from the capital city of each country, the distance from the closest sea coast, and the distance from the national border. Columns (3) and (6) also include as controls the log (1 + area under water (lakes, rivers, and other streams)), log (surface area), land suitability for agriculture, elevation, a malaria stability index, a diamond mine indicator, and an oil field indicator. The Data Appendix gives detailed variable definitions and data sources.

Below the estimates we report in parentheses double-clustered standard errors at the country and the ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 7: Accounting for Migration (cont.)

Panel B: Excluding Areas Close to the National Border

Excluding Area within	Rule of Law				Control of Corruption			
	25 km		50 km		25 km		50 km	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality	0.6297**	0.0244	0.8842***	0.1244	0.8434**	0.0757	1.0483***	0.2106
	(0.2968)	(0.2130)	(0.2007)	(0.4058)	(0.3627)	(0.3004)	(0.2279)	(0.6449)
Adjusted R-squared	0.207	0.793	0.233	0.760	0.224	0.793	0.239	0.761
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Population Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	326	326	194	194	326	326	194	194

The table reports cross-sectional and within-ethnicity OLS estimates associating regional development with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(4)) and control of corruption index (in columns (5)-(8)) in areas of partitioned ethnicities. The dependent variable is the log (0.01 + light density at night from satellite at the ethnicity-country level). In columns (1), (2), (5), and (6) we exclude from the estimation parts of an ethnic homeland within 25 kilometers from each side of the national border (total 50 kilometers). In columns (3), (4), (7), and (8) we exclude from the estimation parts of an ethnic homeland within 50 kilometers from each side of the national border (total 100 kilometers). Odd-numbered columns report cross-sectional specifications. Even-numbered columns report within-ethnicity estimates, where we include a vector of ethnicity fixed effects (constants not reported). In all specifications we control for log (0.01 + population density). We focus on the two-major partitions of each group.

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and the ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 8: National Institutions and Regional Development at the Pixel-Level across and within Partitioned Ethnic Groups

Panel A: Simple Cross-Sectional and Ethnicity Fixed-Effects Estimates

	Rule of Law				Control of Corruption			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality	0.1106***	0.0221	0.4926***	0.0924	0.1378***	0.0294	0.6162***	0.1397
	(0.0376)	(0.0149)	(0.1859)	(0.0721)	(0.0459)	(0.0278)	(0.2247)	(0.1409)
Adjusted R-squared	0.1468	0.3350	0.1492	0.3940	0.1536	0.3350	0.1563	0.3941
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Pixel Area & Pop. Dens.	No	No	Yes	Yes	No	No	Yes	Yes
Observations	44508	44508	44508	44508	44508	44508	44508	44508

Panel B: Local Regressions

	Rule of Law				Control of Corruption			
Bandwidth	50 km		25 km		50 km		25 km	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality	0.1159***	0.0204	0.1205***	0.0206	0.1472***	0.0300	0.1530***	0.0274
	(0.0375)	(0.0152)	(0.0394)	(0.0126)	(0.0454)	(0.0242)	(0.0476)	(0.0189)
Adjusted R-squared	0.14	0.341	0.151	0.371	0.149	0.341	0.16	0.371
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Pixel Area & Pop. Dens.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18764	18764	11801	11801	18764	18764	11801	11801

The table reports cross-sectional and within-ethnicity OLS estimates associating regional development, as reflected in satellite light density at night, with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(4)) and control of corruption index (in columns (5)-(8)). The unit of analysis is pixels of 0.125 x 0.125 decimal degrees (around 12 x 12 kilometers) within partitioned ethnicities. The dependent variable in columns (1), (2), (5), and (6) of Panel A and all specifications of Panel B is a dummy variable that takes the value one if the pixel is lit and zero otherwise. The dependent variable in columns (3), (4), (7), and (8) of Panel A is the log (0.01 + light density at night from satellite) at the pixel level. Odd-numbered columns report cross-sectional specifications. Even-numbered columns report within-ethnicity estimates, where we include a vector of ethnicity fixed effects (constants not reported). In all specifications we control for the log (area) and log (population density) of each pixel. In Panel A we report estimates in the full sample. In Panel B we focus on the two-major partitions of a group zooming in on pixels close to the national border using two different bandwidths. In columns (1)-(2) and (5)-(6) of Panel B we restrict estimation on pixels within 50 kilometers of each side of the national border (total 100 kilometers). In columns (3)- (4) and (7)-(8) of Panel B we restrict estimation on pixels within 25 kilometers of each side of the national border (total 50 kilometers).

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and at the ethno-linguistic level dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 9: National Institutions and Regional Development at the Border
Regression Discontinuity Estimates

	Rule of Law						Control of Corruption					
Bandwidth	All Observations		50 km		25 km		All Observations		50 km		25 km	
RD Polynomial	3rd-order	4th-order	3rd-order	4th-order	3rd-order	4th-order	3rd-order	4th-order	3rd-order	4th-order	3rd-order	4th-order
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Global Regression Discontinuity (RD) Polynomial												
High Institutional Quality Indicator	0.0192	0.0128	0.0127	0.0029	0.0072	-0.0075	0.0102	0.0024	0.0184	0.0071	0.0006	-0.0234
	(0.0169)	(0.0144)	(0.0188)	(0.0214)	(0.0222)	(0.0327)	(0.0167)	(0.0139)	(0.0197)	(0.0203)	(0.0210)	(0.0323)
Adjusted R-squared	0.345	0.346	0.342	0.342	0.372	0.372	0.345	0.345	0.343	0.343	0.372	0.372
Panel B: Ethnic-Specific Regression Discontinuity (RD) Polynomial												
High Institutional Quality Indicator	0.0078	0.0120	0.0117	0.0043	0.0154	-0.0019	0.0116	0.0190	0.0213	-0.0294	0.0150	-0.0038
	(0.0133)	(0.0160)	(0.0167)	(0.0192)	(0.0229)	(0.0377)	(0.0125)	(0.0147)	(0.0162)	(0.0290)	(0.0222)	(0.0387)
Adjusted R-squared	0.420	0.429	0.434	0.445	0.460	0.476	0.420	0.430	0.434	0.440	0.460	0.476
Observations	41935	41935	18764	18764	11801	11801	41935	41935	18764	18764	11801	11801
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pixel Area & Pop. Dens.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports regression discontinuity estimates. Panel A reports regression discontinuity (RD) specifications with a polynomial control function. Estimation is performed across the two major partitions of each ethnic group. In Panel A we include a global (common to all partitioned ethnicities) RD polynomial in distance of the centroid of each pixel to the national border, allowing the polynomial terms to differ in the two sides (countries) of the border. In Panel B we include ethnicity-specific RD polynomials in distance of the centroid of each pixel to the national border, allowing the polynomial terms to differ in the two sides (countries) of the border. In odd-numbered columns we include a third-order RD polynomial, while in even-numbered columns we include a fourth-order RD polynomial. In columns (3)-(6) and (9)-(12) we restrict estimation to pixels close to the national border using two different bandwidths. In columns (3), (4), (9), and (10) we focus on pixels within 50 kilometers on each side of the national border (total 100 kilometers). In columns (5), (6), (11), and (12) we focus on pixels within 25 kilometers of each side of the national border (total 50 kilometers). The high institutional quality indicator takes on the value of one for pixels falling in the country with the higher value in the rule of law index (in columns (1)-(6)) or in the control of corruption index (in columns (7)-(12)). All specifications include ethnicity fixed effects (constants not reported), the log of pixel-level population density and the log of pixel surface area.

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and at the ethno-linguistic level dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 10: Contemporary National Institutions and Regional Development.
Using Micro-data from the 2005 Afrobarometer Surveys across and within Partitioned Ethnic Groups

	Satellite Light Density		Electricity Grid		Piped Water		Sewage System		Schooling Years	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Rule of Law Index										
Institutional Quality	1.7514***	-0.2200	0.2010	0.0115	0.1828	-0.0234	0.1323	0.0260	0.5073	0.2361
	(0.6360)	(0.9616)	(0.1330)	(0.1723)	(0.1474)	(0.1699)	(0.1053)	(0.1366)	(0.4028)	(0.8653)
Adjusted R-squared	0.355	0.603	0.043	0.260	0.049	0.246	0.037	0.254	0.041	0.354
Panel B: Control of Corruption Index										
Institutional Quality	2.3027***	0.4802	0.3075**	0.1085	0.2752***	0.0007	0.2008*	0.1324	0.6251	0.3826
	(0.4036)	(1.1352)	(0.0967)	(0.2107)	(0.0917)	(0.1976)	(0.1044)	(0.1951)	(0.4009)	(0.9691)
Adjusted R-squared	0.440	0.604	0.111	0.262	0.099	0.243	0.083	0.259	0.063	0.356
Enumeration Areas (Obs.)	464	464	464	464	409	409	440	440	467	467
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Population Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports cross-sectional and within-ethnicity OLS estimates associating regional development, as reflected in satellite images on light density at night (in columns (1)-(2)), various public goods provision measures (in columns (3)-(8)) and education (in columns (9)-(10)), with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in Panel A) and control of corruption index (in Panel B) in areas of partitioned ethnicities. The unit of analysis is an enumeration area of the 2005 Afrobarometer Surveys. As within each enumeration area there are several households, we average household responses within the enumeration area and use the respective averages as the dependent variable. Odd-numbered specifications report cross-sectional estimates. Even-numbered specifications report within-ethnicity estimates that include a vector of ethnicity fixed effects (constants not reported). In all specifications we control for log (0.01 + population density in a radius of 10km or 5km of the enumeration centroid)

In columns (1) and (2) the dependent variable is average light density in a radius of 10 km from the centroid of an Afrobarometer's enumeration area. In columns (3) and (4) the dependent variable is the average within an Afrobarometer's enumeration area of respondent's answer on "whether in the enumeration area there is an electricity grid that most houses could access". In columns (5) and (6) the dependent variable is the average within an Afrobarometer's enumeration area of respondent's answer on "whether in the enumeration area there is a piped water system that most houses could access". In columns (7) and (8) dependent variable is the average within an Afrobarometer's enumeration area of respondent's answer on "whether in the enumeration area there is a sewage system that most houses could access". In columns (9) and (10) the dependent variable is the average years of schooling across respondents within each Afrobarometer's enumeration area.

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and at the ethnic group dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 11: Contemporary National Institutions and Regional Development
Heterogeneous Interactions: Proximity to the Capital City

	All Observations		Close to the Border < 50 km		Close to the Border < 25 km	
	Rule of Law	Control of Corruption	Rule of Law	Control of Corruption	Rule of Law	Control of Corruption
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Absolute Distance			
Institutional Quality	0.0292	0.0310	0.0379	0.0426	0.0510*	0.0584*
Double-clustered s.e.	(0.0302)	(0.0434)	(0.0306)	(0.0373)	(0.0280)	(0.0354)
Distance to the Capital	0.0001	0.0001	0.0001	0.0001	0.0001	-0.0001*
Double-clustered s.e.	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Institutional Quality X Distance to the Capital	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001*	-0.0001*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Adjusted R-squared	0.345	0.345	0.341	0.341	0.371	0.371
			Panel B: Relative Distance			
Institutional Quality	0.0764*	0.0845	0.1324**	0.1420**	0.1255**	0.1326**
Double-clustered s.e.	(0.0455)	(0.0579)	(0.0530)	(0.0704)	(0.0515)	(0.0663)
Relative Distance to the Capital	-0.0738	-0.0692	-0.1488*	-0.1441*	-0.1432*	-0.1397
Double-clustered s.e.	(0.0767)	(0.0792)	(0.0768)	(0.0859)	(0.0787)	(0.0894)
Institutional Quality X Relative Distance to the Capital	-0.1006	-0.1015	-0.1806**	-0.1880*	-0.1664**	-0.1740*
	(0.0710)	(0.0832)	(0.0766)	(0.0971)	(0.0759)	(0.0978)
Adjusted R-squared	0.346	0.346	0.344	0.344	0.373	0.373
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Pixel Area & Pop. Dens.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41935	41935	18764	18764	11801	11801

The table reports within-ethnicity OLS estimates associating regional development, as reflected in satellite light density at night, with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in odd-numbered columns) and control of corruption index (in even-numbered columns). The unit of analysis is pixels of 0.125 x 0.125 decimal degrees (around 12 x 12 kilometers) within partitioned ethnicities. The dependent variable in all specifications is a dummy variable that takes the value one if the pixel is lit and zero otherwise. In all specifications we control for ethnicity fixed effects, the log (area), and log (population density) of each pixel. In columns (3) and (4) we restrict estimation to pixels within 50 kilometers of each side of the national border (total 100 kilometers). In columns (5) and (6) we restrict estimation to pixels within 25 kilometers of each side of the national border (total 50 kilometers). The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and at the ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Appendix Table 1: Contemporary National Institutions and Regional Development across and within Partitioned Ethnic Groups
Sensitivity Analysis. Luminosity Expressed in Levels

	Rule of Law				Control of Corruption			
	OLS		NB-ML		OLS		NB-ML	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality	0.1682*	-0.0053	0.8703**	0.1309	0.2159*	-0.0028	1.0587***	0.1260
Double-clustered s.e.	(0.0915)	(0.0820)	(0.3609)	(0.1235)	(0.1122)	(0.1381)	(0.3593)	(0.1297)
Adjusted R-squared	0.083	0.659	__	__	0.086	0.659	__	__
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Population Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	524	524	311	311	524	524	311	311

The table reports cross-sectional and within-ethnicity OLS estimates associating regional development with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(4)) and control of corruption index (in columns (5)-(8)) in areas of partitioned ethnicities. The dependent variable in all specifications is light density at night at the ethnicity-country level. Columns (1), (2), (5), and (6) report OLS estimates. Columns (3), (4), (7), and (8) report negative binomial maximum likelihood estimates. Odd-numbered columns report cross-sectional specifications. Even-numbered columns report within-ethnicity estimates, where we include a vector of ethnicity fixed effects (constants not reported). In all specifications we control for log (0.01 + population density).

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and ethno-linguistic family dimensions. ***, **, and * indicate statistical significance with the most conservative standard errors at the 1%, 5%, and 10% level, respectively.

Appendix Table 2: National Institutions and Regional Population Density
Sensitivity Analysis. Alternative Population Data

	Rule of law			Control of Corruption		
	(1)	(2)	(3)	(4)	(5)	(6)
Institutional Quality	-0.0496	-0.277	-0.3448	-0.1645	-0.3495	-0.4459
	(0.2185)	(0.2577)	(0.2594)	(0.2731)	(0.3174)	(0.3175)
Adjusted R-squared	0.843	0.866	0.877	0.844	0.866	0.877
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Location Controls	No	Yes	Yes	No	Yes	Yes
Geographic Controls	No	No	Yes	No	No	Yes
Observations	524	524	524	524	524	524

The table reports within-ethnicity OLS estimates associating regional population density with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(3)) and control of corruption index (in columns (4)-(6)) in areas of partitioned ethnicities. The dependent variable is log (0.01 + population density at the ethnicity-country level). Columns (1) and (5) report cross-sectional estimates. All estimates include a vector of ethnicity fixed effects (constants not reported). Columns (1), (2), (4), and (5) include as controls the distance of the centroid of each ethnicity-country area from the capital city of each country, the distance from the closest sea coast, and the distance from the national border. Columns (3) and (6) also include as controls the log (1 + area under water (lakes, rivers, and other streams)), log (surface area), land suitability for agriculture, elevation, a malaria stability index, a diamond mine indicator, and an oil field indicator. Population density at the ethnicity-country level is estimated using data from the Gridded Population of the World in 2000 (http://sedac.ciesin.columbia.edu/gpw/). The Data Appendix gives detailed variable definitions and data sources.

Below the estimates we report in parentheses double-clustered standard errors at the country and the ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Appendix Table 3: Contemporary National Institutions and Regional Development across and within Partitioned Ethnic Groups
Sensitivity Analysis. Dropping Each Time a Different African Region

	Excluding									
	North Africa		South Africa		Central Africa		Eastern Africa		Western Africa	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Rule of Law Index										
Rule of Law	0.5513**	0.1647	0.4497*	0.0606	0.8653***	0.2155	0.6747***	0.074	0.7339***	0.1365
Double-clustered s.e.	(0.2391)	(0.1766)	(0.2551)	(0.2758)	(0.2246)	(0.2996)	(0.2194)	(0.2342)	(0.2426)	(0.2116)
Adjusted R-squared	0.262	0.773	0.181	0.767	0.239	0.785	0.239	0.797	0.231	0.817
Panel B: Control of Corruption Index										
Control for Corruption	0.6516**	0.1765	0.4941	-0.1197	1.0196***	0.1427	0.7652***	0.0785	0.9623***	0.1438
Double-clustered s.e.	(0.2988)	(0.2182)	(0.3473)	(0.3532)	(0.2910)	(0.3842)	(0.2616)	(0.3144)	(0.2831)	(0.2940)
Adjusted R-squared	0.263	0.772	0.176	0.767	0.238	0.784	0.237	0.797	0.255	0.816
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Population Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	494	494	435	435	391	391	427	427	349	349

The table reports cross-sectional and within-ethnicity OLS estimates associating regional development with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in Panel A) and control of corruption index (in Panel B) in areas of partitioned ethnicities. The dependent variable is the log (0.01 + light density at night from satellite) at the ethnicity-country level. Odd-numbered columns report cross-sectional specifications. Even-numbered columns report within-ethnicity estimates, where we include a vector of ethnicity fixed effects (constants not reported). In all specifications we control for log (0.01 + population density). In columns (1)-(2) we exclude ethnic groups in North Africa. In columns (3)-(4) we exclude ethnic groups in Southern Africa. In columns (5)-(6) we exclude ethnic groups in Central Africa. In columns (7)-(8) we exclude ethnic groups in Eastern Africa. In columns (9)-(10) we exclude ethnic groups in Western Africa. The regional classification follows Nunn (2007).
The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and ethno-linguistic family dimensions. ***, **, and * indicate statistical significance with the most conservative standard errors at the 1%, 5%, and 10% level, respectively.

Appendix Table 4: Validity of RD Design

	Dependent variable is:									
	Ln (Population Density 2000)	Area under Water Indicator	Mean Elevation	Land Suitability	Malaria Stability	Oil Indicator	Diamond Indicator	Distance to the Capital	Distance to the Sea	Distance to the Border
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Rule of Law - All Partitions										
Rule of Law	-0.1455	0.0074	36.7547	0.0131	-0.0036	0.0050*	-0.0004	-258.9713***	13.1935	10.0343
Double-clustered s.e.	(0.1422)	(0.0154)	(39.6265)	(0.0166)	(0.0165)	(0.0029)	(0.0009)	(100.4366)	(24.5985)	(8.6265)
Adjusted R-squared	0.432	0.158	0.766	0.774	0.871	0.396	0.021	0.637	0.950	0.456
Observations	44508	44508	44508	44441	42784	44508	44508	44508	44508	41935
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Control of Corruption - All Partitions										
Control of Corruption	-0.2727	0.0014	59.484	0.0062	-0.0176	0.0073*	-0.0006	-189.7334	25.3989	9.5485
Double-clustered s.e.	(0.1844)	(0.0244)	(53.9911)	(0.0237)	(0.0236)	(0.0041)	(0.0014)	(127.4789)	(32.5935)	(13.8773)
Adjusted R-squared	0.4325	0.1578	0.7659	0.7735	0.8709	0.3959	0.0207	0.5950	0.9501	0.4557
Observations	44508	44508	44508	44441	42784	44508	44508	44508	44508	41935
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix Table 4: Validity of RD Design (cont.)

	Dependent variable is:									
	Ln (Population Density 2000)	Area under Water Indicator	Mean Elevation	Land Suitability	Malaria Stability	Oil Indicator	Diamond Indicator	Distance to the Capital	Distance to the Sea	Distance to the Border
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel C: Rule of Law Indicator (High-Low) - Two Major Partitions of each Ethnicity										
High Rule of Law Indicator	-0.1023	0.0004	25.4485	0.0065	-0.0031	0.0069	-0.0004	-170.0852**	13.4576	6.7834
Double-clustered s.e.	(0.1397)	(0.0139)	(35.5263)	(0.0120)	(0.0167)	(0.0047)	(0.0011)	(76.9892)	(19.2976)	(8.9336)
Adjusted R-squared	0.441	0.162	0.771	0.782	0.867	0.401	0.022	0.650	0.954	0.456
Observations	41935	41935	41935	41877	40365	41935	41935	41935	41935	41935
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel D: Control of Corruption Indicator (High-Low) - Two Major Partitions of each Ethnicity										
High Control of Corruption Indicator	-0.3146***	0.0125	-14.6994	0.0006	0.0098	0.0041	-0.0005	-15.6741	-7.0526	11.2477
Double-clustered s.e.	(0.1089)	(0.0161)	(36.0606)	(0.0124)	(0.0168)	(0.0044)	(0.0010)	(91.9827)	(17.6939)	(9.2245)
Adjusted R-squared	0.4458	0.1622	0.7707	0.7815	0.8670	0.4007	0.0219	0.6098	0.9537	0.4574
Observations	41935	41935	41935	41877	40365	41935	41935	41935	41935	41935
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports within ethnicity OLS estimates associating various geographical, ecological, and other characteristics with contemporary national institutions across pixels of partitioned ethnicities. The dependent variable in column (1) is the log of population density in 2000; in column (2) is a dummy that takes on the value one when there is a water body (lake, river, and other stream) in the pixel and zero otherwise; in column (3) is mean elevation; in column (4) is an index of land suitability for agriculture; in column (5) is the average of a malaria stability index; in column (6) is an indicator for pixels with an oil field; in column (7) is an indicator for pixels with a diamond mine. In columns (8)-(10) the dependent variable is the distance of the centroid of each pixel from the capital city, the sea coast, and the national border, respectively. In Panels C and D we focus on the two major partitions of a group. The high institutional quality indicator takes on the value of one for pixels falling in the country with the higher value in the rule of law index (in Panel C) or in the control for corruption index (in Panel D). All specifications include ethnicity fixed effects (constants not reported). The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and the ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Appendix Table 5: National Institutions and Regional Development at the Pixel-Level across and within Partitioned Ethnic Groups
Excluding Pixels Close to the National Border

	Rule of Law				Control of Corruption			
Excluding pixels within	50 km		25 km		50 km		25 km	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institutional Quality	0.1109***	0.0266	0.1100***	0.0238	0.1408***	0.0446	0.1399***	0.0400
	(0.0406)	(0.0228)	(0.0392)	(0.0214)	(0.0484)	(0.0441)	(0.0469)	(0.0407)
Adjusted R-squared	0.164	0.381	0.153	0.359	0.173	0.382	0.161	0.359
Ethnicity Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Pixel Area & Pop. Dens.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23171	23171	30134	30134	23171	23171	30134	30134

The table reports cross-sectional and within-ethnicity OLS estimates associating regional development, as reflected in satellite light density at night, with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in columns (1)-(4)) and control of corruption index (in columns (5)-(8)). The unit of analysis is pixels of 0.125 x 0.125 decimal degrees (around 12 x 12 kilometers) within the two-major partitions of a group. The dependent variable in all specifications is a dummy variable that takes the value one if the pixel is lit and zero otherwise. Odd-numbered columns report cross-sectional specifications. Even-numbered columns report within-ethnicity estimates, where we include a vector of ethnicity fixed effects (constants not reported). In all specifications we control for the log (area) and log (population density) of each pixel. In columns (1), (2), (5), and (6) we exclude from the estimation pixels within 50 kilometers from each side of the national border (total 100 kilometers). In columns (3), (4), (7), and (8) we exclude from the estimation the parts of an ethnic homeland within 25 kilometers from each side of the national border (total 50 kilometers).

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and at the ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Appendix Table 6: Contemporary National Institutions and Regional Development
Sensitivity Analysis. Excluding Each Time a Different African Region

	Excluding									
	North Africa		South Africa		Central Africa		Eastern Africa		Western Africa	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Ethnicity Fixed Effects Specifications										
Rule of Law	0.0271*		-0.0134		0.0033		0.0246		0.0268	
Double-clustered s.e.	(0.0150)		(0.0192)		(0.0291)		(0.0176)		(0.0211)	
Control of Corruption		0.0442		-0.0311		0.0161		0.0365		0.0421
Double-clustered s.e.		(0.0271)		(0.0275)		(0.0482)		(0.0327)		(0.0378)
Adjusted R-squared	0.277	0.277	0.349	0.349	0.372	0.372	0.367	0.368	0.359	0.359
Panel B: RD Specifications (Global 4th-order RD Polynomial)										
High Rule of Law Indicator	0.0167		-0.0048		0.0197		0.0167		0.0146	
Double-clustered s.e.	(0.0144)		(0.0159)		(0.0169)		(0.0149)		(0.0167)	
High Control of Corruption Indicator		0.0045		-0.0041		-0.0044		0.0082		0.0021
Double-clustered s.e.		(0.0121)		(0.0109)		(0.0162)		(0.0133)		(0.0141)
Adjusted R-squared	0.277	0.277	0.349	0.349	0.373	0.373	0.369	0.369	0.359	0.359
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pixel Area & Pop. Dens.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39961	39961	31921	31921	31103	31103	31363	31363	33392	33392

Panel A reports within-ethnicity OLS estimates associating regional development with contemporary national institutions, as reflected in World Bank's Governance Matters rule of law index (in odd-numbered columns) and control of corruption index (in even-numbered columns) in areas of partitioned ethnicities. Panel B reports regression discontinuity (RD) estimates with a global (common to all partitioned ethnicities) 4th-order RD polynomial in distance of the centroid of each pixel to the national border, allowing the polynomial terms to differ in the two sides (countries) of the border. The high institutional quality indicator takes on the value of one for pixels falling in the country with the higher value in the rule of law index (in odd-numbered columns) or in the control of+A33 corruption index (in even-numbered columns). In columns (1)-(2) we exclude pixels in Northern Africa. In columns (3)-(4) we exclude pixels in Southern Africa. In columns (5)-(6) we exclude pixels in Central Africa. In columns (7)-(8) we exclude pixels in Eastern Africa. In columns (9)-(10) we exclude pixels in Western Africa. The regional classification follows Nunn (2007). In all specifications we control for ethnicity fixed effects, the ln (pixel population density) and the ln (pixel area) while we focus on the two-major partitions of each group.

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and ethno-linguistic family dimensions. ***, **, and * indicate statistical significance with the most conservative standard errors at the 1%, 5%, and 10% level, respectively.

Appendix Table 7: National Institutions and Regional Development
Sensitivity Analysis. Large Discontinuities in National Institutions across the Border

	Rule of Law				Control of Corruption			
Difference in Inst. Qual.	> median		> 75th percentile		> median		> 75th percentile	
Polynomial	3rd-order	4th-order	3rd-order	4th-order	3rd-order	4th-order	3rd-order	4th-order
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
High Institutional Quality	0.0191	0.0129	0.0100	-0.0070	0.0294	0.0193	0.0229	-0.0023
	(0.0184)	(0.0163)	(0.0254)	(0.0262)	(0.0237)	(0.0184)	(0.0227)	(0.0244)
Adjusted R-squared	0.435	0.436	0.469	0.470	0.412	0.413	0.461	0.463
Ethnicity Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pixel Area & Pop. Dens.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20524	20524	10998	10998	20013	20013	10581	10581

The table reports regression discontinuity (RD) specifications with a polynomial control function in areas of partitioned ethnicities across the national border where there are large differences in national institutional quality. Estimation is performed across pixels falling in the two major partitions of each ethnic group. In columns (1)-(2) and (5)-(6) we identify partitioned ethnicities with large differences in institutional quality across the two sides of the border using the median value of the difference in the rule of law index and the control of corruption index, respectively. In columns (3)-(4) and (7)-(8) we identify partitioned ethnicities with large differences in institutional quality across the two sides of the border using the 75th percentile value of the difference in the rule of law index and the control of corruption index, respectively. In all specifications we include a global (common to all partitioned ethnicities) RD polynomial in distance of the centroid of each pixel to the national border, allowing the polynomial terms to differ in the two sides (countries) of the border. In odd-numbered columns we include a third-order global RD polynomial, while in even-numbered columns we include a fourth-order global RD polynomial. The high institutional quality indicator takes on the value of one for pixels falling in the country with the higher value in the rule of law index (in columns (1)-(6)) or in the control for corruption index (in columns (7)-(12)). All specifications include ethnicity fixed effects (constants not reported), the log of pixel-level population density and the log of pixel surface area.

The Data Appendix gives detailed variable definitions and data sources. Below the estimates we report in parentheses double-clustered standard errors at the country and ethno-linguistic family dimensions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.