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Working Paper 10.05

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December 22, 2010

Abstract

To study whether foreign aid fuels personal, regional and ethnic favoritism, we use satellite data on nighttime light for any region in any aid-recipient country, and we determine for each year and each country the region in which the current political leader was born. Having a panel with 22,850 regions in 91 aid recipient countries with yearly observations from 1992 to 2005, we compare the effect of foreign aid on nighttime light across regions. We find that in countries with poor political institutions, this effect is significantly higher in the region in which the current political leader was born than in other regions. This finding suggests that a disproportionate share of foreign aid ends up in the leader's birth region, and we argue that it supports the view that foreign aid fuels favoritism, broadly defined. We find no such difference in aid-recipient countries with sound political institutions.

JEL classification: C23; D73; F35; O11.

Keywords: Foreign aid; Political leaders; Favoritism; Political institutions.

*We would like to thank Torfinn Harding, Nils Herger, Dirk Niepelt, Andrei Shleifer, Tony Venables and seminar and conference participants at Deakin University, Goethe University Frankfurt, Monash University, Study Center Gerzensee, Queensland University of Technology, University of Heidelberg, University of Melbourne, University of Oxford and the NEUDC conference 2010 for helpful comments and discussions; Torfinn Harding and Tony Venables for their data; and Imogen Halstead for excellent research assistance.

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1 Introduction

Back in the 1960s and 1970s most development economists and donor agencies were optimistic about the potential of foreign aid to foster development in aid recipient countries. One of the first aid pessimists was Peter Bauer. He was concerned that "[b]ecause aid accrues to the government it increases its resources, patronage, and power" (Bauer, 1991, p. 45). In particular, political leaders may engage in various forms of favoritism when allocating foreign aid. They could favor themselves and their family and friends, or the region from which they are coming, or members of the ethnic group to which they belong. So far, however, the question whether foreign aid does systematically fuel such personal, regional and ethnic favoritism remains unanswered. The only existing empirical studies that could potentially help us answering this question are those on the effect of foreign aid on perceived corruption and governance, but their results are mixed.[1,2]

We propose to study whether foreign aid fuels favoritism, broadly defined, by looking whether a disproportionate share of foreign aid ends up in the political leader's birth region. We therefore combine different data sources in a novel way: they include satellite data on nighttime light, and information on the birth places of political leaders. Weather satellites record the intensity of nighttime light. The National Oceanic and Atmospheric Administration (NOAA) provides a measure of nighttime light for each year from 1992 to 2005 based on evening readings during the dark half of the lunar cycle in seasons when the sun sets early. Nighttime light has been proposed as a measure of economic activity by Sutton and Costanza (2002), Doll et al. (2006), Sutton et al. (2007), and – most forcefully – by Henderson et al. (2009). Like GDP, nighttime light is likely to reflect some private consumption, some production and some government expenditures. But GDP and other data collected by governments of poor aid recipient countries are often considered

[1]Svensson (2000) shows that foreign aid is associated with higher corruption in ethnically fractionalized countries. Knack (2001) finds that foreign aid tends to lower the quality of governance, but not to raise corruption. Alesina and Weder (2002) find a positive association between changes in aid and corruption, but Tavares (2003) finds that foreign aid tends to lower corruption.

[2]Bjørnskov (2010) finds a positive effect of foreign aid on the income share of the upper quintile, which could be interpreted as evidence that foreign aid leads to some form of favoritism. But surprisingly, this effect turns out to be stronger in relatively democratic countries than in undemocratic countries.

to be of low quality, partly because governments lack data collection capability.[3] Chen and Nordhaus (2010) point out that nighttime light data is a useful measure of economic activity for countries with poor statistical systems. Also in the presence of weak institutions and the associated low pressures of accountability, governments may deliberately manipulate official statistics, e.g., to cover up corrupt activities. While it is hard to trust country level GDP data of poor aid recipient countries, data on regional GDP is often not even available. Unlike GDP data, nighttime light data is available in the same high quality for any region in any aid-recipient country, making it "uniquely suited to spatial analyses of economic activity" (Henderson et al., 2009, p. 4). As a measure of regional economic activity, we therefore construct nighttime light per capita for any region in any aid-recipient country for which geographical information about regional boarders and regional population data is available.

Goemans et al. (2009) have compiled a data base of effective political leaders. We add the birth places of the political leaders who were in power from 1991 onwards. For each year and each aid-recipient country, we label the region in which the current political leader was born the leader region. In addition to regional nighttime light per capita and leader region dummies, we use standard variables for foreign aid and political institutions (i.e., ODA per capita and Polity2) to construct a panel with 22,850 regions in 91 aid-recipient countries with yearly observations from 1992 to 2005.

Using region and year fixed effects, and a set of control variables, we find that in countries with poor political institutions, the effect of foreign aid on nighttime light is significantly higher in leader regions than in other regions. This finding suggests that a disproportionate share of foreign aid ends up in leader regions, and it is consistent with the view that foreign aid fuels favoritism in weakly institutionalized countries.[4] Interestingly, for aid-recipient countries with sound political institutions we find no evidence that foreign

[3]For example, there was only one qualified accountant in Burundi's entire public sector in 1990 (Bräutigam and Knack, 2004).

[4]It is irrelevant for our argument whether foreign aid is directly channeled to the leader region, or whether more other public revenues are channeled to the leader region when foreign aid increases.

aid has a different effect on nighttime light in leader regions than in other regions. This latter finding is consistent with the view that democratic institutions reduce aid-fueled favoritism.

Before elaborating in more detail on possible and plausible interpretations of our findings, it is helpful to take a closer look at some country examples. Mobutu Sese Seko was dictator of Zaire (today's Democratic Republic of the Congo) from 1965 to 1997. He was a true kleptomaniac. Besides expropriating investors and plundering the central bank, he relied on "the massive diversion of foreign loans and aid" (Edgerton, 2002, p. 211). In the 1980s Mobutu's estimated fortune was $5 billion. He had money on Swiss bank accounts, and properties in Abidjan, Brussels, Cape Town, Dakar, Madrid, Marrakech, Paris, on the French Riveria, as well as in Brazil, Portugal and Switzerland (Edgerton, 2002; Meredith, 2005). However, he most lavishly spent money in Gbadolite, a small town in Equateur in remote northeastern Zaire. Gbadolite was Mobutu ancestral home and near his birth place. There he built a huge palace complex costing $100 million, as well as luxury guesthouses and hotels, a replica of a Chinese pagoda, and "an airport capable of handling supersonic Concordes which Mobutu often chartered for his trips abroad" (Meredith, 2005, p. 299; Edgerton, 2002). In addition, he gave Gbadolite "the country's best supply of water and electricity, not to mention television stations, telephones, and medical services" (Edgerton, 2002, p. 211). In his time in Gbadolite, Mobutu and his clan spent his riches in grand style on average days, and without any restraint whatsoever on ceremonies like his daughter's wedding (Edgerton, 2002). The second tier of government officials also came "primarily from Equateur" (Leslie, 1993, p. 72), and they also engaged in massive corruption.

There is also casual evidence that a disproportionate share of foreign aid may end up in the leader region in Zambia, Kenya and Bolivia. Posner (2005) nicely documents that in Zambia presidents are "expected to channel donor aid or relief food to their regions" (p. 96), and that "the President is also widely assumed to favor members of his own ethnic group when it comes to making governmental appointments" (p. 97). In Kenya,

both the Kalenjin dominated government around Daniel arap Moi, who was president from 1978 to 2002, and the Kikuyu dominated government around Mwai Kibaki, who has been president ever since, engaged in ethnic and regional favoritism, and extracted foreign aid and other public funds on a large scale (Wrong, 2009). In Bolivia, Evo Morales is the first indigenous president and also the first president from a rural district in the highlands, and he uses foreign aid and natural resource revenues accruing in the lowlands to support the poor indigenous population in the highlands.[5]

These examples suggest various reasons why a high share of foreign aid may end up in the leader region: First, political leaders may simply embezzle aid inflows and spend them in their region, possibly together with their family and clan members. Second, they may channel aid inflows towards their region because of regional or ethnic favoritism, or to secure support in their stronghold, or to compensate for past underfunding of their region. Third, they may appoint government officials from their region, and these officials may also embezzle aid and favor their region.

Furthermore, these country examples suggest that we may underestimate aid-fueled favoritism, among others, because some political leaders favor a multitude of regions when allocating aid, and because some foreign aid is channeled onto overseas bank accounts. As a consequence, our finding of aid-fueled favoritism in countries with poor political institutions is even more remarkable. But, on the other hand, we need to be cautious when interpreting our findings for countries with sound political institutions. These findings are consistent with our preferred view that sound political institutions reduce aid-fueled favoritism, but also with the view that sound political institutions lead to different forms of aid-fueled favoritism, which are just not observable from outer space.

Our findings are well in line with the predictions of some recent theoretical models: The model of Besley and Persson (2010) predicts that foreign aid leads to higher public goods provision if state capacity is high, but to transfers to the group in power if state

[5]See, e.g., New York Times, U.S. Aid Can't Win Bolivia's Love as New Suitors Emerge, May 14, 2006; and New York Times, A Crisis Highlights Divisions in Bolivia, September 15, 2008.

capacity is low. Similarly, the model of Bhattacharyya and Hodler (2010) suggests that political leaders embezzle natural resource rents and foreign aid inflows, for that matter, if and only if political institutions are sufficiently weak. The finding of a disproportionate share of foreign aid ending up in the leader region is also consistent with the models of foreign aid and rent seeking by Svensson (2000) and Hodler (2007).

Our paper contributes to the recent literature on the role of political leaders for economic outcomes. Jones and Olken (2005) find that political leaders matter for economic growth, and more so in autocratic than in democratic countries. Similarly our findings suggest that political leaders matter more for the allocation of public funds in autocratic than in democratic countries. A likely driving force of both these results is that autocratic leaders face few constraints and can choose more or less any policy they like, while checks and balances prevent democratic leaders from choosing some socially very harmful policies. Our paper is also related to Kasara (2007), Kudamatsu (2009), Franck and Rainer (2009), and Burgess et al. (2010), who all study whether and how the political leader's ethnicity affects policy outcomes across ethnic groups in Sub-Saharan African countries.[6] As our approach of measuring favoritism also captures personal favoritism, i.e., corruption, our paper is further related to Reinikka and Svensson (2004), Hsieh and Moretti (2006), Olken and Barron (2009), and Bertrand et al. (2007), who all study corruption using innovative measures rather than standard perception-based measures of corruption.[7]

The remainder of this paper is organized as follows: In sections 2 and 3 we present our data and our empirical strategy. In section 4 we present our main findings, and we show that they are robust to the use of alternative samples, alternative measures of foreign aid and political institutions, alternative subnational units, additional control variables, and an instrumental variables approach to address the potential endogeneity of foreign aid. We also address the potential endogeneity of leader regions. We then briefly conclude in

[6]More generally, our paper relates to the literature on the negative economic consequences of ethnic divisions. There is evidence that ethnic divisions lead to corruption, poor governance (La Porta et al., 1999; Alesina et al., 2003) and low public good provision (Miguel and Gugerty, 2005), thereby lowering economic growth (Mauro, 1995; Easterly and Levine, 1997).

[7]Olken (2009) discusses the limitations of relying on perception-based measures of corruption.

section 5.

2 Data

Satellite data on nighttime light reflections stems from NOAA (2009).[8] Weather satellites from the US Air Force circle the earth 14 times per day and measure light intensity everywhere on earth between 65 degrees North and 65 degrees South every night somewhen between 8.30 and 10.00pm. To get primarily man-made nighttime light, only readings from the dark half of the lunar cycle in seasons when the sun sets early is used, and readings affected by northern or southern lights, forest fires and cloud cover are removed. The original nighttime light readings are then recalibrated to account for variations in sensor settings over time. The recalibrated data is available on a scale from 0 to 63, with higher values implying higher light intensity. This data is available for the time period from 1992 to 2005 for output pixels that correspond to approximately one square kilometer.

Nighttime light data is a proxy for economic activities, as most forms of consumption and production in the evening require light. Also public infrastructure is often lit at night. It is therefore not surprising that Henderson et al. (2009) find a high correlation between changes in nighttime light and GDP over time. Compared to GDP data, nighttime light data has two main advantages as measure of economic activity: First it is available in the same high quality for all countries that are not too close to either of the two poles, while GDP data is often of poor quality or even unavailable for developing countries.[9]

Second it is available at the regional and local level, which is very useful for our purpose. The example of Mobutu's ancestral town of Gbadolite nicely illustrates how well nighttime light data can capture changes in economic activity at the local level. Figure 1 shows nighttime light in Gbadolite for various years. Nighttime light was rather intense in the period until 1996. Then in 1997 Laurent-Désiré Kabila and his rebel groups

[8]See Henderson et al. (2009) for a more detailed description of nighttime light data, as well as for an excellent discussion of its advantages and the various weaknesses of GDP data.

[9]Nighttime light data is available for all countries that received aid in the period from 1992 to 2005 except Russia, as parts of Russia are above 65 degrees North.

seized power in the Congo and political rents stopped floating into town. As a result nighttime light intensity dropped considerably.

Our dependent variable is the log of nighttime light per capita in region i in country c in year t, $Light_{ict}$. It is constructed in three steps: First, we use raw satellite images on average nighttime light reflections per annum obtained from NOAA. Figure 2, panel (a) provides an illustrative example of nighttime light in India in 2003. Because pixel size varies by latitude we project the original satellite image on a surface using the Eckert IV projection in order to preserve an equal area. Second, we apply another GIS-shapefile that contains information on subnational administrative units and their boundaries (CIESIN, 2005). For most countries, regional administrative boundaries are available at two different federal levels. We choose the lowest federal level available for each country. Figure 2, panel (b) shows these boundaries for India. For each subnational region i, we calculate the sum of all nighttime light pixel values within each subnational region. Third, in order to adjust the sum of nightime light per subnational region for population size, we use a third set of GIS-shapefiles that contain information of the population distribution around the world. The global population grid project (CIESIN, 2005) collected basic population numbers from national census data worldwide and combined it with the spatial boundary information on subnational administrative units. The published population data has then been disaggregated and assigned to equally sized grid cells within each subnational unit. Figure 3, panel (a) shows the distribution of population in India in 2000. For our analysis we convert this disaggregated population information back to the total population by administrative unit. As subnational population data is available only for the years 1990, 1995, 2000 and 2005, all missing years are replaced by a linear interpolation of subnational population on years. Once again we take the sum of all population pixel values within each subnational region (see figure 3, panel (b)), and we use it to derive nighttime light per 1,000 inhabitants. Finally, taking the logarithm gives us our dependent variable $Light_{ict}$.

The data base of Goemans et al. (2009) identifies the effective political leader of each country for many years up to 2004. It contains information about the exact time period

in which a particular individual is a country's political leader. We add to this data base the birthplace of all political leaders in aid-recipient countries within the time period from 1991 onwards. We collect this information using resources cited in Goemans et al. (2009) as well as various internet sites. We map the political leaders' birthplaces with subnational regions via GIS using shapefiles with longitude and latitude information on settlement points (CIESIN, 2005) if possible, and latitude and longitude of birthplaces otherwise. We thereby exclude leaders who were born abroad as well as leaders for whom we could not find birthplace information.[10] We call the region in which the current political leader was born the leader region, and we construct the dummy variable $Leader_{ict}$ that is equal to one if region i was a leader region of country c in year t, and equal to zero otherwise.

We use standard measures for foreign aid and political institutions. Our main aid measure, Aid_{ct}, is based on official development assistance (ODA) data from the OECD (2008), and defined as the log of net ODA in current US dollars per capita. Our main institutional variable, $Polity_{ct}$, is based on the Polity IV database by Marshall and Jaggers (2005). $Polity_{ct}$ is the difference between the democracy and the autocracy indicators, rescaled such that it ranges from 0 to 1, with higher values implying better political institutions. It measures the competitiveness and regulation of political participation, the openness and competitiveness of executive recruitment, and the constraints on the executive. Note that Aid_{ct} and $Polity_{ct}$ are available at the country level only. Combining our four main variables $Light_{ict}$, $Leader_{ict}$, Aid_{ct} and $Polity_{ct}$, we get an unbalanced panel of 22,850 regions in 91 aid-recipient countries with annual observations for the years 1992 to 2005. Table 1 presents descriptive statistics for these four variables. In addition, we use various control variables.[11]

[10] All leaders for whom we could not find birthplace information were in power for less than 50 days.

[11] Appendix A provides a list of the 91 countries in our sample, and Appendix B a brief description of all variables used in our analysis.

3 Empirical Strategy

The objective of our empirical analysis is to test whether and how the effect of foreign aid on nighttime light is different in leader regions than in other regions, and how this difference depends on the quality of political institutions. For that purpose we estimate the following equation:

$$\begin{aligned} Light_{ict} &= \alpha_i + \beta_t + \gamma_1 Leader_{ict-1} + \gamma_2 Aid_{ct-1} + \gamma_3 Polity_{ct-1} + \gamma_4 (Leader_{ict-1} \times Aid_{ct-1}) \\ &+ \gamma_5 (Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}) + X'_{ict}\Lambda_X + Z'_{ict-1}\Lambda_Z + \varepsilon_{ict} \end{aligned}$$

In what follows we briefly discuss the various terms of this equation. The regional dummy variable α_i indicates the use of region fixed effects. Region fixed effects are important to overcome the omitted variable bias that might otherwise arise because the regions' nighttime light and their likelihood of being a leader region could both depend on some unobservable region-specific characteristics. The year dummy variable β_t controls for time varying common shocks and changes in satellites and their sensor settings.

We use lagged values of our three main explanatory variables – Aid_{ct}, $Polity_{ct}$ and $Leader_{ict}$ – because the process from aid disbursements to changes in observed nighttime light intensity takes time. This delay follows from the time lags between the arrival of aid payments to the point in time when the central government decides on the allocation of aid (and other public funds); between the government's allocation decision and the arrival of transfers in the chosen regions; and also between the arrival of transfers in these regions and the increase in recorded nighttime light via investment (e.g. construction of houses or plants), private consumption (e.g. electronic devices), or government expenditures (e.g. lamp posts). Also note that ODA data documents the sum of all aid disbursements in country c over the entire year t; and that it is especially unlikely that aid payments received late in the year could translate into nighttime light in the same year. In addition, the use of lagged values of our main explanatory variables may help to reduce any potential simultaneity bias.

Vector X_{ict} contains control variables that may either affect the "production" of nighttime light, or its observability from outer space. These control variables are regional population ($Population_{ict}$), oil and coal production (Oil_{ct}, $Coal_{ct}$), the numbers of natural disasters and revolutions ($Disasters_{ct}$, $Revolutions_{ct}$), and a standard measure of the quality of government ($Governance_{ct}$). Note that all of these control variables, except $Population_{ict}$, are at the country level. We refrain from using economic control variables from official government statistics in our main specification, but we will add such control variables in one of our robustness exercises.

Vector Z_{ict-1} contains the interaction terms $Aid_{ct-1} \times Polity_{ct-1}$ and $Leader_{ict-1} \times Polity_{ct-1}$. We need to control for these two additional interaction terms to ensure that a significant coefficient γ_5 really implies significance of $Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$, and cannot just be a statistical artefact because $Aid_{ct-1} \times Polity_{ct-1}$ or $Leader_{ict-1} \times Polity_{ct-1}$ is significant, but uncontrolled for.

The difference between the effect of Aid_{ct-1} on $Light_{ict}$ in leader regions and other regions is $\gamma_4 + \gamma_5 Polity_{ct-1}$. We are therefore primarily interested in the coefficients γ_4 and γ_5. We expect γ_4 to be positive and γ_5 to be negative. A positive and statistically significant coefficient γ_4 implies that in countries with poor political institutions the effect of Aid_{ct-1} on $Light_{ict}$ is higher in leader regions than elsewhere. A negative and statistically significant coefficient γ_5 implies that the difference between the effects of Aid_{ct-1} on $Light_{ict}$ in leader regions and other regions becomes smaller as political institutions improve. Based on $\gamma_4 + \gamma_5$, we can further check whether the effect of Aid_{ct-1} on $Light_{ict}$ is different in leader regions than elsewhere when political institutions are excellent.

Following our discussion in the introduction, and keeping the broad definition of favoritism in mind, we will interpret $\gamma_4 > 0$ as evidence that foreign aid fuels favoritism, and $\gamma_5 < 0$ as evidence that sound political institutions reduce aid-fueled favoritism.

4 Main Findings and Robustness Tests

Table 2 presents our main results. In column 1 we include our three main explanatory variables, $Leader_{ict-1}$, Aid_{ct-1} and $Polity_{ct-1}$, but without any interaction terms. As in all other regressions, region and year fixed effects are included, and standard errors are adjusted for county-year clustering. We find that $Leader_{ict-1}$ has a positive effect on $Light_{ict}$, while Aid_{ct-1} has a negative effect. In column 2 we add the interaction term $Leader_{ict-1} \times Aid_{ct-1}$, which turns out to be insignificant, suggesting that the effect of Aid_{ct-1} on $Light_{ict}$ is on average not significantly different in leader regions than in other regions. In column 3 we also add the interaction term $Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$. We find that the coefficient on $Leader_{ict-1} \times Aid_{ct-1}$, γ_4, is significantly positive, while the coefficient on $Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$, γ_5, is significantly negative. In columns 4 and 5 we add interaction terms Z_{ict-1} and control variables X_{ict}. We see that coefficient γ_4 remains significantly positive, and coefficient γ_5 significantly negative. Further the coefficient of Aid_{ct-1} is significantly negative, suggesting a negative effect of Aid_{ct-1} on $Light_{ict}$ when $Leader_{ict-1} = 0$ and $Polity_{ct-1} = 0$.[12] Regional population has a negative effect on nighttime light per capita, which suggests that an increase in population translates into a comparatively smaller increase in recorded nighttime light. Also we note that $Governance_{ct}$ tends to have a positive effect on $Light_{ict}$, while $Polity_{ct-1}$ tends to have a negative effect.

Figure 5 illustrates the results from our baseline specification (column 5). It shows the effect of $Leader_{ict-1} \times Aid_{ct-1}$ on $Light_{ict}$, which is $\gamma_4 + \gamma_5 Polity_{ct-1}$, and how this effect changes in $Polity_{ct-1}$. We can see that this effect is significantly positive for low levels of $Polity_{ct-1}$, which implies that the effect of Aid_{ct-1} on $Light_{ict}$ is significantly higher in leader regions than in other regions of countries with poor political institutions. Due to our log specification, we can interpret the coefficients as elasticities. Hence, when Aid_{ct-1} increases by 100 percent, the difference between $Light_{ict}$ in the leader region and in other regions increases by almost 10 percent in countries with very poor political institutions.

[12] The subsequent robustness exercises show that this negative effect is not robust.

However, the effect of $Leader_{ict-1} \times Aid_{ct-1}$ on $Light_{ict}$ decreases in $Polity_{ct-1}$ and is close to zero for $Polity_{ct-1}$ close to one. That is, in countries with sufficiently strong political institutions we cannot observe any difference between the effect of Aid_{ct-1} on $Light_{ict}$ in leader regions and other regions. This latter result follows because better political institutions lower the effect of Aid_{ct-1} on $Light_{ict}$ in the leader region, and also because they raise the effect of Aid_{ct-1} on $Light_{ict}$ in other regions. As argued in the introduction, these findings are consistent with the view that foreign aid fuels favoritisms in countries with poor political institutions, and that sound political institutions reduce aid-fueled favoritism.

We now present various robustness exercises. A first concern could be that our results are driven by countries from a particular region of the world. For example, they might be driven by the ethnically highly fractionalized countries in Sub-Saharan Africa, or by the mostly Muslim countries with their mostly authoritarian regimes in the Middle East and Northern Africa, or by the formerly communist states in Eastern Europe and Central Asia. In columns 1-6 of table 3 we therefore exclude one region of the world at a time from our sample.[13] We find in all instances that $Leader_{ct-1} \times Aid_{ct-1}$ remains significantly positive, and that $Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$ remains negative and significant at least at the 10% level. In column 7 we find that these interaction terms remain highly significant when excluding member countries of the Organization of Petroleum Exporting Countries (OPEC). Hence our main results do not strongly depend on the countries from any particular region of the world, or the major oil producers and exporters.[14]

In table 4 we look at various other sub-samples. It is sometimes suggested that the poorest countries, or the "bottom billion" as Collier (2007) calls them, are fundamentally different than better performing developing countries. In columns 1 and 2 we therefore present the results separately for the least developed countries (LDCs) and the other aid

[13]The world regions are East Asia and Pacific (EAP), Eastern Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), Middle East and North Africa (MENA), South Asia (SA), and Sub-Saharan Africa (SSA).

[14]Our main results are also robust when we exclude countries colonized by the British, France and Spain, respectively (results available on request).

recipient countries. The results are similar but the coefficients of interest are higher for the LDCs. Hence, it could be the case that aid-fueled favoritism is somewhat more pronounced in LDCs, but sound political institutions seem to be no less useful in preventing favoritism in LDCs than elsewhere.

One form of favoritism that our approach might capture is ethnic favoritism, which might be more prevalent in ethnically fractionalized than in homogenous countries (even though our results hold when excluding Sub-Saharan Africa). In columns 3 and 4 of table 4 we therefore split the sample into countries in which ethnolinguistic fractionalization (ELF) is lower than in the median country of our sample, and countries in which ELF is above the median. Again the general pattern is the same in both sub samples. It however seems that sound political institutions might be somewhat less successful in preventing aid-fueled favoritism in fractionalized countries than in more homogenous countries.

As we use region fixed effects, it is clear that the coefficient estimates of $Leader_{ict-1}$ and $Polity_{ct-1}$ are exclusively driven by observations from countries in which political leadership and polity scores, respectively, varied over the sample period. But as Aid_{ct-1} varies over time for all countries in our sample, the coefficient estimates of $Leader_{ct-1} \times Aid_{ct-1}$ and $Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$ are also influenced by observations from the 18 countries in our sample in which the same political leader was in power from 1991 to 2004.[15] In addition, the coefficient estimate of $Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$ is also influenced by observations from the 21 countries in our sample in which there was no change in polity scores from 1991 to 2004.[16] To make sure that our main results are not driven by either of these two sets of countries, we drop the 18 countries without any change in $Leader_{ict-1}$ in column 5 of table 4, and the 21 countries without any change in $Polity_{ct-1}$ in column 6. In both instances our two coefficients of interest show the predicted signs and are highly significant.

[15]Most countries without any change in political leadership are autocratic Sub-Saharan African countries.

[16]Countries without any change in polity scores are very diverse, ranging from highly autocratic countries like North Korea to Costa Rica, Slovenia and Uruguay, which all got the highest possible polity score throughout the sample period.

In table 5 we show that our results are robust when using alternative measures of aid inflows and nighttime light. When constructing our standard aid variable, we take the log of ODA per capita. Hence we loose all observations with zero or negative aid inflows. We therefore construct a new aid variable (Aid_{ct}^{nn}) by setting negative values of ODA per capita equal to zero, and then taking the log of these non-negative values plus one. We use Aid_{ct}^{nn} in column 1, and the often used aid dependency measure of ODA as a share of GDP (Aid_{ct}^{GDP}) in column 2. Based on ODA data, Roodman (2006) constructs an alternative aid measure, Net Aid Transfers, which, among others, excludes cancelation of old non-ODA loans. In column 3 we use the log of Net Aid Transfers per capita (Aid_{ct}^{NAT}). We find that the coefficients of interest are highly significant when using Aid_{ct}^{nn}, and still significant at least at the 10% level when using Aid_{ct}^{GDP} or Aid_{ct}^{NAT}.

We argued earlier that the nighttime light data is of excellent quality. However we can be less certain about the quality of the regional population data, which we also use to construct our dependent variable $Light_{ict}$. To ensure that our results are not driven by some problems with the regional population data, we use the log of nighttime light per area ($Light_{ict}^{area}$) as dependent variable in column 4 of table 5. For the same reason we replace regional population by country level population in our set of control variables. It is reassuring that our results are very similar with nighttime light per area (and country level population as control variable) as they are with nighttime light per capita (and regional population as control variable).

A multitude of different indicators are used in the literature to measure the quality of political institutions. While $Polity_{ct}$ is probably the most widely used of these measures, table 6 shows that our main results also hold for other commonly used measures of institutional quality. First, we use the $Politydummy_{ct}$, which is equal to 1 if $Polity_{ct}$ is positive, and equal to 0 if $Polity_{ct}$ is negative. Second, we use the number of veto players ($Checks_{ct}$), which is a often referred to as a measure of checks and balances. $Checks_{ct}$ might a particularly appropriate alternative to $Polity_{ct}$ because political leaders can more easily engage in favoritism when there are fewer veto players that need to be convinced or

bought off. Third, we use the Freedom House measures of political rights ($Rights_{ct}$) and civil liberties ($Liberties_{ct}$), which we rescale so that they vary from 0 to 1 with higher values indicating better institutions. Finally we replace $Polity_{ct}$ by $Governance_{ct}$. In all instances we find that our main results still hold. The interactions of these institutional variables with $Leader_{ict-1} \times Aid_{ct-1}$ are significantly negative, while $Leader_{ict-1} \times Aid_{ct-1}$ by itself is significantly positive.

In table 7 we add further control variables. One could be concerned that a disproportionate share of foreign aid may end up in leader regions because quite a few leaders are born in capital regions, i.e., regions in which capital cities are located, and because a disproportionate share of foreign aid may end up in capital regions. Reasons for the latter could be that political leaders and their entourage may spend embezzled foreign aid in the capital, or that the political power of the capital's population may induce the government to spend most resources in the capital (Ades and Glaeser, 1995). We therefore control in all columns of table 7 for the interactions of Aid_{ct-1} and $Polity_{ct-1}$ with a dummy variable that is equal to one for capital regions ($Capital_{ic}$). We find that our main results still hold. Further we indeed find evidence that a disproportionate share of foreign aid ends up in capital regions. Unlike the finding of a disproportionate share of foreign aid ending up in leader regions, this effect is however independent of the quality of political institutions. So far, we have refrained from adding economic control variables based on data collected by recipient country governments. But in column 2 we add government expenditures per capita ($Expenditures_{ct}$), investment as a share of GDP ($Investment_{ct}$), and in column 3 we further add the inflation rate ($Inflation_{ct}$) and $M2_{ct}$, which is often used as a measure of financial depth. In column 4 we also add country-specific time trends. We find that the coefficients of interest remain significant in all instances.

Apart from foreign aid, rents and revenues that accrue to governments from other sources may also provide political leaders with opportunities to engage in favoritism. Hence a disproportionate share of other rents and revenues may also end up in leader regions. Moreover, some of these rents and revenues are correlated with foreign aid inflows

which could potentially bias our estimates. In table 8 we therefore use log government expenditures per capita ($Expenditures_{ict-1}$) and log resource rents per capita (RR_{ict-1}), as well as their interactions with $Leader_{ict-1}$ and $Polity_{ict-1}$. In column 1 we replace Aid_{ct-1} by $Expenditures_{ct-1}$ in our main specification. We find that government expenditures have an overall positive effect on $Light_{ict}$, but that the effect is not significantly different in leader regions than elsewhere. In column 2 we use both Aid_{ct-1} and $Expenditures_{ct-1}$, as well as the respective interaction terms. We find that our coefficients of interest still show the predicted signs. In columns 3 and 4 we present similar regressions using resource rents RR_{ct-1} rather than government expenditures. Again we find that resource rents increase $Light_{ict}$ in general, but that there is no significant difference between the effect in leader regions and elsewhere. Also our main results still hold. In column 5 we include all three sources of rents and revenues, and their respective interaction terms. We again find that favoritism in the political leaders' birth regions is mainly fueled by foreign aid.[17]

Foreign aid may well be endogenous to economic activity at the country level and, therefore, to aggregate country-wide nighttime light. Regional nighttime light affects aggregate country-wide nighttime light by construction. We might therefore be concerned about the endogeneity of foreign aid in our specification. These endogeneity concerns however should not be too serious. First, because an average country in our sample consists of 251 regions, such that most regions have an almost negligible effect on aggregate country-wide nighttime light. Second, because we use lagged values of foreign aid. Nev-

[17]There are at least two possible explanations why we may find no evidence that disproportionate shares of government expenditures and resource rents end up in leader regions, not even in countries with weak political institutions where a disproportionate share of foreign aid ends up in leader regions. The first explanation has to do with the visibility of resources and rents. People paying taxes and observing mines and oil fields may hold their government accountable and may want to know what happens to these revenues and rents. However they do not observe aid inflows and find it therefore harder to keep their government accountable for its aid allocation. The second explanation has to do with the quality of the data. Aid data is of high quality, while data on government expenditures does typically not include embezzled public funds; and the World Bank's (2009) adjusted net savings data has many gaps for rents from various types of resources in various countries. We partly address this latter problem by excluding countries for which only data on rents from forestry is available. However we still have numerous countries with gaps for rents from particular sources of energy and minerals. Hence it could be that disproportionate shares of government expenditures and resource rents do actually end up in leader regions, but that the quality of the available data is just not good enough to reveal that pattern.

ertheless we check whether our results are robust to the use of an instrumental variables approach. Most instruments suggested in the literature are of cross sectional nature (e.g., Rajan and Subramanian, 2008). In our setting, however, the region fixed effects control for all time-invariant determinants of aid, while the timing of aid inflows can potentially be endogenous. So we need an instrument that captures exogenous variation in aid inflows over time. We use the instrument proposed by Harding and Venables (2010). Their instrument is based on bilateral foreign aid flows from 22 donors to all the recipient countries, and given by $A_{ct} = \sum_{d=1}^{22} (s_{cd} a_{dt})$, where s_{cd} is the average annual share of bilateral aid that donor d has given to recipient country c over the period 1960-2008, and a_{dt} is total bilateral aid from donor d to all recipient countries in year t. The idea behind this instrument is that the time-variation in a_{dt} is driven by the overall aid budget of donor d, which is likely to be determined by national budget considerations and other donor characteristics rather than the economic or political situation in a particular recipient country. The share s_{cd} is a long-run historical average and should be exogenous.

In table 9, we present two-stage least squares (2SLS) estimates using the log of A_{ct-1} per capita (Aid^{HV}_{ct-1}) and its interactions with $Leader_{ict-1}$ and $Polity_{ct-1}$ and $Leader_{ict-1} \times Polity_{ct-1}$ as instruments for Aid_{ct-1} and its interactions with $Leader_{ict-1}$, $Polity_{ct-1}$ and $Leader_{ict-1} \times Polity_{ct-1}$. In columns 1 and 2 we reestimate columns 4 and 5 of table 2 using 2SLS (where the latter is our main specification). In columns 3 and 4 we further add the additional control variables and the country-specific time trends used in table 7. In all instances the F-statistics of the first stage regressions exceed the threshold value of 10 suggested by Staiger and Stock (1997) to uncover weak instruments. Also the Andersson-Rubin test rejects the null of underidentification in all four specifications. We note that the coefficients of interest remain highly significant and become somewhat larger in magnitude compared to our OLS estimates.

In table 10 we look at whether the effect of Aid_{ct-1} on $Light_{ict}$ is different in past and future leader regions than in other regions. In column 1 we look at past leader regions, i.e., at regions that used to be leader regions until recently. We therefore replace

$Leader_{ict-1}$ with the lag of the dummy variable $Past_{ict}$ that is equal to one for regions that are not leader regions in year t, but were leader regions in $t-1$. We find that $Past_{ict-1}$ itself is insignificant, and that its interactions with Aid_{ct-1} and $Aid_{ct-1} \times Polity_{ct-1}$ are insignificant as well (with the coefficients even having the "wrong" signs). In columns 2 and 3 we use the dummy variables $Past^{regular}_{ict-1}$ and $Past^{irregular}_{ict-1}$ to distinguish between the cases in which the former political leaders lost power through regular means (e.g., retirement, term limits or electoral defeat), and cases in which they lost power through irregular means (e.g., coup d'états or popular revolts). In both cases the coefficients of interest are again insignificant. This absence of significance has various implications: First, it implies that the disproportionate share of foreign aid that flows to leader regions has no noticeable long-run effect on nighttime light. Hence it seems that most aid ending up in leader regions is used for consumption purposes rather than, say, investments into infrastructure project. Second, this absence of significance supports our interpretation of our main finding. The significance of $Leader_{ict-1} \times Aid_{ct-1}$ and $Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$ suggests that foreign aid has a different effect in leader regions than in other regions, and that this effect depends on the quality of political institutions. Our preferred interpretation is that this difference comes from the fact that the current political leaders were born in the leader regions rather than from some other time variant characteristics of leader regions. The use of region fixed effects already ensures that our results cannot be driven by some time invariant characteristics of leader regions; and the absence of significance when replacing $Leader_{ict-1}$ by $Past_{ict-1}$, $Past^{regular}_{ict-1}$ or $Past^{irregular}_{ict-1}$ further suggests that it is the political leaders that matter for aid allocation rather than some characteristics of the regions they are coming from.

In their study of the effects of political leaders on economic growth, Jones and Olken (2005) address the potential endogeneity of leadership changes by focusing on cases of political leaders that died of natural causes or accidents while in power. Similarly in column 4 we use the dummy variable $Past^{death}_{ict-1}$ to focus exclusively on regions of former political leaders who died of natural causes while in power. Again all coefficients of interest

are insignificant, which further supports our claim that political leaders themselves rather than some regional characteristics matter for aid allocation.

We now turn to future leader regions. In column 5 we use the dummy variable $Future^1_{ict}$ that is equal to one for regions that are not yet leader regions in year t, but will be leader regions in $t+1$. We find that $Future^1_{ict}$ and its interaction with $Aid_{ct-1} \times Polity_{ct-1}$ are insignificant, while $Future^1_{ict} \times Aid_{ct-1}$ is significant at the 10% level. In column 6 we show that all coefficients of interest become insignificant when using the dummy variable $Future^2_{ict}$ that is equal to one for regions that will become leader regions in year $t+2$. Hence future leader regions are quite similar to other regions, which again suggests that it is primarily political leaders themselves that matter for aid allocation.[18]

The size of subnational administrative units varies between different countries, due to differences in size, geography, and rules defining administrative boundaries. To ensure that our result are not somehow an artefact of these differently sized regions, we construct equally sized, artificial subnational units around each settlement point. We use GIS-software to construct settlement areas that cover a circular area with a 10 km radius around each settlement point (CIESIN, 2005) in any aid-recipient country.[19] We take these settlement areas as our new subnational unit i. As dependent variable we use the log of nighttime light per area.[20] We identify each settlement point that is a leader's

[18]In column 5 $Future^1_{ict} \times Aid_{ct-1}$ is weakly significant. It may well be that future political leaders have some limited impact on aid allocation decisions already shortly before becoming the official political leader, e.g., because they already play an important role in their predecessors' government, or because the predecessors try to buy them or their supporters off. This explanation is consistent with our claim that foreign aid has a different effect on leader regions than other regions *because* political leaders were born in the leader regions. Alternatively, some changes in underlying regional characteristics might make future leader regions slightly better in appropriating foreign aid; and these changes might also raise the probability that the future political leader comes from these regions. The insignificance of $Future^2_{ict} \times Aid_{ct-1}$ in column 6 suggests, however, that changes in political leadership would need to follow changes in underlying regional characteristics very quickly, which we think is implausible.

[19]A more detailed description of the construction of this dataset can be found in Appendix C.

[20]The gridded population data used to construct our main dependent variable provides a good estimate of population at subnational level. However, it is questionable whether the spatial interpolation used to disaggregate these population figures and assign them to grid cells coincides well with our narrowly defined geographical units in this robustness test. We therefore use nighttime light per area rather than per capita.

birthplace either by name or longitude and latitude, and we define this settlement area as the leader settlement area. Again, we build interaction terms between Aid_{ct-1}, $Polity_{ct-1}$, and the new leader settlement area dummy variable ($Leader_{ict-1}$). In table 11 we present the results when rerunning our main specification and some specifications with less or more control variables with these new settlement area variables. The results show that our two interaction terms of interest are highly significant also when using small and equally sized subnational units. Moreover we find further support that a disproportionate share of foreign aid ends up in capital cities.

5 Conclusions

In this paper we have compared the effect of foreign aid on nighttime light across subnational regions in a sample of 91 aid-recipient countries. We have found that foreign aid has a significantly higher effect on nighttime light in the region in which the current political leader was born than in other regions in countries with poor political institutions, but not in countries with sound political institutions. These results both support and qualify Peter Bauer's worries that foreign aid may lead to patronage and favoritism. They suggest that foreign aid indeed tends to fuel favoritism, but that this tendency can possibly be checked by sound political institutions that constrain political leaders and hold them accountable.

We think our approach of combining nighttime light at the regional and local level with data on the birth places of politicians opens a promising avenue for future research on the political economy of regional development.

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Appendix A: List of countries

Albania, Algeria, Angola, Argentina, Bangladesh, Belarus, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Chad, Chile, China, Colombia, Democratic Republic of the Congo, Republic of Congo, Costa Rica, Djibouti, Ecuador, El Salvador, Eritrea, Ethiopia, Fiji, Gabon, Gambia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iran, Iraq, Jordan, Kenya, North Korea, South Korea, Laos, Liberia, Macedonia, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Rwanda, Senegal, Sierra Leone, Slovenia, Somalia, South Africa, Sri Lanka, Sudan, Tanzania, Thailand, Togo, Tunisia, Uganda, Ukraine, Uruguay, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

Appendix B: Description and Sources of Variables

See table 12.

Appendix C: Settlement areas

The settlement areas have been constructed using a shapefile including the coordinates of settlement points around the world provided by CSIESN (2005). These settlement points are major cities but also small scale towns and villages. Even though it does not include every human settlement, it is to our knowledge the most comprehensive collection of settlement points publicly available. Around each of these points a circular shaped buffer area with a radius of 10 km has been constructed using ARC-GIS. An illustrative example for India can be found in figure 5. We end up with 25,264 settlement buffers with an area of approx. 314 km^2 for our sample. Using either the name or the coordinates of a political leader's birthplace, we can identify the leader settlement area necessary for our

estimates.

Figure 6 illustrates the procedure on the examples of Moi, the political leader of Kenya from 1978-2002, and Kibaki who succeeded Moi in 2002. The small green dots represent the settlement points and the yellow circular areas are the respective artificial settlement areas. Daniel Moi was born in Kurieng'wo, which is the black dot in the center of the more north-western red circular area. This settlement area is defined as the leader settlement area for the years 1992 until 2002. Mwai Kibaki was born in Gatuyaini, which is the black dot in the center of the more south-eastern red circular area. This settlement area is defined as the leader settlement area for Kenya from 2002 onwards. However, this settlement area intersects with two other settlement areas, Kangema in the south and Nyeri in the north. This problem occurs because the distance between these villages is less than 20 km (2×10 km radius). Therefore, we label these two areas also as leader settlement areas from 2002 onwards, as parts of their populated area lie in the buffer of the main leader settlement area.

Table 1: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
$Light_{ict}$	304167	2.922	1.608	−5.652	10.672
$Leader_{ict}$	364742	0.004	0.063	0	1
Aid_{ct}	366370 (1428)	2.141 (3.412)	1.519 (1.438)	−3.645	8.075
$Polity_{ct}$	357609 (1300)	0.707 (0.575)	0.279 (0.306)	0.050	1.000

Notes: Descriptive statistics for observations at the country level are in parentheses.

Table 2: Main Results

	(1)	(2)	(3)	(4)	(5)
$Leader_{ict-1}$	0.030**	−0.014	−0.010	−0.008	0.011
	(0.015)	(0.029)	(0.029)	(0.065)	(0.069)
Aid_{ct-1}	−0.045***	−0.045***	−0.045***	−0.075***	−0.083***
	(0.014)	(0.014)	(0.014)	(0.029)	(0.030)
$Polity_{ct-1}$	−0.005	−0.005	−0.003	−0.086	−0.179*
	(0.071)	(0.071)	(0.071)	(0.099)	(0.105)
$Leader_{ict-1} \times Aid_{ct-1}$		0.015	0.058***	0.065***	0.095***
		(0.010)	(0.014)	(0.022)	(0.029)
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$			−0.065***	−0.071**	−0.110***
			(0.019)	(0.032)	(0.040)
$Leader_{ict-1} \times Polity_{ct-1}$				−0.013	−0.028
				(0.085)	(0.092)
$Aid_{ct-1} \times Polity_{ct-1}$				0.038	0.071**
				(0.032)	(0.034)
$Population_{ict}$					−0.768***
					(0.078)
Oil_{ct}					0.007
					(0.023)
$Coal_{ct}$					0.026
					(0.061)
$Disaster_{ct}$					−0.002
					(0.003)
$Revolutions_{ct}$					0.001
					(0.009)
$Governance_{ct}$					0.239*
					(0.126)
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.157	0.157	0.157	0.157	0.184
N	282596	282596	282596	282596	269061

Notes: Dependent variable is $Light_{ict}$. Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 3: Excluding World Regions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Excluded observations	EAP	ECA	LAC	MENA	SA	SSA	OPEC
$Leader_{ict-1}$	−0.066	−0.001	0.041	−0.023	0.023	0.024	0.008
	(0.109)	(0.069)	(0.070)	(0.077)	(0.070)	(0.082)	(0.083)
Aid_{ct-1}	−0.041	−0.081***	−0.079***	−0.115***	−0.078***	−0.093**	−0.076***
	(0.039)	(0.029)	(0.030)	(0.030)	(0.030)	(0.040)	(0.029)
$Polity_{ct-1}$	−0.159	−0.188*	−0.187	−0.281***	−0.188*	−0.078	−0.109
	(0.124)	(0.105)	(0.133)	(0.109)	(0.108)	(0.122)	(0.130)
$Leader_{ict-1} \times Aid_{ct-1}$	0.077**	0.103***	0.082***	0.117***	0.090***	0.111**	0.113***
	(0.036)	(0.029)	(0.030)	(0.030)	(0.029)	(0.044)	(0.029)
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$	−0.078*	−0.114***	−0.100*	−0.137***	−0.103**	−0.137**	−0.131***
	(0.044)	(0.040)	(0.054)	(0.041)	(0.040)	(0.058)	(0.040)
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables X_{ict}	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.187	0.183	0.155	0.198	0.185	0.203	0.211
N	221715	261353	126172	236282	260103	239680	228850

Notes: Dependent variable is $Light_{ict}$. Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 4: Alternative Samples

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	No LDCs	Only LDCs	Low ELF	High ELF	Leader changes	Polity changes
$Leader_{ict-1}$	0.053	−0.561**	0.053	−0.102	0.028	−0.106
	(0.076)	(0.254)	(0.091)	(0.118)	(0.072)	(0.094)
Aid_{ct-1}	−0.104***	0.022	−0.092**	−0.120***	−0.103***	−0.110***
	(0.036)	(0.078)	(0.042)	(0.045)	(0.035)	(0.039)
$Polity_{ct-1}$	−0.212**	−0.539	−0.297	−0.201	−0.203*	−0.216*
	(0.108)	(0.486)	(0.181)	(0.127)	(0.107)	(0.115)
$Leader_{ict-1} \times Aid_{ct-1}$	0.110***	0.198***	0.094**	0.112***	0.093***	0.118***
	(0.039)	(0.063)	(0.048)	(0.039)	(0.032)	(0.035)
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$	−0.133**	−0.196**	−0.130**	−0.098*	−0.113**	−0.137***
	(0.052)	(0.092)	(0.066)	(0.051)	(0.044)	(0.044)
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes	Yes	Yes
Control variables X_{ict}	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.189	0.138	0.211	0.156	0.189	0.178
N	257745	11316	196575	72486	254280	166328

Notes: Dependent variable is $Light_{ict}$. Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 5: Alternatives Measures of Aid and Light

	(1)	(2)	(3)	(4)
$Leader_{ict-1}$	−0.037	0.125**	0.090	0.003
	(0.077)	(0.055)	(0.063)	(0.068)
$Polity_{ct-1}$	−0.195*	−0.029	−0.008	−0.183*
	(0.111)	(0.090)	(0.086)	(0.106)
Aid^{nn}_{ct-1}	−0.087***			
	(0.032)			
$Leader_{ict-1} \times Aid^{nn}_{ct-1}$	0.104***			
	(0.031)			
$Leader_{ict-1} \times Aid^{nn}_{ct-1} \times Polity_{ct-1}$	−0.121***			
	(0.042)			
Aid^{GDP}_{ct-1}		−0.177		
		(0.226)		
$Leader_{ict-1} \times Aid^{GDP}_{ct-1}$		0.624**		
		(0.246)		
$Leader_{ict-1} \times Aid^{GDP}_{ct-1} \times Polity_{ct-1}$		−0.725*		
		(0.372)		
Aid^{NAT}_{ct-1}			−0.001*	
			(0.000)	
$Leader_{ict-1} \times Aid^{NAT}_{ct-1}$			0.063**	
			(0.026)	
$Leader_{ict-1} \times Aid^{NAT}_{ct-1} \times Polity_{ct-1}$			−0.070*	
			(0.037)	
Aid_{ct-1}				−0.083***
				(0.030)
$Leader_{ict-1} \times Aid_{ct-1}$				0.097***
				(0.029)
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$				−0.111***
				(0.040)
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes
Control variables X_{ict}	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.187	0.190	0.183	0.246
N	280832	277839	261017	272078

Notes: Dependent variable is $Light_{ict}$ in columns 1–3, and $Light^{area}_{ict}$ in column 4. In each column the interaction term with $Polity_{ct-1}$ in Z_{ict-1} is based on the particular aid variable used. Control variables in column 4 include the log of country level population instead of regional population ($Population_{ict}$). Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 6: Alternative Measures of Political Institutions

	(1)	(2)	(3)	(4)	(5)
$Leader_{ict-1}$	0.006	−0.027	0.012	−0.036	−0.099
	(0.056)	(0.049)	(0.056)	(0.062)	(0.105)
Aid_{ct-1}	−0.062***	−0.009	−0.071***	−0.104***	−0.007
	(0.024)	(0.025)	(0.024)	(0.024)	(0.031)
$Leader_{ict-1} \times Aid_{ct-1}$	0.073***	0.061**	0.069***	0.093***	0.104***
	(0.022)	(0.024)	(0.021)	(0.025)	(0.032)
$Politydummy_{ct-1}$	−0.095				
	(0.071)				
$Leader_{ict-1} \times Aid_{ct-1} \times Politydummy_{ct-1}$	−0.072***				
	(0.024)				
$Checks_{ct-1}$		−0.005			
		(0.006)			
$Leader_{ict-1} \times Aid_{ct-1} \times Checks_{ct-1}$		−0.018**			
		(0.008)			
$Rights_{ct-1}$			−0.088		
			(0.084)		
$Leader_{ict-1} \times Aid_{ct-1} \times Rights_{ct-1}$			−0.097***		
			(0.034)		
$Liberties_{ct-1}$				−0.156	
				(0.112)	
$Leader_{ict-1} \times Aid_{ct-1} \times Liberties_{ct-1}$				−0.149***	
				(0.043)	
$Governance_{ct-1}$					0.472***
					(0.175)
$Leader_{ict-1} \times Aid_{ct-1} \times Governance_{ct-1}$					−0.222***
					(0.067)
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes	Yes
Control variables X_{ict}	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.185	0.191	0.186	0.187	0.187
N	271424	253226	271424	271424	270499

Notes: Dependent variable is $Light_{ict}$. In each column the interactions terms in Z_{ict-1} are based on the particular institutional variable used. Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 7: Additional Control Variables

	(1)	(2)	(3)	(4)
$Leader_{ict-1}$	0.074	−0.088	−0.216***	−0.067
	(0.072)	(0.082)	(0.074)	(0.068)
Aid_{ct-1}	−0.084***	−0.094**	−0.092**	0.004
	(0.030)	(0.041)	(0.040)	(0.037)
$Polity_{ct-1}$	−0.181*	−0.269**	−0.197*	0.084
	(0.105)	(0.124)	(0.114)	(0.141)
$Leader_{ict-1} \times Aid_{ct-1}$	0.077***	0.113***	0.151***	0.088***
	(0.028)	(0.033)	(0.033)	(0.029)
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$	−0.095**	−0.135***	−0.170***	−0.087**
	(0.039)	(0.044)	(0.046)	(0.042)
$Capital_{ic} \times Aid_{ct-1}$	0.138***	0.202***	0.261***	0.122***
	(0.039)	(0.052)	(0.051)	(0.041)
$Capital_{ic} \times Aid_{ct-1} \times Polity_{ct-1}$	0.027	−0.059	−0.110*	0.041
	(0.045)	(0.056)	(0.056)	(0.046)
$Capital_{ic} \times Polity_{ct-1}$	−0.323**	−0.055	0.088	−0.408***
	(0.137)	(0.156)	(0.147)	(0.127)
$Expenditures_{ct}$		0.110***	0.090***	0.105***
		(0.030)	(0.028)	(0.024)
$Investment_{ct}$		−0.004	−0.002	0.007***
		(0.003)	(0.003)	(0.002)
$Inflation_{ct}$			0.000	0.000
			(0.000)	(0.000)
$M2_{ct}$			0.005***	0.004***
			(0.001)	(0.001)
Country-specific time trend	No	No	No	Yes
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes
Control variables X_{ict}	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.184	0.220	0.224	0.263
N	269061	231094	228572	228572

Notes: Dependent variable is $Light_{ict}$. Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 8: Alternative Sources of Rents

	(1)	(2)	(3)	(4)	(5)
$Leader_{ict-1}$	0.364*	−0.175	0.385***	0.144	0.026
	(0.202)	(0.260)	(0.103)	(0.141)	(0.261)
$Polity_{ct-1}$	0.295	−0.008	0.631***	0.662***	0.620*
	(0.251)	(0.342)	(0.137)	(0.206)	(0.333)
Aid_{ct-1}		−0.114***		−0.042	−0.047
		(0.043)		(0.034)	(0.048)
$Leader_{ict-1} \times Aid_{ct-1}$		0.134***		0.082**	0.104***
		(0.035)		(0.032)	(0.039)
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$		−0.156***		−0.099**	−0.123**
		(0.047)		(0.045)	(0.052)
$Expenditures_{ct-1}$	0.145***	0.150***			0.071
	(0.045)	(0.047)			(0.056)
$Leader_{ict-1} \times Expenditures_{ct-1}$	−0.034	0.017			0.009
	(0.045)	(0.050)			(0.055)
$Leader_{ict-1} \times Expenditures_{ct-1} \times Polity_{ct-1}$	0.038	−0.015			0.004
	(0.057)	(0.063)			(0.066)
RR_{ct-1}			0.133***	0.143***	0.185***
			(0.029)	(0.035)	(0.047)
$Leader_{ict-1} \times RR_{ct-1}$			−0.032	−0.021	−0.019
			(0.025)	(0.027)	(0.036)
$Leader_{ict-1} \times RR_{ct-1} \times Polity_{ct-1}$			0.037	0.025	0.022
			(0.034)	(0.038)	(0.046)
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes	Yes
Control variables X_{ict}	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.194	0.194	0.186	0.185	0.195
N	276996	264055	273985	261010	256324

Notes: Dependent variable is $Light_{ict}$. Interactions terms Z_{ict-1} include $Leader_{ict-1} \times Polity_{ct-1}$ in all columns; $Expenditures_{ct-1} \times Polity_{ct-1}$ in columns 1, 2 and 5; $Aid_{ct-1} \times Polity_{ct-1}$ in columns 2, 4 and 5; and $RR_{ct-1} \times Polity_{ct-1}$ in columns 3, 4 and 5. Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 9: 2SLS estimates with instruments for foreign aid

	(1)	(2)	(3)	(4)
$Leader_{ict-1}$	−0.035	−0.234**	−0.273***	−0.191**
	(0.088)	(0.103)	(0.097)	(0.088)
Aid_{ct-1}	−0.060	−0.331***	−0.006	−0.149***
	(0.048)	(0.118)	(0.063)	(0.035)
$Polity_{ct-1}$	−0.120*	−0.617***	−0.159	−0.071
	(0.064)	(0.176)	(0.098)	(0.059)
$Leader_{ict-1} \times Aid_{ct-1}$	0.079***	0.192***	0.182***	0.142***
	(0.029)	(0.039)	(0.038)	(0.036)
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$	−0.110**	−0.253***	−0.226***	−0.178***
	(0.046)	(0.057)	(0.059)	(0.055)
$Capital_{ic} \times Aid_{ct-1}$			0.482***	0.437***
			(0.126)	(0.119)
$Capital_{ic} \times Aid_{ct-1} \times Polity_{ct-1}$			−0.106	0.006
			(0.085)	(0.073)
$Capital_{ic} \times Polity_{ct-1}$			0.036	−0.280
			(0.257)	(0.227)
$Investment_{ct}$			0.000	0.004***
			(0.001)	(0.001)
$Expenditures_{ct}$			0.083***	0.115***
			(0.009)	(0.005)
$Inflation_{ct}$			0.000**	−0.000*
			(0.000)	(0.000)
$M2_{ct}$			0.006***	0.003***
			(0.000)	(0.000)
Country-specific time trend	No	No	No	Yes
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes
Control variables X_{ict}	No	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
1^{st} stage F-statistics:				
Aid_{ct-1}	1765.85	2742.95	3048.25	381.69
$Leader_{ict-1} \times Aid_{ct-1}$	372.64	343.80	228.90	232.72
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$	307.04	294.74	154.57	161.26
$Aid_{ct-1} \times Polity_{ct-1}$	10036.79	14699.41	14872.80	1728.22
$Capital_{ic} \times Aid_{ct-1}$			12.90	13.09
$Capital_{ic} \times Aid_{ct-1} \times Polity_{ct-1}$			65.43	68.02
Underid. test p-value	0.000	0.000	0.000	0.000
R^2	0.156	0.169	0.218	0.259
N	282278	268801	228418	228418

Notes: Dependent variable is $Light_{ict}$. In all columns we use 2SLS with Aid_{ct}^{HV} and its interactions with $Leader_{ict}$, $Polity_{ct}$ and $Leader_{ict} \times Polity_{ct}$ to instrument for Aid_{ct} and its interactions with $Leader_{ict}$, $Polity_{ct}$ and $Leader_{ict} \times Polity_{ct}$. In columns 3 and 4 we further use the interactions of Aid_{ct}^{HV} with $Capital_{ic}$ and $Capital_{ic} \times Polity_{ct}$ to instrument for the interactions of Aid_{ct} with $Capital_{ic}$ and $Capital_{ic} \times Polity_{ct}$. Robust standard errors in parenthesis. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 10: Past and Future Leader Regions

	(1)	(2)	(3)	(4)	(5)	(6)
Aid_{ct-1}	−0.082***	−0.082***	−0.082***	−0.082***	−0.063**	−0.048
	(0.029)	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)
$Polity_{ct-1}$	−0.231**	−0.231**	−0.231**	−0.231**	−0.128	−0.090
	(0.096)	(0.096)	(0.096)	(0.096)	(0.107)	(0.111)
$Past_{ict-1}$	0.116					
	(0.094)					
$Past_{ict-1} \times Aid_{ct-1}$	−0.045					
	(0.045)					
$Past_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$	0.010					
	(0.060)					
$Past^{regular}_{ict-1}$		0.030				
		(0.196)				
$Past^{regular}_{ict-1} \times Aid_{ct-1}$		−0.006				
		(0.080)				
$Past^{regular}_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$		−0.031				
		(0.098)				
$Past^{irregular}_{ict-1}$			0.288			
			(0.349)			
$Past^{irregular}_{ict-1} \times Aid_{ct-1}$			−0.130			
			(0.143)			
$Past^{irregular}_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$			−0.004			
			(0.258)			
$Past^{death}_{ict-1}$				0.061		
				(0.085)		
$Past^{death}_{ict-1} \times Aid_{ct-1}$				0.039		
				(0.123)		
$Past^{death}_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$				−0.014		
				(0.153)		
$Future^{1}_{ict}$					−0.099	
					(0.150)	
$Future^{1}_{ict} \times Aid_{ct-1}$					0.095*	
					(0.051)	
$Future^{1}_{ict} \times Aid_{ct-1} \times Polity_{ct-1}$					−0.100	
					(0.064)	
$Future^{2}_{ict}$						−0.064
						(0.154)
$Future^{2}_{ict} \times Aid_{ct-1}$						0.037
						(0.058)
$Future^{2}_{ict} \times Aid_{ct-1} \times Polity_{ct-1}$						−0.080
						(0.073)
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes	Yes	Yes
Control variables X_{ict}	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.160	0.160	0.160	0.160	0.197	0.217
N	251581	251581	251581	251581	249522	229343

Notes: Dependent variable is $Light_{ict}$. In each column the interaction term with $Polity_{ct-1}$ in Z_{ict-1} is based on the particular past or future leader region variable used. Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 11: Settlement Areas

	(1)	(2)	(3)	(4)
$Leader_{ict-1}$	−0.075*	−0.048	−0.083*	−0.076*
	(0.040)	(0.040)	(0.046)	(0.046)
Aid_{ct-1}	−0.037	−0.057***	−0.034**	−0.022*
	(0.028)	(0.014)	(0.014)	(0.013)
$Polity_{ct-1}$	−0.100	−0.172***	−0.050	−0.087
	(0.078)	(0.047)	(0.047)	(0.055)
$Leader_{ict-1} \times Aid_{ct-1}$	0.045***	0.049***	0.040***	0.041***
	(0.014)	(0.014)	(0.015)	(0.015)
$Leader_{ict-1} \times Aid_{ct-1} \times Polity_{ct-1}$	−0.057***	−0.055***	−0.052***	−0.049***
	(0.018)	(0.017)	(0.017)	(0.018)
$Capital_{ic} \times Aid_{ct-1}$			0.060***	0.064***
			(0.023)	(0.022)
$Capital_{ic} \times Aid_{ct-1} \times Polity_{ct-1}$			−0.012	−0.005
			(0.026)	(0.025)
$Capital_{ic} \times Polity_{ct-1}$			−0.054	−0.075
			(0.089)	(0.092)
$Investment_{ct}$			−0.001	0.003**
			(0.001)	(0.001)
$Expenditures_{ct}$			0.019	0.020*
			(0.013)	(0.010)
$Inflation_{ct}$			−0.000***	−0.000***
			(0.000)	(0.000)
$M2_{ct}$			0.002***	0.003***
			(0.000)	(0.001)
Country-specific time trend	No	No	No	Yes
Interaction terms Z_{ict-1}	Yes	Yes	Yes	Yes
Control variables X_{ict}	No	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.307	0.328	0.363	0.379
N	308991	298494	257571	257571

Notes: Dependent variable is log of light per settlement area i. $Leader_{ict}$ is a dummy that equals one if and only if settlement area i is the political leader's birthplace. $Capital_{ic}$ is a dummy that equals one if and only if settlement area i is the capital city of country c. Control variables X_{ict} include the log of country level population rather than population per settlement area. Standard errors are adjusted for country-year clustering. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table 12: Variable description and sources

Variable	Description	Source
$Light_{ict}$	Log of nighttime light per capita (see text for details).	NOAA (2009), CIESIN (2005)
$Leader_{ict}$	Dummy variable equal to 1 if region i is the birth region of the current political leader, and 0 otherwise.	Goemans et al. (2009); identification of leader's birthplace done by the authors
Aid_{ct}	Log of net overseas development assistance (ODA) disbursed in current USD per capita.	OECD (2008)
$Polity_{ct}$	Revised Combined Polity Score (Polity2), normalized to 0-1. Higher values indicate better political institutions.	Marshall and Jaggers (2005)
$Population_{ict}$	Log of population at subnational level (in 1,000).	Gridded Population of the World dataset (GPW), CIESIN (2005)
Oil_{ct}	Log of annual oil production (in barrel).	U.S. EIA (2008)
$Coal_{ct}$	Log annual coal production (in metric tons).	U.S. EIA (2008)
$Disasters_{ct}$	Number of natural disasters.	EM-DAT, CRED(2008)
$Revolutions_{ct}$	Number of revolutions per year.	Banks (2004)
$Governance_{ct}$	ICRG indicator of Quality of Government. Higher values indicate higher quality of government.	PRS Group (2007)
Aid_{ct}^{nn}	Log of ODA per capita plus one, with negative values of ODA set to zero.	Authors' calculation and OECD (2008)
Aid_{ct}^{GDP}	ODA as share of GDP.	OECD (2008)
Aid_{ct}^{NAT}	Log of Net Aid Transfers per capita.	Roodman (2006)
$Light_{ict}^{area}$	Log of nighttime light per area (see text for details).	NOAA (2009), CIESIN (2005)
$Politydummy_{ct}$	Dummy variable equal to 1 if $Polity_{ct} \geq 0$, and 0 otherwise.	Authors' calculation
$Checks_{ct}$	Number of veto players.	Beck et al. (2001)
$Rights_{ct}$	Freedom House Political Rights Index, normalized to 0-1. Higher values indicate more political rights.	http://www.freedomhouse.org
$Liberties_{ct}$	Freedom House Civil Liberties Index, normalized to 0-1. Higher values indicate more civil liberties.	http://www.freedomhouse.org
$Capital_{ic}$	Dummy variable equal to 1 if the country's capital is located in region i, and 0 otherwise.	Authors' calculation
$Expenditures_{ct}$	Log of government expenditures per capita.	World Bank (2008)
$Investment_{ct}$	Investment as share of GDP.	Penn World Table Version 6.3
$Inflation_{ct}$	Average annual rate of CPI-based inflation.	Easterly (2005)
$M2_{ct}$	Ratio of M2/GDP. (financial depth).	Easterly (2005)
RR_{ct}	Log of resource rents per capita.	World Bank (2009)
Aid_{ct}^{HV}	Log of constructed aid flows per capita (see text for details).	Harding and Venables (2010)
$Past_{ict}$	Dummy variable equal to 1 if region i is not leader region in t, but in $t-1$, and 0 otherwise.	Authors' calculation
$Past_{ict}^{regular}$	Dummy variable equal to 1 if $Past_{ict} = 1$ and exit from office was regular.	Authors' calculation and Goemans et al. (2009)
$Past_{ict}^{irregular}$	Dummy variable equal to 1 if $Past_{ict} = 1$ and exit from office was irregular.	Authors' calculation and Goemans et al. (2009)
$Past_{ict}^{death}$	Dummy variable equal to 1 if $Past_{ict} = 1$ and leader died of natural cause while in power.	Authors' calculation and Goemans et al. (2009)
$Future_{ict}^{1}$	Dummy variable equal to 1 if region i is not leader region in t, but in $t+1$, and 0 otherwise.	Authors' calculation
$Future_{ict}^{2}$	Dummy variable equal to 1 if region i is not leader region in t and $t+1$, but in $t+2$, and 0 otherwise.	Authors' calculation

Figure 1: Nightime light intensity, Gbadolite, Equateur, Zaire; 1992, 1996, 1998 and 2000

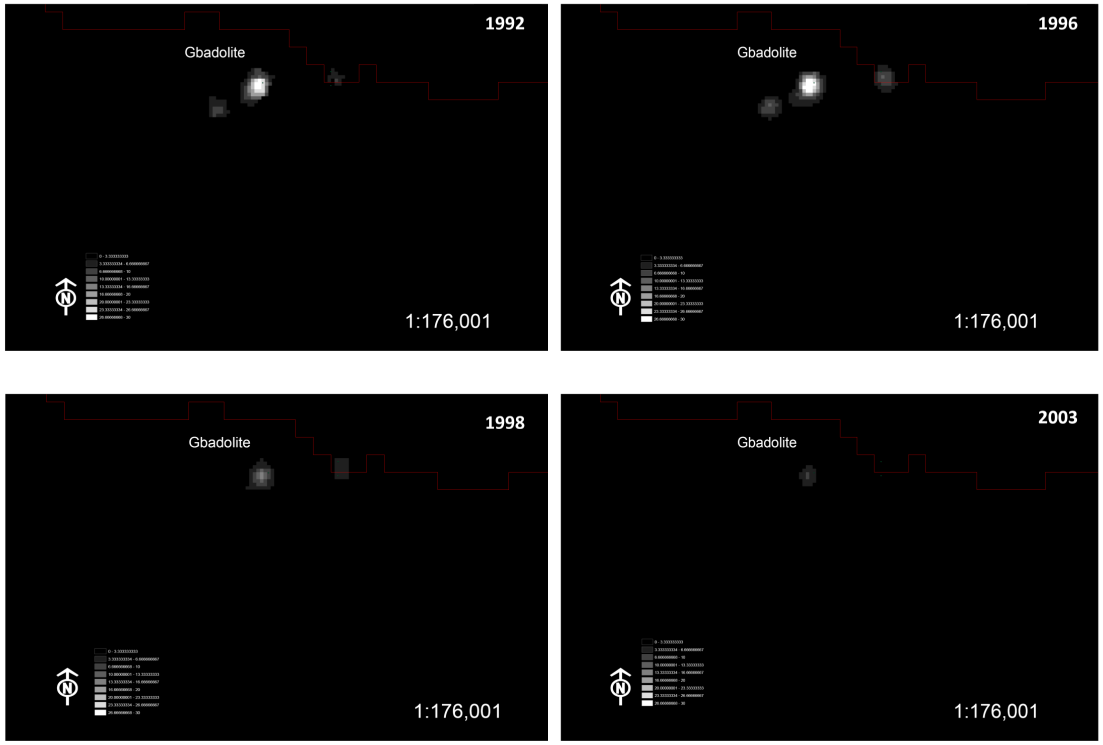
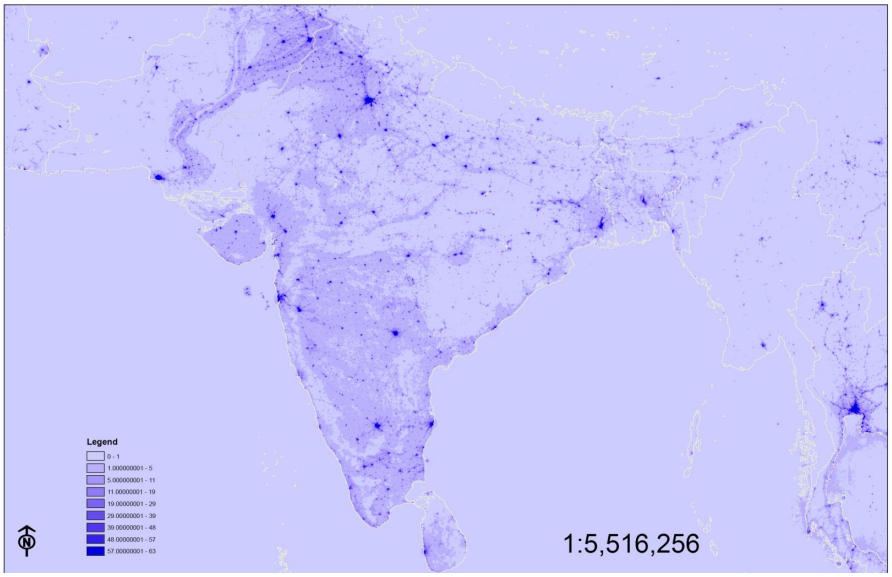


Figure 2: Nightime light intensity, India; 2003

a)



b)

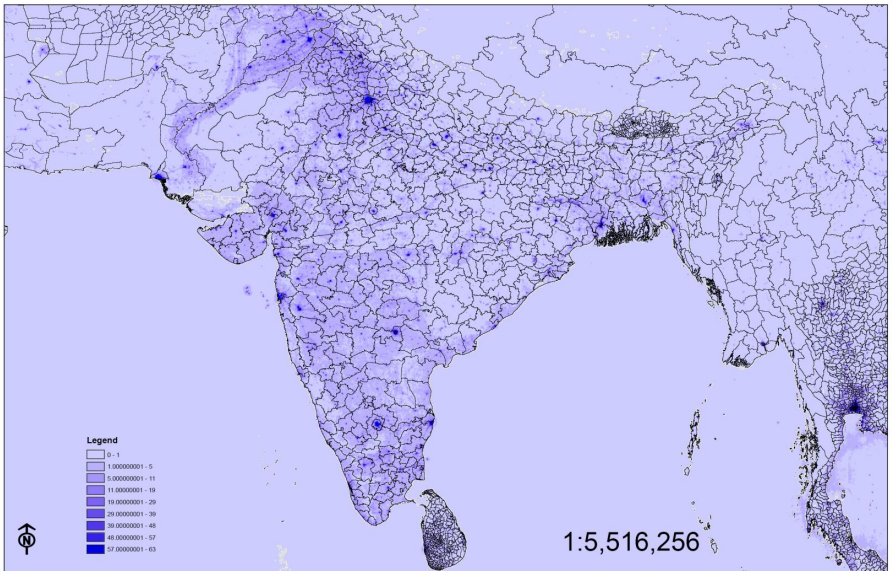
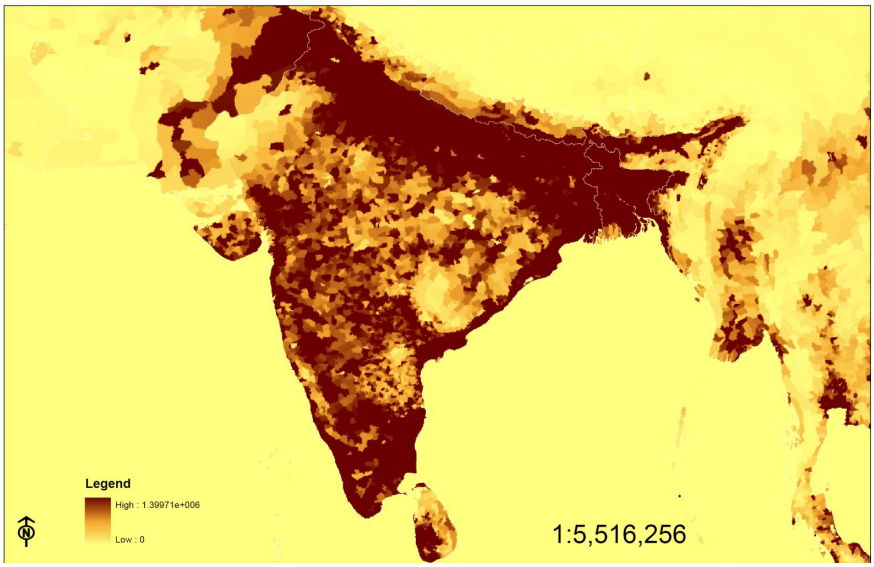


Figure 3: Population Grid, India; 2000

a)



b)

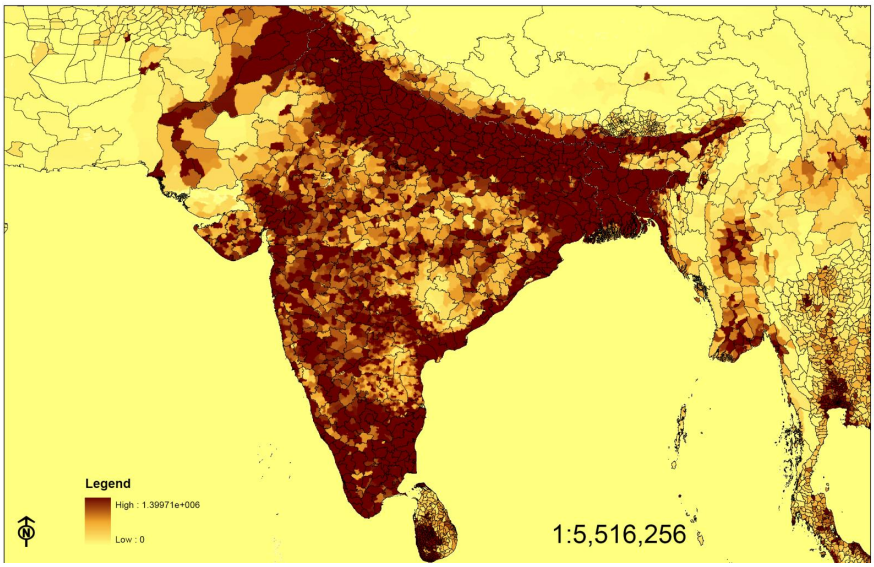


Figure 4: Main result

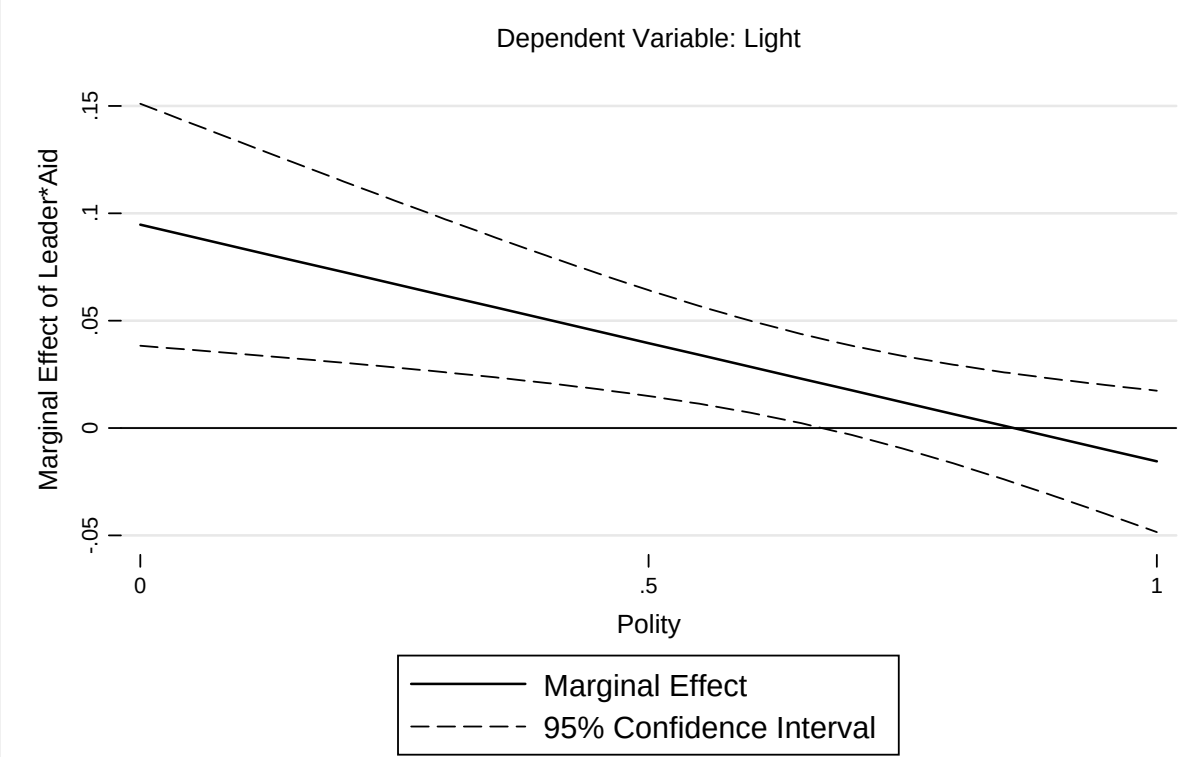


Figure 5: Nightime light intensity and settlement areas, India; 2003

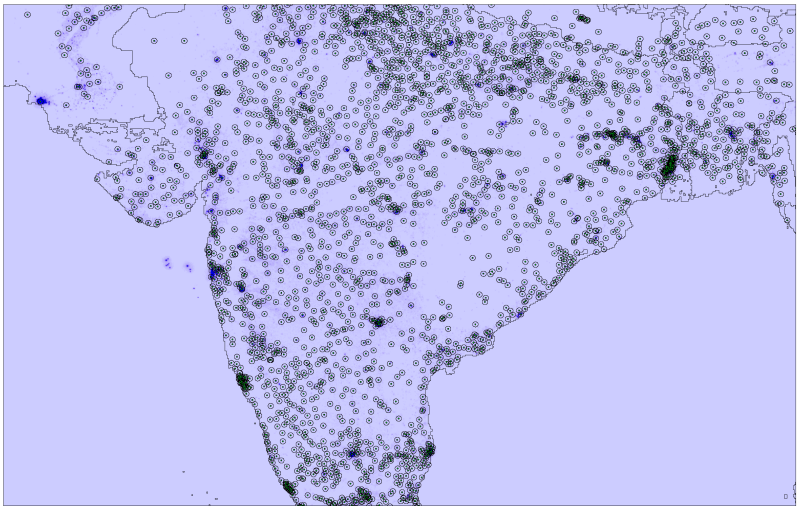


Figure 6: Settlement and leader settlement areas, Kenya