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Subnational Border Reforms and Economic Development in Africa

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Subnational border reforms and economic development in Africa

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Abstract

We study how subnational border reforms affect local economic development in Africa by relating all changes to subnational borders across the continent during 1992-2013 to nighttime luminosity. Difference-in-difference regressions at the pixel-level suggest that mergers have strong positive effects on local economic development. The effects of splits are also positive, but smaller. To identify relevant mechanisms, we link border changes to geocoded data on conflicts and political attitudes. Splits affect development by improving political stability. Mergers have no effect on political stability and instead seem to affect economic development by increasing administrative efficiency.

Keywords: Border changes, economic development, night-light data, Africa
JEL codes: D73, H77, R11

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1 Introduction

Recent evidence suggests that the legacy of the colonial period continues to impair African development to this day. During the scramble for Africa, colonial borders were drawn and spheres of influence determined by the European colonizers with little regard for the ethnic markup of the affected regions (Thomson, 2010). These borders were inherited by the newly formed African nation states after decolonization and have hardly changed ever since. The traditional homelands of many ethnic groups in contemporary Africa are hence split by arbitrary borders. At the same time, different groups are forced within the administrative confines of political jurisdictions to which they may harbor little allegiance. These circumstances are a natural breeding ground for political instability and obvious impediments to development. Indeed, Michalopoulos and Papaioannou (2016) show that the arbitrary nature of African borders continues to be source of conflict and economic inefficiency on the continent.

If improperly drawn borders are one reason for the lackluster economic performance of African countries, then the implied solution appears to be to simply reshape these borders. Several authors indeed bemoan a secessionist deficit on the continent (for instance, Englebert and Hummel (2005)). However, as national borders have essentially remained the same since decolonization, it is difficult to predict whether a reshaping of African borders will change the economic fortunes of the continent[1] – nor is it obvious how exactly borders should be reshaped. Should countries be split up into smaller nations or merged into larger supranational units? In addition, on a more practical level, it is not easy to change national borders and any attempts in this regard may have unforeseeable consequences.

Accordingly, if border changes would be one remedy to the chronic economic difficulties and political conflicts in Africa, they may be more feasible and more effective at the subnational rather than the national level. In this paper, we study changes to the borders of first-level subnational units – typically labeled states, regions, or provinces – in Africa to advance our understanding of how territorial reorganizations may affect economic development on the continent. Unlike national borders, the borders of first-level subnational governments in Africa have been frequently changed in shape and structure over the last decades (Grossman et al., 2017; Fox and Gurley, 2006). These border changes were nominally often part of broader public sector reforms (Erk, 2014) or deliberate attempts to adjust administrative borders such that they better reflect the ethno-linguistic markup of the country (Fessha, 2012).[2] In any case, they provide considerable identifying variation to explore how splits and mergers affect economic development in Africa. At the same time, the first-level subnational units share many of the traits of national governments. They are generally important administrative units with an independent political life and their territorial organization is often a source of persistent controversy and conflict (Elaigwu, 2008).

We identify subnational border changes in Africa by making use of shapefiles on administrative borders from the United Nations' Global Administrative Unit Layers (GAUL) project. The shapefiles are available for every year during the period 1992-2013 and indicate the borders of all first-level subna-

[1] The only secession on the continent took place in 2011, when South Sudan split from Sudan.

[2] However, there were also exceptional cases, for example in Rwanda where border changes were deliberate attempts to reduce subnational ethnic homogeneity.

tional governments (henceforth referred to as regions) across the globe in a given year. Consequently, any changes to the line features that indicate borders from one to the next year imply a border reform. After identifying these changes with geographic information system (GIS) software, we classify them into splits or mergers depending on whether a new line feature emerged (split) or an existing feature vanished (merger) within an existing subnational region.

A challenge for the subsequent analysis is to determine the unit of analysis. The subnational regions themselves cannot be used as units of analysis as those regions that are affected by a border change by definition cease to exist in their current form. This prevents us from constructing a consistent time series at the level of subnational regions.[3] We address this issue by dividing all of Africa into a grid of 1×1 degree pixels (about 110km $\times$ 110km). We use these pixels as time-constant units in our estimations.[4] Specifically, we project the the changes to the line features identified from the GAUL dataset onto this grid of pixel to determine whether a particular pixel (or more specifically the territory it is overlayed on) was affected by a a split or a merger.

Another challenge is how to measure economic performance at the subnational level. First, GDP calculations for developing countries are questionable due to poor statistical capacity (Jerven, 2013). Moreover, even if existing GDP data were reliable, it is typically not available at lower levels of geography, notably not at the pixel-level. We thus follow recent research and use nighttime luminosity as measured by orbital satellites as proxy for economic performance (Henderson et al., 2012). Specifically, we calculate average night light output in all 1×1 degree pixels for each year between 1992 to 2013 and match this data to the pixel-level data on subnational border changes.

Interpreting border changes as policy treatments, we implement a difference-in-differences design at the pixel level. Specifically, we explore whether pixels that were affected by a split or merger witness an improvement or deterioration in their economic conditions, as proxied by pixel-level luminosity. Our results indicate that mergers led to higher night light output in the post-treatment period. In our baseline specification, mergers increase pixel-level luminosity by about 42% compared to the pre-merger period. Using the estimate for the elasticity between night lights and GDP of 0.3 by Henderson et al. (2012), we calculate that pixel-level GDP increases in the long-run on average by 12.6% because of a merger. We find smaller, albeit still positive, effects for splits: luminosity increases by 13%, which translates to an increase in GDP by 3.9%.

One inherent limitation of our setting is that border changes are not random events. Accordingly, one concern is that pixels affected by a border change were on a different economic trajectory than other, unaffected pixels. If border changes are endogenous to economic developments, our estimates may be confounded. On the other hand, non-economic, and in particular administrative and political concerns, often appear in practice to be main motivation for border changes. Prior evidence suggests that the creation of new subnational units (by splits) in African countries follows an electoral cycle, especially

[3] That is, if a existing region A is split into two new regions called B and C, the region A ceases to exist.

[4] The area covered by a pixel ($12,100 km^2$) roughly corresponds to the size of Los Angeles county ($12,305 km^2$). We choose this pixel size for two reasons. First, it is sufficiently large to capture the aggregate effects of border changes (rather than only effects immediately at the border). If e. g. a merger leads to cost-savings, the positive implications should spread over the entirety of the affected regions. On the other hand, this pixel size is arguably also sufficiently small as to not dilute the effect of border changes if they are mostly local.

in areas with strong political opposition (Grossman and Lewis, 2014; Hassan, 2013). We have also hand-collected information on the official reasons given for a large fraction of the border changes in our sample. It appears that border changes are primarily implemented to increase administrative efficiency, often in the context of decentralization reforms, and secondly to address political conflicts. There is in general no indication that border changes are implemented after (negative or positive) economic shocks. Hence, to the extent that border changes are orthogonal to economic shocks, our empirical approach should produce unbiased estimates.

Nevertheless, it is of course possible that there are a number of border changes in our sample that were implemented for economic reasons. It is not feasible to address such endogeneity concerns in our cross-country context by means of a quasi-experiment as there is no institutional mechanism that would induce quasi-random variation in subnational border changes across all of Africa. While we acknowledge this limitation, we attempt to address it to the extent possible. First, we verify the common trend assumption using event-study plots. We observe no shocks in night lights before splits or mergers, suggesting that border changes were not primarily driven by differences in economic trajectories. Second, we estimate regressions where we control for country-level year effects to account for country-specific economic developments. Third, we control for a number of observable time-varying covariates. In all these specifications, we obtain similar results as in our baseline estimates.

Another noteworthy issue is that the magnitudes of the treatment effects for splits and mergers are noticeably different. This difference suggests the possibility that these two forms of border changes affect night lights through different channels. Exploring mechanisms, we indeed find evidence for this. One important motive as to why splits are implemented appears to be to increase political stability. Specifically, we observe fewer conflicts after splits.[5] Substantial evidence suggests that (violent) conflicts have negative economic implications (Cerra and Saxena, 2008; Abadie and Gardeazabal, 2003). Hence, the first-order effects of splits on political stability ostensibly have positive, even if relatively small, implications for economic development.

For mergers, concerns of political stability appear to be less important. We observe no effects on conflicts. On the other hand, we find that mergers are particularly effective in countries that have a higher bureaucratic quality. These results suggest that mergers are primarily implemented to improve local administrative efficiency with an aim to make better use of limited public resources (i. e. affected regions maintaining similar levels of public services with presumably lower administrative overhead). This might be one of the main reason why economic effects of mergers are more positive than those of splits.

Nevertheless, one drawback of our analysis of mechanisms is that, given the data limitations, we cannot provide more direct evidence on whether mergers indeed improve administrative efficiency. Accordingly, the evidence for this channel is mostly indirect. Similarly, we cannot rule out other plausible channels through which both splits and mergers may affect development. For example, it is possible that splits, too, lead to improvements in administrative efficiency if they result in a better targeted provision of public goods (Oates, 1999). Mergers, on the other hand, may reduce inefficient inter-jurisdictional competition (Burgess et al., 2012). However, those channels that we pinpoint – reduced ethnic conflicts

[5]This result is similar to evidence on administrative unit splits in Indonesia (Bazzi and Gudgeon, 2016; Bazzi et al., 2018).

in the case of splits and increased administrative efficiency – are plausible and have been shown to be relevant in other contexts.

This paper contributes to various strands of literature. First, our results are related to the emerging literature on subnational border changes in the developing world and their implications for economic outcomes. For example, Asher and Novosad (2015) show that in India, living conditions in new states that were carved out of existing states improve after splits. Shenoy (2018), on the other hand, finds ambiguous results regarding economic activity around newly established borders after splits of Indian provinces. Swee (2015) documents that the partitions of municipalities after the Bosnian War led to better educational outcomes. Grossman et al. (2017) find that an increase in the number of regional administrations per country improves aggregate health outcomes. On the other hand, as indicated above, splits might also lead to harmful externalities and a race to the bottom through intensified jurisdictional competition. For example, Burgess et al. (2012) show that more government units in Indonesia exacerbate deforestation. Similarly, Lipscomb and Mobarak (2017) find evidence of negative spillovers in water pollution after splits of counties in Brazil.

We contribute to this literature by linking border changes to local economic performance in Africa. While there are prior studies that explore how border changes affect economic outcomes in individual countries, we are the first to study their economic consequences at the subnational level for the entire African continent. We are also the first to study the economic consequences of both splits and mergers simultaneously. Most of the previous literature has focused primarily on splits of administrative units, arguably because they are the more common form of border change in the developing world (e.g. Bazzi et al. (2018) and Grossman et al. (2017)). However, as we show below, there were also a significant number of mergers in Africa. Finally, we are able to tie differences in the economic implications of mergers and splits to some underlying channels and thus identify relevant mechanisms.[6]

This paper also contributes to the literature on the optimal size of political jurisdictions. On the one hand, the costs associated with the heterogeneity in preferences of the population likely increase with the size of a region (Oates, 1999). On the other hand, larger regional units presumably imply more cost-effective provision of public goods due to scale economies (Bolton and Roland, 1997; Alesina and Spolaore, 1997). A further argument against smaller (and hence more) regional units is, as alluded above, that they would imply stronger inter-jurisdictional competition, which may lead to inefficient aggregate equilibrium (Zodrow and Mieszkowski, 1986).

The remainder of this paper is structured as follows. The next section provides background on subnational border changes in Africa over the last two decades. Section 3 introduces the data and discusses our empirical strategy. Section 4 presents the main results and Section 5 discusses mechanisms. Section 6 concludes.

[6]By considering mergers, this paper is also related to the literature on the economic consequences of amalgamations of administrative units. The existing studies on this question, however, focus on local governments in industrialized countries. For example, Loumeau et al. (2017) show that municipal mergers have a positive net effect for economic activity in Germany. Pickering et al. (2016) find similar evidence for Japan. Blesse and Baskaran (2016) find that (voluntary) municipal mergers do not reduce local government expenditures. Reingewertz (2012) and Blom-Hansen et al. (2014), on the other hand, show that mergers significantly reduce local spending in Israel and Denmark.

2 Background

2.1 Historical background on border design in Africa

Many developing countries are characterized by artificial administrative borders inherited from colonial times. Artificial borders are particularly prevalent in African countries (see Easterly and Levine (1997) for early evidence on the topic). Since the "scramble for Africa" in the late 19th century, African borders often follow latitudes and longitudes lines rather than natural borders (e.g. rivers) and do not coincide with the historical territories of the local ethnic groups. Alesina et al. (2011) state that about 80% of African national borders can be categorized as such artificial lines. As for the main motives of these artificial borders, Pierskalla et al. (2017) point to the desire of the former colonial powers to effectively extract of resources as well as the wish to maintain political stability and exert territorial control.

With decolonization in the aftermath of World War II, independent nation states emerged on the African continent. These new nations kept the arbitrary national borders drawn by the colonial powers. Moreover, in their aim to mold the disparate ethnicities into unified nations and to engage in nation building, most African countries opted for a unitary model of government instead of decentralization and federalism.[7] These decisions reverberate to this day and manifest themselves in substantial ethnic fragmentation within and across political jurisdictions and sub-optimal state organization, both of which have been shown to lie at the heart of the continent's disappointing economic performance (Michalopoulos and Papaioannou, 2016).

In the absence of changes to national borders (except for the secession of South Sudan from Sudan in 2011), subnational border changes by mergers or splits of administrative regions might provide a (partial) remedy for these impediments to development. However, in marked contrast to national borders, little attention has been devoted in the literature to African subnational borders. There is to our knowledge no comprehensive history of subnational border formation and evolution in Africa. Accordingly, little is known about how they were determined at the dawn of independence as well as why (and why not) they were adjusted during the post-independence history of Africa.

It is plausible that the subnational borders which African countries inherited were as arbitrary as their national borders. Several pieces of evidence are consistent with this notion. First, there are well-known cases where subnational borders follow longitude or latitude lines, for example in Nigeria, where the British created two regions (northern and southern) for which the common border is at the $7^{\circ}10'$ line of latitude (Berger, 2009).

Second, while subnational border changes have been significantly more common than national border changes across Africa, eyeballing Figure 1, which displays subnational borders in Africa as of 1992 and 2013, reveals that subnational borders often follow straight lines even as of 2013. Hence, despite all adjustments that have been made in the post-independence periods, traces of the arbitrary nature of subnational borders persist to this day.

[7] First, only three African countries (Ethiopia, Nigeria and Sudan) can be characterized as federations (Treisman, 2008). Second, African federalism is considered to be ineffective. National governments generally do not honor the constitutional arrangements and are reluctant to provide autonomy for ethnic minorities (Fessha, 2012).

Third, the available anecdotal evidence on the creation of (new) subnational units and the definition of their boundaries suggests that these were contentious negotiations in which the interests of several stakeholders had to be taken into account. If various concerns needed to be simultaneously addressed, it is plausible that the resulting borders were neither politically nor economically optimal. An example is the creation of the provinces in South Africa during the transition to democracy after Apartheid. As Makgetla and Jackson (2010) note, the constitutional committee tasked with the delimitation of the provinces had to balance several political concerns (e. g. to gerrymander the provinces such that influential stakeholders would maximize their electoral clout as well as to respect the settlement patterns of ethnic and linguistic groups) and the need to create states that were economically viable.[8]

2.2 Subnational border changes in Africa

According to the GAUL data (we describe this data in more detail in Section 3), border reforms at the state-level have been a frequent phenomenon in Africa during the last two decades.[9] As mentioned, Figure 1 shows the first-tier subnational boundaries in African countries in 1992 and 2013. As is obvious from this figure, subnational borders have changed significantly in several countries. Moreover, different types of border changes could be observed. The most straightforward type of border change is the split of an existing region into two or more regions. In these cases, the name of the original region is either retained by one of the new regions or both regions receive new names. The original name is typically retained by one of the new regions if one of the newly created regions is relatively small (i. e. if the split was a secession of a small part of a larger region).

The opposite type of border change is a merger of two or more existing regions into one larger entity. In these cases, either an entirely new region is created or an existing (typically large) region absorbs one or more smaller regions. Finally, a third type of border change combines both mergers and splits. In these cases, subnational borders are completely re-aligned.

The number of regions in 1992 was 685. It has increased by 80 regions to 765 (or by 10.5%) by 2013 (see Figure 2). Table 1 gives an overview of the affected countries per year and type of reform being implemented. The table also suggests that some countries experienced several border reforms. Figure 1 shows that in countries such as Egypt and Burundi, border changes were ostensibly isolated events that affected only a few regions. In other countries, for example Buskin Faso and Ethiopia, border changes affected the entire country and were ostensibly part of broader reforms.

Most border changes in Africa follow a top-down approach given the centralist nature of African countries. Accordingly, border changes are usually a central government policy imposed on subnational

[8]For example, the National Party (NP) supported the creation of the Northern Cape province as its demographics would seem to give it an electoral edge against the African National Congress (AN) in provincial elections. Makgetla and Jackson (2010) state: "... technical committee members did not envision a Northern Cape, instead drawing a boundary between the Western Cape and North-West province. AN members on the technical team noted that the Northern Cape had no history of local administration and that the cost of governing the sparse population, coupled with the region's modest local revenue, would make a provincial government's work additionally difficult." In the end, politics trumped the economic concerns and the Northern Cape province was created.

[9]See also Table 1 in Grossman and Lewis (2014), which documents general trends in the creation of new subnational units (states, districts and municipalities) in Sub-Saharan Africa. However, they give no information on mergers of subnational units.

governments. The reasons for the border changes are, however, specific to the country in question. In Buskin Faso, for example, a territorial reorganization was initiated in 2001 that saw the introduction of a new tier of government – called regions – that encompassed the old provinces. These changes were part of a wider public sector reform to improve administrative efficiency. In Rwanda, in contrast, the boundaries of the provinces were completely redrawn in 2006 in a deliberate attempt to reduce the degree of within-region ethnic homogeneity. In other cases, countries implemented splits to re-centralize power to the national tier as well as to reduce the intergovernmental bargaining power of the subnational units (Grossman and Lewis, 2014). Splits were also implemented for electoral reasons (Resnick, 2017), in particular to more easily target fiscal transfers from the central government to specific voter groups (Hassan, 2013; Gottlieb et al., 2019), to strengthen relationships with local elites (Green, 2010), or to address ethnic grievances (Pierskalla, 2016).

3 Data and empirical strategy

3.1 Data

3.1.1 GAUL data on border changes

As mentioned, our data on border reforms is taken from the GAUL project. The main objectives of the GAUL project are to provide reliable spatial information on administrative units and to maintain a historical record of changes that occur to their shapes and extent (GAUL, 2014). The project assembles this information using various official sources and makes it available to the public in the form of GIS shapefiles in which subnational borders are indicated as line features.

In these shapefiles, the emergence or dissolving of a line from one to the next year ostensibly implies some form of border reform. We use GIS software to systematically track changes to the line features that represent the borders of the first-level subnational units. Line features can change in two ways. First, a line can emerge within an existing subnational unit. We classify these changes as splits. Second, an existing line between two regions may vanish. We classify these types of border changes as mergers.[10]

For an illustration, consider Figure 1. Subfigure (a) overlays the regional boundaries across Africa in 1992 over the boundaries in 2013. The borders in 1992 are colored green while those in 2013 are colored blue (we indicate country borders with black lines). The observable blue lines hence indicate new borders that emerged over the sample period and thereby allow us to identify all splits from 1992 to 2013. Subfigure (b) overlays the regional boundaries in 2013 over those in 1992. In this case, the borders as of 1992 are colored blue and those in 2013 green. Therefore, the blue lines show those borders that vanished over the sample period and hence indicate mergers.

Since we have annual data, we can identify the year in which a particular region was split or merged. After identifying such changes to the line features, we project the emerging (in case of splits) or vanishing (in case of mergers) line to a 1×1 degree (about 110km $\times$ 110km) grid of pixels covering all of

[10]Note that with this algorithmic procedure, a border change where a region cedes territory to another already existing region is classified as a split from the perspective of the ceding region. From the perspective of the receiving region, this border change would be classified as a merger (as an existing line vanishes). Pixels affected by this type of border change would hence be classified as having experienced both a split and a merger at the same time.

the African continent. As discussed above, unlike the subnational regions themselves, the 1×1 degree pixels can serve as time-constant units of analysis.

Based on the projection of border changes to the grid of pixels, we classify pixels as being subject to a split or a merger in a given year. Consider subfigure (a) of Figure 3 which shows how Africa is divided into the 1×1 degree pixels. Pixels are colored depending on whether they were at least once affected by splits or mergers over the sample period. As suggested by our discussion in Section 2, and in line with Figure 1, we observe that more pixels were subject to splits than mergers. There is also a large number of pixels where the corresponding territory underwent both at least one split and one merger over the sample period.

3.1.2 Luminosity as proxy for economic development

Following previous literature, we use nighttime luminosity as a proxy for development at low levels of geography (Alesina et al., 2016; Hodler and Raschky, 2014; Michalopoulos and Papaioannou, 2016; Bruederle and Hodler, 2018). This data is based on images of the earth at night obtained by satellites of the US Air Force (USAF) Defense Meteorological Satellite Program Operational Linesman System (DBMS-OLD). The original imagery is processed by the National Oceanic and Atmospheric Agency (NOAA) and released to the public as raster datasets.

The raster datasets consist of annual average stable night lights between 8.30pm to 10pm and are available at a resolution of 30 arc-seconds (about 0.86 square kilometer at the equator) for all years after 1992. Each pixel of the dataset stores a digital value ranging from 0 to 63 indicating the amount of average light of an area covering 30 arc-seconds. Higher values imply that a pixel emanates more light (Henderson et al., 2012).

To obtain a proxy for pixel-level GDP, we overlay the grid of pixels over the raster datasets and calculate the sum of the digital values of each cell with size 30 arc-seconds that falls within the boundaries of each of the 1×1 degree pixel as shown in subfigure (a) of Figure 3. Subfigure (b) plots average night lights over the sample period in each of these pixels. More strongly shaded pixels indicate higher luminosity. In general, the pattern of pixel-level luminosity matches with anecdotal evidence of African development. For example, coastal areas tend to have higher luminosity than the hinterland.

3.1.3 Conflict data

We use geocoded data on conflict events from the Armed Conflict Location and Event Data Project (ACLED) to explore how border changes affect the incidence of conflicts. This dataset collects, inter alia, information on the location and date of reported conflict events, e. g. violence committed by government forces, rebels, etc. The data covers all countries in Africa over the period 1997-2014. We use the information on violent conflicts (with fatalities) and project these conflict events on the 1×1 degree grid.

3.1.4 Afrobarometer data

To study how political attitudes evolve after border changes, we rely on data from the Afrobarometer surveys. The Afrobarometer surveys are an "independent, nonpartisan research project that measures the social, political, and economic atmosphere in Africa".[11] There are currently six waves of the survey, with a varying coverage of countries across waves. Later waves have generally a better coverage (the first wave covers 12 countries while the sixth wave covers 36 countries). The overall sample size increased throughout the first six waves, from about 21,000 to about 54,000 respondents.

For the surveys, interviewers conduct face-to-face interviews with representative samples of respondents in each wave and country (1,200 or 2,400 respondents, respectively) and ask several questions about their personal circumstances as well as their attitudes toward the current political climate. To explore the effect of border changes on political attitudes, we focus on responses regarding interest in politics and trust in the executive of the central government (president or prime minister). In addition, we exploit information on support of democracy, satisfaction with democracy and understanding of government.

The wording of the questions is not exactly identical across waves, but their content is nearly the same. Specifically, to measure effects on political attitudes, we use responses to questions with the following content:

- **Trust in president**: How much do you trust the president?
- **Support democracy**: Is democracy preferable to any other kind of government?
- **Satisfied democracy**: How satisfied are you with the way democracy works in your country?
- **Understand government**: Politics and government sometimes seem so complicated that you can't really understand what's going on. Do you agree?
- **Interest in politics**: How interested are you in public affairs?

Responses are on an ordinal scale. We transform the data into binary variables to make them comparable across survey waves. If the relevant dummy variable assumes 1, then this implies higher interest in politics, more trust in the president, more support and satisfaction of democracy as well as a higher understanding of government.

3.1.5 Data for ethnic fractionalization

To measure ethnic fractionalization, we rely on a shapefile provided by the Geo-Referencing of Ethnic Groups (GREG) project. This project uses maps and data from the Soviet Atlas Narodov Mira to georeference ethnic groups across the globe, including Africa. We project the ethnic groups boundaries on the grid of pixels and count the number of groups that fall within a pixel to construct a measure of pixel-level ethnic heterogeneity.[12]

[11] See `http://afrobarometer.org/`.

[12] Note that GREG denotes up to three major ethnic groups in each settlement area. We count all mentioned groups for our heterogeneity measure. Moreover, GREG measures the spatial location of ethnicities prior to our sample period. Hence, the

3.1.6 Data on subnational elections

To measure subnational autonomy, we hand-collect for each country data on whether it had any type of subnational election during our sample period. The idea is that the existence of subnational elections likely suggests some degree of subnational political independence. Typically, subnational elections, if they take place, are held for legislative bodies and/or the regional executive. Table 2 lists which countries held subnational elections, together with the years in which the elections took place.

3.1.7 Data for covariates

We use geographically disaggregated data on total population, forest cover, urban land area, the age and gender ratios as controls in some specifications. This data is obtained from various sources.

Data on total population is from the Gridded Population of the World Version 4 dataset, which relies on population census to model local population at a resolution of 30 arc-seconds. This data is available in five-year increments starting in 2000. As for the luminosity data, we overlay the grid of pixels over the raster datasets and calculate the sum of the digital values of each cell of 30 arc-seconds that falls within the boundaries of a given 1×1 pixel. Since we have no annual data for population, we replace missing population data with the information from the last available year (i. e. the value of a pixel in 2009 is the same as its value in 2005). For years before 2000, i. e. the first year with available data, we use the value in 2000.

Information on forest cover is from the MODIS Percentage Forest Cover Fraction dataset. This data is based on satellite imagery of the fraction of an area covered by trees or forests by the MODIS Sensor (Moderate Resolution Imaging Spectroradiometer). The data is available at a resolution of 250 meter grid cells and for all years between 2001-2010 from the US Geological Survey and Integrated Climate Data Center. As for the population data, we aggregate the forest cover data to the level of 1×1 grid cells and replace missing values before 2001 with the value in 2001 and after 2010 with value in 2010.

Disaggregated data on the demographic and gender composition of African regions is taken from the United Nations Population Division, World Population Prospects (2015 Revision). This dataset is mainly based on detailed official subnational data and is available for 5-year age groupings, both for male and female at a resolution of about 0.01×0.01 decimal degrees (about 1km $\times$ 1km) for 2000 and 2005. As before, we aggregate this 0.01×0.01 pixels to our 1×1 degree pixels and replace missing years with the closest available values.

Data on land cover is obtained from the MODIS land surface type dataset from the US Geological Survey and Integrated Climate Data Center. The data measures the land area fraction by land use type at a resolution of 0.5×0.5 decimal degrees for each year in 2001 to 2012. We use the fraction of urban or developed land as a measure of urbanized land area. Again, we aggregate the urban land area to the level of 1×1 degree pixels for later analysis.

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numbers reflect values before the start of our sample period and accordingly, are not affected by the various border reforms during our sample period.

3.2 Empirical strategy

To estimate the effect of border changes on local development, we implement a difference-in-difference design using the 1×1 degree pixels as units of observations. The basic specification is:

$$y_{i,t} = \alpha_i + \gamma_t + \beta_s \text{Split}_{i,t} + \beta_m \text{Merger}_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where $y_{i,t}$ is log of pixel-level aggregate night light output in pixel i in year t.[13] $\text{Split}_{i,t}$ is a dummy that is one for all $T \leq t \leq 2013$ after a new feature line in the GAUL files emerged in T within the territory covered by a particular pixel (i. e. from the first split by which a pixel is affected until the end of the sample period). Similarly, $\text{Merger}_{i,t}$ is a dummy variable that is 1 for all $T \leq t \leq 2013$ after a feature line vanished within the territory covered by a pixel.[14]

To account for year-specific continent-wide effects, we include year fixed effects γ_t. Year fixed effects also account for annual variations in measured night light output due to different calibrations of the satellites used to record luminosity. To control for systematic (but time-invariant) differences between pixels, we include pixel fixed effects (α_i). For hypothesis tests, we rely on heteroscedasticity-robust standard errors that are clustered at the level of the pixels.

As always with difference-in-difference designs, the identifying assumption is that treated and control pixels would have had common trends in the absence of treatment. This identifying assumption is particularly important in our context as border changes do not take place randomly. To explore the robustness of our results to possible violations of the common trends assumption, we control for a number of time-varying pixel-level variables in robustness tests. We also report results from event-study regressions where we can observe whether there shocks to nighttime luminosity systematically precede border changes.

4 Results

4.1 Baseline

4.1.1 Main results

Table 3 collects the baseline results where we relate border changes to night light output. We observe a positive and significant coefficient for both splits and mergers across all specifications, indicating that pixels that were affected by either type of border change experience an improvement in economic conditions, compared to unaffected pixels. More specifically, the results indicate that night light output is on average about 13% higher after splits and 42% higher after mergers. Using the elasticity between night-lights and GDP of 0.3 estimated by Henderson et al. (2012), these results imply that splits cause an increase of GDP by 3.9% while mergers cause an increase of 12.6%.

[13] For pixels that have a value of 0 for aggregate night light output, we add 1 before taking the log.

[14] Note that by this definition of the treatment dummies, we implicitly account for the (few) pixels affected by border changes in two separate years.

While plausible when viewed in isolation, it may appear paradoxical that both splits and mergers have a positive effect on development. As we show below, an explanation for this apparent paradox is that splits and mergers work through different transmission channels. However, before exploring transmission channels, we first establish the robustness of the baseline estimates.

4.1.2 Robustness

Time-varying covariates. To establish the robustness of the previous results, we replicate the baseline specification after controlling for various time-varying covariates at the pixel-level: population, forest cover, the share of a pixel that is urbanized, the share of young among the total population (age < 25 years), the share of old (age > 65), and the gender ratio (number of women / men).[15]

Table 4 collects the results. The share of urban area is the only variable that shows a significant correlation with night light output: as pixels become more urbanized, night light output increases. However, the estimates for splits and mergers remain virtually unchanged.

Country-specific year effects. While the baseline regressions include year fixed effects and hence control for continent-wide common shocks, it is possible that countries that implemented border reforms were from the outset on different economic trajectories than countries that did not experience border changes.

To establish whether our results are robust to this concern, we re-estimate Equation 1 while including country-specific rather than continent-wide year fixed effects, i.e. holding institutional and economic changes at the country-level constant. We hence identify the effect of border changes with within-country variation. The identifying assumption is that pixels which were not affected by a border change were on the same economic trajectory than treated pixels within the same country.

Note that it is difficult to define country-level fixed effects in our pixel-based approach. In particular, pixels may cover two or more countries. As a practical solution to this issue, we assign any pixels that cover two or more countries to the country which encompasses the largest fraction of a pixel. However, as a consequence of this, these estimates may be inaccurate and should hence be regarded as suggestive.

The results are collected in Table 5. Despite the issues mentioned above, the estimated coefficients are similar to the baseline results, suggesting that country-level shocks do not bias the baseline estimates.

4.2 Event-studies

In this section, we report results from event-study regressions. The main purpose of these specifications is to asses how quickly the economic benefits of border changes emerge, and thus to gain a more comprehensive picture of how border changes affect economic development. In addition, event studies can help us to evaluate whether border changes are induced by recent economic shocks.

We estimate models of the following form:

[15] We include all variables in logs.

$$
\begin{aligned}
y_{i,t} =& \alpha_i + \gamma_t + \beta_{<-5}\text{Border change}_{i,t<-5} + \sum_{t=-5}^{-1} \beta_t \text{Border change}_{i,t} \\
&+ \sum_{t=1}^{5} \beta_t \text{Border change}_{i,t} + \beta_{t>5}\text{Border change}_{i,t>5} + \varepsilon_{i,t},
\end{aligned} \tag{2}
$$

with Border change $\in \{\text{Split}, \text{Merger}\}$ and $t = -1$ as the base year. That is, we explore luminosity in treated pixels in all years before and after a border change relative to luminosity in the year immediately before the border change. For the first four years before the base year and the first five years after the border change, we provide annual estimates. For the remaining years, we estimate an average effect over all remaining years.

We collect the results for splits in subfigure (a) of Figure 4. We observe no obvious trend or shocks, suggesting that there were no systematic differences in the economic trajectories of pixels affected and not affected by splits. After a split takes place, we observe no change in night lights for the first five years. Only after five years, the effect turns significantly positive.

Subfigure (b) reports the results for mergers. As for splits, we observe similar pre-treatment trends in the treated and control pixels. After a merger, the positive effects accumulate over time. We begin to observe a significant positive effect from year three onwards. After five years, luminosity is about 50% higher in treated pixels compared to the control pixels. Overall, these results confirm the previous findings. Mergers have a quick yet persistent effect on night lights while the effects of splits are more muted.

5 Mechanisms

The above results suggest that the subnational border changes observed in Africa, in particular mergers but also splits, had on average a positive effect on development. Since these estimates are average treatment effects on the treated, one conclusion that follows is that those regions which were affected by border changes were in general not of optimal size. Changing their size and shape led to improvements, both in the case of mergers and, to a lesser extent, in the case of splits.

It is, however, notable that the estimates for splits and mergers are of significantly different magnitudes.[16] This points to different channels through which splits and mergers affect development. In the following, we focus on two specific channels. First, border changes may increase administrative efficiency. Splits may increase efficiency if they make it easier for public officials to tap into local knowledge and to better tailor policies to heterogeneous populations. Mergers may increase efficiency if they lead to a reduction in administrative overhead and enable public officials to exploit economies of scale in the provision of public services.

The second channel works through increased political stability. As discussed, one apparent shortcoming of African borders is that similar groups can be either arbitrarily separated into several regions, or lumped together with dissimilar groups into a single region. Splits and mergers may hence lead to

[16] Conducting t-tests for the baseline estimates for both mergers and splits yield a significant difference at the 1% level.

a better match of the ethnic groups' historical settlement areas and a country's current administrative structure, thereby improving political stability and reducing conflicts. This increase in political stability may then have positive effects for development.

5.1 The role of ethnic fractionalization

If improved political stability is a relevant channel, we should expect that the economic effects of border changes depend on whether they have changed the degree of regional ethnic fractionalization. If border changes increase ethnic homogeneity, i. e. align with the historical settlement areas of ethnic groups, regional ethnic fractionalization should be reduced (e.g. Grossman and Lewis (2014) and Pierskalla (2016)). On the other hand, if splits take place in ethnically homogeneous regions or mergers happen between heterogeneous regions, then regional fractionalization should increase. In this subsection, we study whether heterogeneous or homogeneous pixels display a stronger effect on night lights after a border reform. The idea is that if splits or mergers affect luminosity through an improvement in political stability, we should observe stronger effects for splits in pixels where more ethnic groups live (since the new borders were presumably drawn in a way to divide two disparate groups) and for mergers in pixels where fewer groups live (since the vanishing borders might have divided one homogeneous group into different regions).

Table 6 expands the baseline specification with interaction effects between mergers and splits and a measure of ethnic fractionalization. Specifically, we construct a count variable to measure ethnic fractionalization by counting the number of distinct ethnic groups in a pixel.

We find that ethnically heterogeneous pixels experience a strong increase in night lights after a split. The interaction term between splits and the number of ethnic groups is significantly positive. Accordingly, we conjecture that splits lead to higher growth if they reduce regional ethnic fragmentation. For mergers, we find no significant differences between homogeneous and heterogeneous pixels. Specifically, the interaction between the merger dummy and the number of groups is insignificant.

Overall, these results indicate that the weak positive effects of splits found in the baseline regressions comes at least in part from a reduction of political instability in ethnically heterogeneous regions. For mergers, on the other hand, this channel appears to be unimportant, arguably because subnational mergers in Africa were implemented for reasons other than to improve political stability.

5.2 Border changes and conflict

To explore the above interpretation further, we next study whether border changes affect the incidence of conflicts. Specifically, we relate the treatment dummies for splits and mergers to conflict events. The results are collected in in Table 7. Splits result in about 17% fewer conflicts, while mergers have no significant effect.

These results reaffirm that one channel through which splits affect development is a reduction of conflicts. They also suggest that this channel is not relevant for mergers, again because mergers are presumably intended to achieve other goals than political stability.

5.3 Subnational elections

To investigate the link between the specific institutional context and border changes further, we next study whether splits and mergers are more effective when they are implemented in countries where subnational units have significant autonomy. It is plausible that subnational autonomy is a necessary precondition for border changes to reduce (ethnic) conflicts. If a new region is created through a split or merger, but its policies as well as the chief administrators are still determined at the center, the border change may be merely symbolic and hence have no substantive consequences.

Table 8 reports regressions where we interact the border change dummy with a dummy for whether in a given year the country into which (the largest share of) a pixel falls has any type of subnational elections, which we interpret as a proxy for subnational (political) autonomy. The results indicate that splits are only effective in increasing growth if they take place in countries with subnational elections. For mergers, on the other hand, we find no difference in their effect between countries with and without subnational elections.

5.4 Political attitudes

If splits affect economic development through a reduction in conflicts, we should observe a corresponding change in political attitudes in the affected regions. In particular, inhabitants should be more likely to be satisfied with the political system. It is also possible that mergers, even if they do not lead to more conflicts, affect political attitudes. These effects are especially likely if the growth effect found for mergers is due to cuts in public services and cost savings rather than increased administrative efficiency.

To explore these questions, we use Afrobarometer survey data, which we match to our pixel-level border change data. We then estimate different variants of the following model:

$$d_{n,i,t} = \alpha_i + \gamma_t + \beta_s \text{Split}_{i,t} + \beta_m \text{Merger}_{i,t} + \varepsilon_{i,t}, \tag{3}$$

where $d_{n,i,t}$ are our re-coded variables that record the response of an individual n residing in pixel i in year t to one of the five questions on political attitudes discussed in Section 3.1.4. In all regressions we control for pixel-fixed effects α_i and year fixed effects γ_t, respectively.

The results are collected in Table 9. We find that splits have strong and statistically significant effects on certain political attitudes. Respondents that were subject to splits show an increase in their trust in the president. Hence, splits ostensibly increase the satisfaction with the national government. Respondents also voice a lower interest in politics, which may indicate that potentially divisive conflicts are pacified. On the other hand, we find no effects on the support for "democracy" nor on how well respondents "understand government".

For mergers, in contrast, we find no effects on any of the measures of political attitudes. This indicates that the positive effect of mergers on growth does not work through political channels. These results are, however, consistent with the positive effects on luminosity found above as they suggest that mergers do not lead to a disenchantment with the political process either.

5.5 Bureaucratic efficiency

Finally, we study the link between administrative efficiency and border changes further. If mergers lead to higher luminosity primarily because they imply higher administrative efficiency, then their effect should be more pronounced in countries that have a more competent bureaucracy. These countries should be most equipped to fully reap the economies of scale that may come with mergers.

We explore this issue by estimating interaction models of the following form:

$$\begin{aligned} y_{i,t} = \alpha_i + \gamma_t + \beta_b \text{Border change}_{i,t} + \beta_k \text{Bureaucratic quality}_{k,t} + \\ \beta_t \text{Border change}_{i,t} \times \text{Bureaucratic quality}_{k,t} + \varepsilon_{i,t}, \end{aligned} \tag{4}$$

with $\text{Border change}_{i,t} \in \{\text{Split}, \text{Merger}\}$ at the pixel-year level and $\text{Bureaucratic quality}_{k,t}$ for country k in year t. As discussed, we obtain country-level information on government effectiveness as measured by bureaucratic quality from the International Political Risk Guide. Specifically, we use the composite score of government effectiveness which is normalized to values between 0 and 1.

Table 10 collects the results. In the most complete specification (Model 3), we find that mergers are significantly more effective in raising economic activity in countries with higher bureaucratic quality. This is consistent with the interpretation that one important channel through which mergers affect luminosity is administrative efficiency.

6 Conclusion

In this paper, we study the economic consequences of subnational border changes in Africa. Tracking all changes to the borders of of first-level subnational units during 1992-2013 across all of Africa, we find that territories that were affected by mergers and splits experience stronger economic development as measured by nighttime luminosity. The effect of mergers is larger and more robust than that of splits, indicating that these two types of border reforms work through different channels. Indeed, we find suggestive evidence that splits increase political stability and reduce conflicts, possibly by leading to more positive political attitudes by the affected inhabitants. On the other hand, we find no effects of mergers on political attitudes or conflicts. While only circumstantial, this evidence is consistent with the interpretation that mergers have a positive effect on development because they increase administrative efficiency. Splits appear to be implemented primarily for political reasons and, as a consequence, have only second-order, albeit still positive, effects on economic growth.

Overall, these results suggest that the present shape of subnational borders in Africa, just as presumably those of national borders, is inefficient. African governments should in particular consider merging subnational units. Mergers may increase administrative efficiency and thereby improve economic performance. If, however, their main aim is to reduce ethnic conflicts and foster political stability, then splits seem to be an effective strategy. They not only achieve these aims, but by doing so also appear to have positive implications for economic development.

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(a) 1992

(b) 2013

Figure 1: Subnational borders in Africa in 1992 and 2013. Subfigure (a) overlays the 1992 boundaries of first-tier regions over the 2013 boundaries. Subfigure (b) overlays the 1992 boundaries of first-tier regions over the 2013 boundaries.

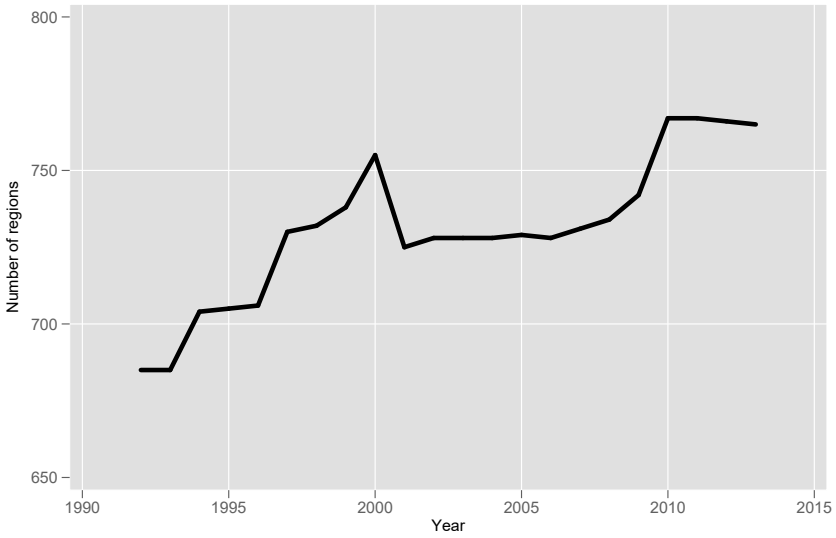
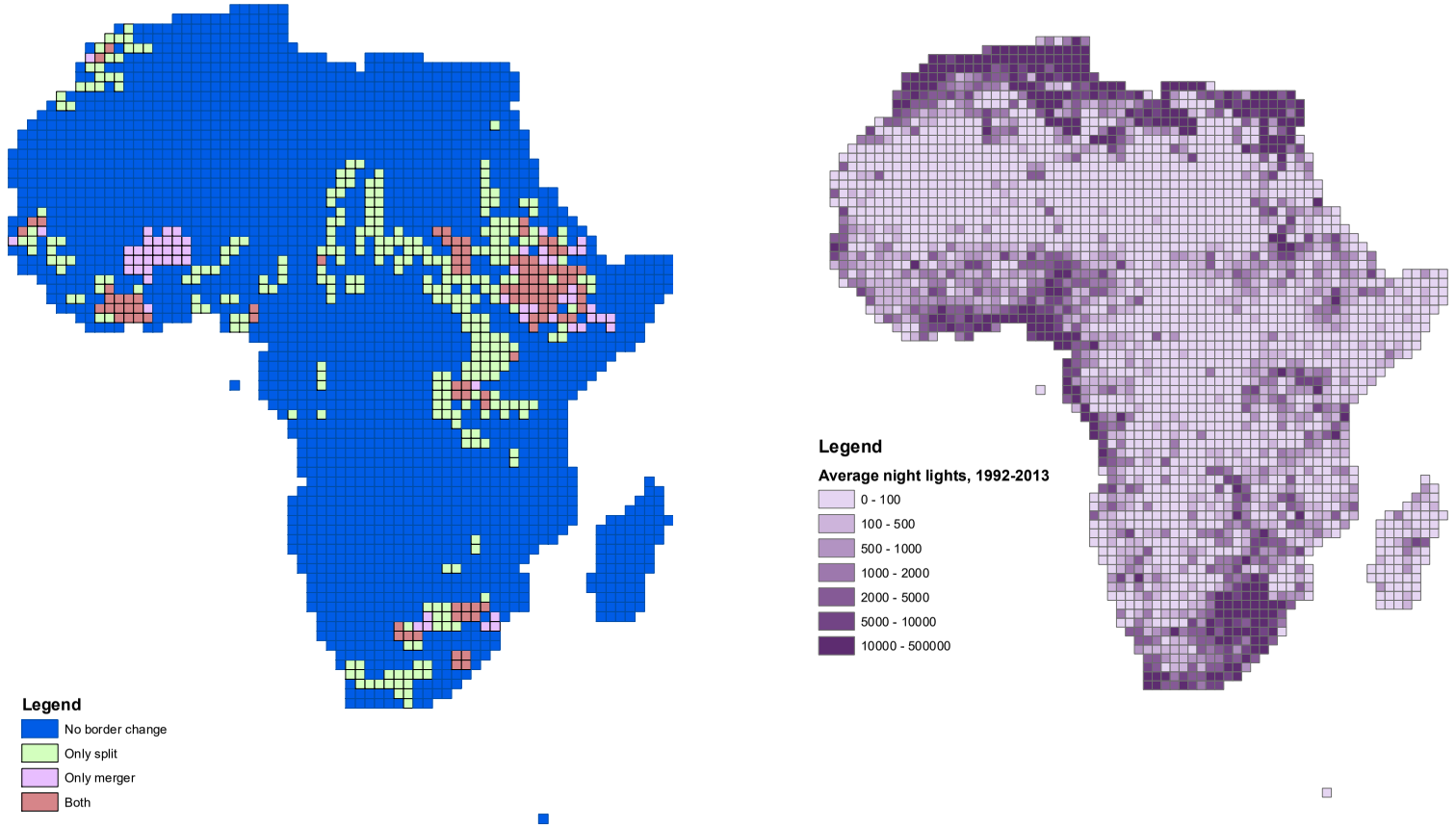
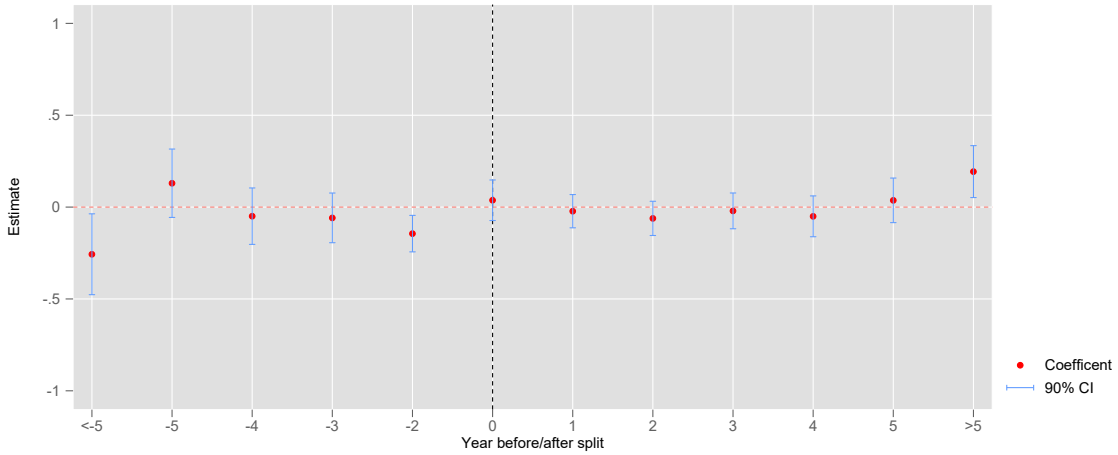


Figure 2: Number of first-level regions in Africa, 1992-2013.

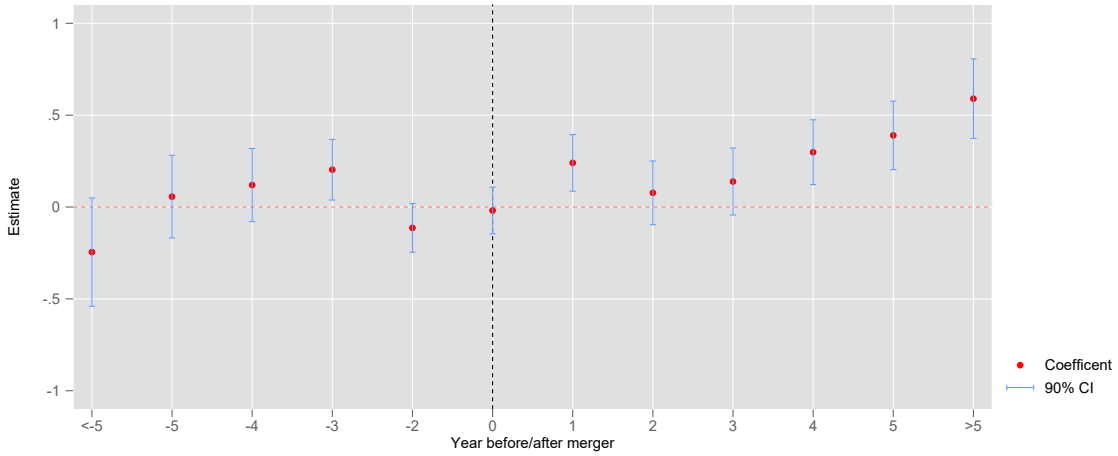


(a) BORDER CHANGES **(b)** NIGHT LIGHT OUTPUT

Figure 3: Border changes and light output at the pixel-level. Subfigure (a) shows the pixels affected by a split, merger, or both during the sample period. Subfigure (b) shows average night light output of each pixels over the sample period.



(a) SPLITS



(b) MERGERS

Figure 4: Event-study of splits and mergers around a 5-year window. This figure shows event study plots at the pixel-level for splits and mergers covering the first five pre-border change and the first five post-border change years. The baseline level of night lights is the one in the year before the border change.

Table 1: BORDER CHANGES IN AFRICA

Year	Splits	Mergers
1994	Ethiopia; SouthAfrica; Sudan	Ethiopia; SouthAfrica
1995	Congo	
1996	Guinea	
1997	Côted'Ivoire; DRC Congo; Morocco; Nigeria; Zimbabwe	Côted'Ivoire; Morocco; Nigeria
1998	Burundi; Ethiopia	
1999	Benin	
2000	Chad; Côted'Ivoire; Liberia; Sudan	Chad
2001	Côted'Ivoire; Liberia	BurkinaFaso
2002	Congo; Senegal; Tanzania	Senegal
2003	Congo	Gambia
2005	SouthAfrica; Uganda	SouthAfrica
2006	Rwanda; Sudan; Uganda	Rwanda
2007	Uganda	
2008	Senegal	
2009	Egypt; Uganda	
2010	Uganda	Uganda
2011	Congo; Sudan	
2012	Côted'Ivoire; Tanzania	Côted'Ivoire; Tanzania
2013		Mozambique

This table collects which countries under-went border changes (either split or mergers) during the sample period.

Table 2: SUBNATIONAL ELECTIONS IN AFRICA IN SAMPLE PERIOD

Country	Regional elections (Years of elections)
Algeria	Yes (1997,2002,2007,2012)
Angola	No
Botswana	Yes (1994,1999,2004,2009)
Cameroon	No
Central African Republic	No
Chad	No
Congo	Yes (2002,2008)
Cote d'Ivoire	No
Democratic Republic of the Congo	Yes (2007)
Equatorial Guinea	No
Eritrea	Yes (1993,1997,2002,2004)
Gabon	No
Gambia	Yes (2002,2008,2013)
Ghana	Yes (1996,2000,2004,2008,2012)
Guinea-Bissau	No
Lesotho	Yes (2005,2011)
Liberia	No
Libya	No
Malawi	No
Mali	Yes (1999,2004,2009)
Mauritania	No
Morocco	No
Mozambique	Yes (1998,2003,2009)
Namibia	Yes (1992,1998,2004,2010)
Niger	No
Nigeria	Yes (1992,1999,2003,2007,2011)
Rwanda	No
Senegal	Yes (1996,2002,2009)
Sierra Leone	No
Somalia	No
South Africa	Yes (1994,1999,2004,2009)
Sudan	Yes (2010)
Swaziland	No
Togo	No
Tunisia	No
Uganda	Yes (1997,2001,2002)
Western Sahara	No
Zambia	No
Zimbabwe	Yes (2013)
Burkina Faso	Yes (2012)
Burundi	No
Guinea	No
Madagascar	Yes (2008)
United Republic of Tanzania	No
Kenya	No
Egypt	Yes (2002,2008)
Ethiopia	Yes (2000,2005,2010)
Benin	Yes (2002,2008)

This table collects information on whether African countries had elections at the regional level in the 1992–2013 period (election years in parentheses). The sources for this data are available on request.

Table 3: BORDER CHANGES AND ECONOMIC DEVELOPMENT IN AFRICA: BASELINE REGRESSIONS

	(1)	(2)	(3)
Split	0.181***		0.127**
	(0.063)		(0.064)
Merger		0.453***	0.417***
		(0.104)	(0.105)
Pixel FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Pixels	2758	2758	2758
N	60676	60676	60676

[a] This table collects difference-in-difference regressions that relate border changes in Africa (splits or mergers) to the log of night light output. The unit of observation are 1 $\times$ 1 degree pixels.

[b] Stars indicate significance levels at 10%(*), 5%(**) and 1%(***).

[c] Standard errors (in paranetheses) are clustered at the pixel-level and robust to heteroscedasticity.

Table 4: BORDER CHANGES AND ECONOMIC GROWTH IN AFRICA: REGRESSIONS WITH PIXEL-LEVEL COVARIATES

	(1)	(2)	(3)
Split	0.181***		0.128**
	(0.063)		(0.064)
Merger		0.446***	0.410***
		(0.104)	(0.106)
Population	-0.027	-0.004	-0.011
	(0.144)	(0.143)	(0.144)
Forest cover	-0.011	-0.010	-0.010
	(0.018)	(0.018)	(0.018)
Urban share	0.369***	0.369***	0.374***
	(0.109)	(0.106)	(0.109)
Young share	67.190	62.355	61.807
	(61.386)	(65.365)	(65.051)
Old share	1.379	0.902	0.631
	(16.750)	(16.915)	(16.902)
Gender ratio	-24.191	-23.372	-22.260
	(58.068)	(58.853)	(58.897)
Pixel FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Pixels	2758	2758	2758
N	60676	60676	60676

[a] This table collects difference-in-difference regressions that relate border changes in Africa (splits or mergers) to the log of night light output. The unit of observation are 1×1 degree pixels.

[b] Stars indicate significance levels at 10%(*), 5%(**) and 1%(***).

[c] Standard errors (in paranetheses) are clustered at the pixel-level and robust to heteroscedasticity.

Table 5: BORDER CHANGES AND ECONOMIC GROWTH IN AFRICA: REGRESSIONS WITH COUNTRY-SPECIFIC YEAR EFFECTS

	(1)	(2)	(3)
Split	0.161**		0.133*
	(0.074)		(0.074)
Merger		0.369***	0.340***
		(0.124)	(0.124)
Pixel FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Pixels	2758	2758	2758
N	60676	60676	60676

[a] This table collects difference-in-difference regressions that relate border changes in Africa (splits or mergers) to the log of night light output. The unit of observation are 1 $\times$ 1 degree pixels.
[b] Stars indicate significance levels at 10%(*), 5%(**) and 1%(***).
[c] Standard errors (in paranetheses) are clustered at the pixel-level and robust to heteroscedasticity.

Table 6: BORDER-INDUCED ETHNIC CHANGES AND ECONOMIC EFFECTS

	(1)	(2)	(3)
Split	-0.123		-0.126
	(0.129)		(0.128)
Split $\times$ Ethnic groups	0.112**		0.095*
	(0.050)		(0.049)
Merger		0.050	0.073
		(0.261)	(0.262)
Merger $\times$ Ethnic groups		0.134	0.113
		(0.098)	(0.098)
Pixel FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Pixels	2684	2684	2684
N	59048	59048	59048

[a] This table collects interaction models of the number of ethnicities in a 1 $\times$ 1 degree pixel with a treatment dummy on whether that pixel was affected by a merger or split in a specific year and all subsequent years. We relate border changes in Africa (splits or mergers) to the log of night light output. The unit of observation are 1 $\times$ 1 degree pixels.
[b] Stars indicate significance levels at 10%(*), 5%(**) and 1%(***).
[c] Standard errors (in paranetheses) are clustered at the pixel-level and robust to heteroscedasticity.

Table 7: BORDER CHANGES AND CONFLICTS IN AFRICA

	(1)	(2)	(3)
Split	-0.165***		-0.167***
	(0.061)		(0.062)
Merger		0.003	0.020
		(0.047)	(0.046)
Pixel FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Pixels	2758	2758	2758
N	46886	46886	46886

[a] This table collects difference-in-difference regressions that relate border changes in Africa (splits or mergers) to the log of total conflict events. The unit of observation are 1×1 degree pixels.

[b] Stars indicate significance levels at 10%(*), 5%(**) and 1%(***). Standard errors (in paranetheses) are clustered at the pixel-level and robust to heteroscedasticity.

Table 8: BORDER CHANGES AND SUB-NATIONAL ELECTIONS

	(1)	(2)	(3)
Split $\times$ Elections	0.396***		0.325***
	(0.093)		(0.095)
Split $\times$ No Elections	0.026		-0.001
	(0.070)		(0.072)
Merger $\times$ Elections		0.472***	0.365***
		(0.113)	(0.113)
Merger $\times$ No Elections		0.308	0.333*
		(0.198)	(0.202)
Elections	0.055	0.088**	0.049
	(0.041)	(0.039)	(0.041)
Pixel FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Pixels	2758	2758	2758
N	60676	60676	60676

[a] This table collects interaction models for whether the country into which the largest share of a pixel falls has sub-national elections and the border change dummies. We relate border changes (splits and mergers) in Africa to the log of night light output. The unit of observation are 1×1 degree pixels.

[b] Stars indicate significance levels at 10%(*), 5%(**) and 1%(***).

[c] Standard errors (in paranetheses) are clustered at the pixel-level and robust to heteroscedasticity.

Table 9: BORDER CHANGES AND POLITICAL ATTITUDES: EVIDENCE FROM AFROBAROMETER

	(Trust in president)	(Support democracy)	(Satisfied with democracy)	(Understand government)	(Interest in politics)
Split	0.122***	0.022	0.010	-0.013	-0.149***
	(0.042)	(0.015)	(0.030)	(0.024)	(0.021)
Merger	-0.042	0.016	0.041	0.000	-0.006
	(0.056)	(0.018)	(0.030)	(0.050)	(0.019)
Pixel FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Regions	1005	1065	1065	837	1065
N	92071	151014	152273	89215	166656
F	9.226	3016.583	12.210	123.103	243.726

[a] This table collects difference-in-difference regressions that relate border changes in Africa (splits or mergers) to survey evidence on political attitudes from the Afrobarometer. The unit of observation are individual survey respondents.
[b] Stars indicate significance levels at 10%(*), 5%(**) and 1%(***).
[c] Standard errors (in paranetheses) are clustered at the pixel-level and robust to heteroscedasticity.

Table 10: BORDER CHANGES AND ECONOMIC DEVELOPMENT IN AFRICA: THE EFFECT OF BUREAUCRATIC QUALITY

	(1)	(2)	(3)
Split	0.102		0.098
	(0.066)		(0.068)
Split × Bureaucratic quality	0.459**		0.159
	(0.214)		(0.232)
Merger		0.296**	0.269**
		(0.120)	(0.123)
Merger × Bureaucratic quality		0.822**	0.750*
		(0.369)	(0.402)
Bureaucratic quality	-0.152	-0.146	-0.161
	(0.175)	(0.171)	(0.174)
Region FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Regions	2438	2438	2438
N	50148	50148	50148

[a] This table depicts the interaction effects of splits and mergers with a measure for bureaucratic quality from the International Country Risk Guide. The outcome variable is log of night light output at the 1 × 1 degree pixel-level.
[b] Stars indicate significance levels at 10%(*), 5%(**) and 1%(***).
[c] Standard errors (in parentheses) are clustered at the pixel-level and robust to heteroscedasticity.

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