Journal of Development Economics 167 (2024) 103214

Contents lists available at ScienceDirect

Journal of Development Economics

journal homepage: www.elsevier.com/locate/devec

Regular article

Accountability failure in isolated areas: The cost of remoteness from the capital city☆

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ARTICLE INFO

JEL classification:
D72
H41
O10
O40
R12

Keywords:
Accountability
Boundary discontinuity
Capital city
Development
Public goods
Spatial inequality
Sub-Saharan Africa

ABSTRACT

This paper documents that in Sub-Saharan Africa areas isolated from the capital city are less economically developed and examines potential underlying mechanisms. We apply a boundary-discontinuity design using national borders that divide pre-colonial ethnic homelands to obtain quasi-experimental variation in distance to the national capital city. We find that isolation significantly reduces nightlights at the intensive and extensive margin, and that a one percent increase in distance to the capital causes a drop in household wealth corresponding to 3.5 percentiles of the national wealth distribution. Our results suggest that a lower provision of public goods in isolated areas is a key link between remoteness and economic performance. Despite receiving worse services, people who are isolated exhibit a higher level of trust in their political leaders. Further, isolated citizens consume the news less frequently and penalize their leaders less for misgovernance. We interpret these findings as pointing towards dysfunctional accountability mechanisms that reduce the incentives of vote-maximizing state executives to invest into isolated areas.

The spatial distribution of economic activity in Sub-Saharan Africa is shaped by large differences in standards of living across regions (International Monetary Fund., 2015). Accordingly, gaining a better understanding of the underlying mechanisms that cause and maintain these spatial disparities is key for designing policies that could lift millions of individuals in the least developed regions out of poverty. Yet, the ongoing research on the subject has been largely descriptive (Odusola et al., 2017) rather than seeking to reveal underlying patterns and mechanisms. Only a limited number of scholars (see for example Kanbur and Venables (2005), Hodler and Raschky (2014) or Addison et al. (2017)) have examined spatial patterns and causes of inequality that go beyond the 'urban-rural bias' thematically (Lipton, 1977; Bates, 1981; Young, 2013; Lagakos, 2020).

For historical reasons, most African capital cities are located either at or close to the coast rather than in a central location which is why large parts of the population live far away from the capital city.[1] Previous research has pointed out that isolated capital cities impose important adverse effects on statewide outcomes such as aggregate corruption levels, conflict and quality of governance (Campante and Do, 2014; Campante et al., 2019). Yet, these studies look at capital city isolation as an aggregated state characteristics and do not investigate if there are spatial heterogeneities i.e. how locations farther from the capital perform economically relatively to their counterparts close to the capital.[2] Other research on the role of the capital city emphasizes that the ability of African states to broadcast power and

☆ I wish to thank my advisors, Olmo Silva and Felipe Carozzi, for their guidance and support. I received valuable comments from the Editor Andrew Foster, several anonymous referees, Denis Cogneau, Quoc-Anh Do, Steve Gibbons, Julien Grenet, Sergei Guriev, Vernon Henderson, Miren Lafourcade, Marco Manacorda, Alexander Moradi, Anders Olofsgård, Elias Papaioannou, Michel Serafinelli and Oliver Vanden Eynde. I am grateful to Remi Jedwab and Adam Storeygard for sharing their roads data. I also wish to thank seminar participants in the Applied Economics Lunch Seminar at Paris School of Economics, the 14th North American meeting of the Urban Economics Association, the 10th European Meeting of the Urban Economics Association and the 2021 German Development Economics Conference. This work was supported by the Economic and Social Research Council, United Kingdom [grant number: ES/P000622/1]. All remaining errors are my own.

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[1] For European colonizers who targeted the extraction of resources but had little access to the hinterlands, coastal trading points constituted suitable locations for colonial headquarters. Over the course of the colonial period, these administrative centers flourished and the majority of them subsequently persisted as post-colonial national capital cities in modern African states.

[2] Campante and Do (2014) include a few descriptives on the individual level and show that citizens further away from state capitals are less engaged with state politics.

https://doi.org/10.1016/j.jdeveco.2023.103214
Received 19 November 2022; Received in revised form 13 November 2023; Accepted 15 November 2023
Available online 22 November 2023

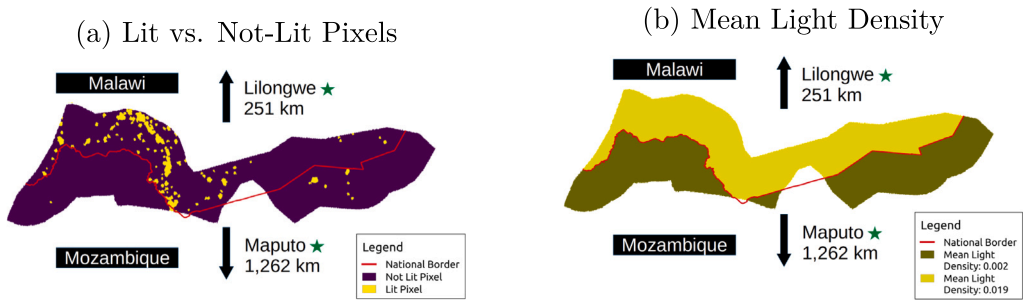

Fig. 1. Ethnic homeland partitioned between Malawi and Mozambique. *Note:* This figure illustrates Nyanja ethnic homeland that is partitioned between Malawi and Mozambique. We observe that the Malawian side contains more lit pixels and features an overall higher average light density indicating that the Malawian side is more advanced economically. The Mozambican side is located 1262 km from its capital city Maputo, while the Malawian side is situated only 251 km from its capital city Lilongwe. Our identification strategy aims at exploiting this jump in distance from the capital city to explain differences in economic outcomes. The figures are based on own calculations using 2016 VIIRS nighttime lights from EOG, Colorado School of Mines.

impose institutions is restricted beyond the capital city (Herbst, 2000; Michalopoulos and Papaioannou, 2014). What is still unclear in this strand of research is what the reduced state presence means for the economic performance in areas far from the capital,[3] as well as what the underlying mechanisms are that reduce the presence of the state in remote areas.

In this study, we suggest that the answer to this question is connected to the literature on accountability and public goods provision that emphasizes the importance of information about government actions to incentivize the attention of politicians (Besley and Burgess, 2002; Strömberg, 2004; Guriev et al., 2020). We argue that geographical isolation leads to information frictions which impair accountability mechanisms and leave the political leadership with reduced incentives to invest into remote areas. In other words, the same improvements in government performance return less votes in isolated areas. To support our claims empirically, we show that there is a significant and causal negative impact of distance from the capital city on economic performance. We further document a significant drop in public goods in remote areas, show that isolated citizens follow the news less frequently, have an overly positive view of the government and penalize their leaders less for misgovernance. Lastly, we show that alternative explanations such as market access or conflict are unlikely to be relevant with regard to the observed patterns.

The core challenge when seeking to identify the impact of isolation from the capital city is that capital cities are not randomly located in space. There are numerous geographical characteristics, most notably isolation from the coast, that are simultaneously correlated with isolation from the capital city and economic performance and thus confound ordinary regressions. We overcome this obstacle by applying a boundary discontinuity design (BDD) across national boundaries and comparing places with otherwise similar geographical features but varying distances to their respective capital city. Moving across the boundary might not constitute a valid counterfactual if the switch between countries coincides with other variables that might themselves be linked with development such as ethnicity and culture. We therefore restrict our analysis to boundary segments that divide pre-colonial ethnic homelands. Fig. 1 illustrates the intuition of our identification strategy using the example of the Nyanja ethnic homeland that is divided into two adjacent countries, Malawi and Mozambique. Our identification strategy exploits the jump in distance from the capital city at the border to explain differences in economic outcomes.

[3] Michalopoulos and Papaioannou (2014) establish that there is a reduced state presence in isolated areas using cross-border comparisons for areas with similar distance to the capital city (close vs. close and far vs. far) between countries with good and bad institutions. In this paper, we focus on the relative performance of remote areas and compare locations close vs. far from the capital while keeping institutions constant.

Using remote sensing data on nightlights as a proxy for economic activity, our results indicate that a one percentage point increase in distance from the capital city reduces the probability of a pixel to be lit by 0.031 percentage points or 0.12 times the average probability to be lit (2.5%). Alternatively, using DHS survey data we find that this corresponds to a reduction in household wealth of 3.5 percentiles of the national wealth distribution. To confirm that this effect is actually driven by isolation from the political center and not by remoteness from a major city, we show that the effects are unique to the capital city and do not apply to the largest non-capital cities. Having established this reduced form relationship, we turn to the question of how isolation from the capital city impacts economic performance. We investigate three plausible mechanisms that are suggested by the literature: public goods provision, market access and conflict. Our analysis indicates that the latter two are unlikely to be relevant with regard to the effects under scrutiny. In contrast, we document a significant and strong causal impact of distance from the capital city on the level and quality of public goods provision suggesting that it plays and important role behind the observed patterns. We then explore two potential explanations for reduced public goods in isolated areas: (i) isolated areas are less represented in national politics or (ii) isolated citizens are less able to hold political leaders accountable for providing government services i.e. dysfunctional accountability mechanisms. While political leaders are less likely to come from an isolated region, those regions are more likely to participate in the ruling government coalition. This finding contradicts the view that remote areas are systematically excluded from power. Yet, we find clear evidence that isolated citizens are not able to incentivize the incumbent government for the provision of public services to the same extent as those close to the capital. Despite being served with a lower level of public goods, people in isolated areas exhibit a higher level of trust in their national political leadership, evaluate their performance better and are less likely to believe that their leaders are corrupt. We argue that the positive view of the government is associated to the fact that isolated citizens consume the news less frequently and therefore have less insights into government actions. To support this hypothesis, we show that isolated citizens are less responsive to changes in the quality of governance. In times of increased corruption and political misconduct, citizens close to the capital city lose trust and reduce their electoral support of the incumbent government to a significantly larger extent than citizens in isolated areas. This circumstance has important adverse consequences for political accountability in isolated areas. Since isolated citizens react less to government performance, vote-maximizing state executives are incentivized to invest more government resources into areas closer to the capital city — as this is where the marginal voters are.

Classical work on the origins of regional inequalities was conducted by Williamson (1965). Since then, research on the determinants of regional development has provided ample evidence that local geographical factors and endowments have a strong impact on the level of economic prosperity (see for example Diamond (1997), Nunn and Wantchekon (2011), Alesina et al. (2016), Jedwab and Moradi (2016), Bakker et al. (2018), Boxell (2019), Michalopoulos et al. (2019) and Alesina et al. (2021)). Other research points out that historical institutional framework conditions such as pre-colonial ethnic institutions are a key factor for economic development (see for example Gennaioli and Rainer (2007), Michalopoulos and Papaioannou (2013) or Michalopoulos and Papaioannou (2020) for a recent extensive literature review of African historiography). Hodler and Raschky (2014) and Burgess et al. (2015), in turn, show that political factors such as the ethnic affiliation of the incumbent president plays an important role for regional economic growth. The authors document that under weak political institutions, public investments and economic growth are biased in favor of the president's home region. Thus, these studies clearly underline that research on comparative development needs to go beyond the national level and occupy itself with subnational patterns. Moreover, political mechanisms are a key determinant of comparative regional development. These insights are especially relevant in the African context where states are 'artificial', have not grown together as one over the centuries and feature very high levels of heterogeneity and ethnic fractionalization (Alesina et al., 2011; Michalopoulos and Papaioannou, 2020).

The remainder of this paper is organized into four sections. Firstly, Section 1 will introduce the dataset, and establish the empirical identification strategy. Secondly, Section 2 will present our empirical results. In Section 3, we examine potential mechanisms that link isolation from the capital city and economic performance. Finally, Section 4 will summarize the findings and conclude the paper.

1. Data and empirical strategy

There are 38 Sub-Saharan African countries in our sample (see Figure A1).[4,5] Fig. 2 presents the distribution of isolation from the capital city for our sample countries. As becomes clear from the graph, isolation from the capital city is not a characteristic that only applies to a small minority but with a median of 303 km (mean: 391 km) rather represents the common case.

1.1. Measuring economic performance locally

To examine the impact of distance from the capital city, we require information on economic activity for small spatial units. Since reliable administrative data on the local level is not available in Sub-Saharan Africa, we use the 2016 VIIRS nighttime lights by the Earth Observation Group (Colorado School of Mines) as our main measure for local economic performance (Elvidge et al., 2017). One drawback of using nightlights is highlighted by Chen and Nordhaus (2011) and Cogneau and Dupraz (2014) who point out that the predictive power of nightlights for economic activity is low and noisy for areas of low population and nightlight density. While this measurement error in the dependent variable would not lead to bias, it increases the variance of the estimates. In addition to using nightlights, we cross-validate our findings and address potential shortcomings of nightlights by complementing our analysis using the survey-based DHS wealth index.

Nighttime Lights (VIIRS):

The use of nighttime luminosity data as a proxy for economic activity has greatly increased in recent years. Several studies have investigated and validated the consistency of nighttime lights as a proxy for GDP (Henderson et al., 2012; Michalopoulos and Papaioannou, 2013; Donaldson and Storeygard, 2016). As is common in the literature, we use two measures of nightlights:

- Intensive approach (log nightlight intensity*):

$$Y_i = ln(Lights_i + 0.002000212) \quad (1)$$

- Extensive approach (the extent to which cells are lit or not lit):

$$Y_i = \begin{cases} 1 & if \quad Lights_i > 0 \\ 0 & if \quad Lights_i = 0 \end{cases} \quad (2)$$

*Since the vast majority of pixels has a light density of 0, we add the minimal observed light density that is greater than zero as a constant term before taking the natural logarithm. The results remain qualitatively equivalent when using alternative constant terms such as 0.0001 or 0.001. However, as pointed out by Chen and Roth (2022), it is problematic to interpret estimates based on such transformations as percentage changes. Since the absolute magnitude of this coefficient is not critical in our study, as changes in light density are hard to translate into economic units, we will nevertheless use this approach as a rough approximation for the intensive margin — but highlight that these interpretations should be handled with caution. In the following, we will provide an alternative approach to estimate the economic impact of isolation from the capital city based on DHS survey data that allows for an interpretation in terms of changes in percentiles within the national wealth distribution.

Wealth Index (DHS):

The DHS (Demographic and Health Surveys Program) has collected nationally representative and geocoded[6] data on sociodemographic, economic and health characteristics and covers 30 out of the 38 countries in our sample (ICF, 2018).[7] We use the most recent household recode survey available for each available country (as of 2020).

Based on a household's ownership of selected assets (such as car, bicycle, refrigerator, computer, television) and household facilities (such as roof and floor material or type of toilet facility), the DHS estimates a household's 'wealth index' using principal component analysis (PCA).[8] The PCA represents a composite measure of a household's cumulative living standard relative to other households within each country and year which makes it suitable for applications that seek to understand the relative distribution of living standards within countries. We normalize the PCA for each survey to make a household's wealth index more comparable to the relative position of households in other countries. As a second alternative measure, we rank and assign each household its relative position in the national wealth distribution.

[4] We exclude small island states, Sudan and South Sudan due to their recent separation, as well as Somalia and Somaliland due to the absence of a stable political power in Somalia and the special role of the government in Somaliland (Eubank, 2012). We further exclude South Africa as it has subdivided its three branches of government into three separate capital cities and Lesotho as it does not share a boundary with any remaining country in the sample.

[5] For the most part, the assignment of capital cities is uncontroversial as the majority have persisted as such since the colonial era. The exceptions are Ivory Coast and Nigeria where the capital city was ultimately shifted in 1983 from Abidjan to Yamoussoukro and in 1991 from Lagos to Abuja respectively. Tanzania has also been planning to move its capital from Dar es Salaam to Dodoma since 1973. However, since the Tanzanian parliament had not been relocated till 2019, we use Dar es Salaam as capital city of Tanzania.

[6] The longitude and latitude of each respondent is recorded using a GPS receiver. Note that to protect the privacy of respondents, the DHS displaces the GPS coordinates randomly up to 2 km for urban clusters and up to 5 km for rural clusters with 1% of rural clusters being displaced up to 10 km. This displacement is restricted such that respondents always stay within the same country and region.

[7] The following countries are not covered in the DHS sample: Botswana, Congo, Djibouti, Equatorial Guinea, Eritrea, Gambia, Guinea-Bissau and Mauritania.

[8] For more information about the construction of the DHS wealth index visit: https://dhsprogram.com/topics/wealth-index/Wealth-Index-Construction.cfm.

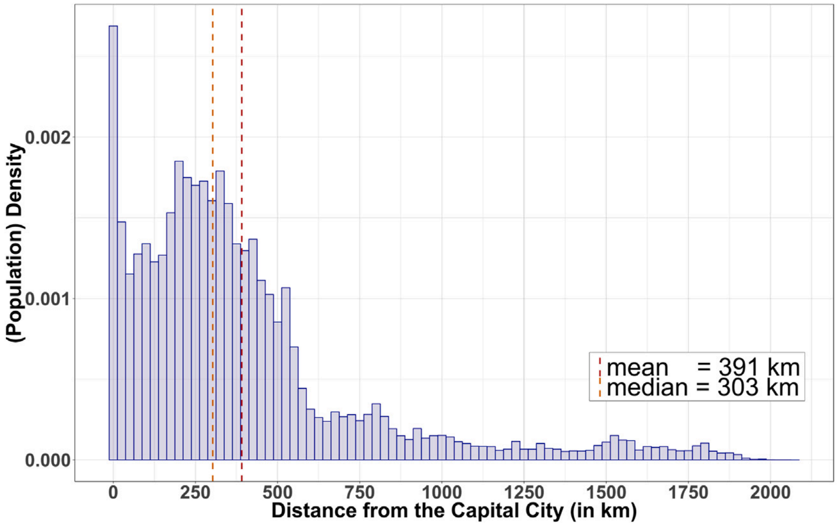

Fig. 2. Isolation from the capital city — Overview. *Note:* This figure is based on own calculations using the UN-adjusted population density grid for the year 2015 by Worldpop. It displays the density distribution of isolation from the capital city for our sample countries. The population within a range of 20 km from the capital city that is omitted by default from all estimations (see Section 1.2). Each bar represents an interval of 25 km. The upper limit of isolation from the capital city is 2075 km. The average person lives 391 km (median: 303 km) away from the capital city.

While the second measure loses valuable information regarding the absolute difference between two consecutive households, its interpretation is more intuitive as differences between households can be expressed in terms of percentile changes within the national wealth distribution.

1.2. Identification

Challenge:

The most intuitive way to assess the effect of isolation from the capital city[9] on local economic development is a simple univariate analysis. In Fig. 3, we plot the share of lit pixels over distance from the capital city. The graph reveals that, on average, the probability of detecting nightlights in a pixel decreases exponentially with distance from the respective capital city. Yet, this correlation is hard to interpret as it is shaped by a variety of confounders. Most notably, isolation from the capital city is correlated with a range of location-specific geographical factors, that are themselves determinants of economic performance. For instance, African capitals tend to be located at the coast which means that proximity to capital cities concurrently translates into the advantages of proximity to ports and international trade (Henderson et al., 2017). Also, it is highly doubtful whether the relationship actually reverses for very high distance as is suggested by the slightly positive slope starting at around 1250 km. It is more likely that these pixels just happen to be in economically more dynamic areas such as the mining areas in the South-Eastern part of DR Congo. Consequently, local economic framework conditions such as endowments with natural resources or local institutions and culture (Michalopoulos and Papaioannou, 2013) confound simple correlations.

One way of addressing these shortcomings would be attempting to explicitly model all relevant relationships by including a wide set of geographical covariates, X_i, and country and ethnicity fixed effects, b_c and b_e. Eq. (3) illustrates the respective OLS model equation where Y_i refers to our measure of *Nightlight Density* in pixel i and CAP_i to log distance from the capital city.[10] Yet, since we have to assume that we only control for a subset, $\hat{X}_i$, of all relevant location-specific factors ($X_i = \hat{X}_i + \widetilde{X_i}$), CAP_i is likely to remain endogenous with unobserved location-specific characteristics $\varepsilon_i = \widetilde{X_i} + u_i$ and $E(\varepsilon_i|CAP_i) \neq 0$. As a result, OLS-estimations based on Eq. (3) are likely biased.

$$Y_i = \beta CAP_i + \gamma X_i + b_c + b_e + \varepsilon_i \tag{3}$$

Construction of the BDD Model:

In the African context, a tangible solution is to establish counterfactuals in a BDD model at national borders. Since African borders were arbitrarily drawn by the colonial powers and divide pre-colonial ethnic homelands with similar geographical, social and historical traits, the assignment of areas close to the boundary to a particular country and its respective capital city can consequently be interpreted as accidental (Asiwaju, 1985; Michalopoulos and Papaioannou, 2016, 2020).

Hence, national borders constitute an arbitrary cutoff with a quasi-random jump in distance from the capital city. However, as opposed to Dell (2010), Basten and Betz (2013), Michalopoulos and Papaioannou (2014) or Dell et al. (2018), simply pooling areas around boundaries does not remove the heterogeneity in unobservables with respect to treatment intensity. As opposed to country-wide indicators, isolation from the capital city is autocorrelated i.e. evolves gradually along the boundary which induces a cross-border correlation and induces a spurious relationship between isolation from the capital city and other autocorrelated (un-)observable location-specific factors that concurrently gradually evolve along both sides of the boundary. For example,

[9] We measure isolation from the capital city as the Euclidean distance between a location (a pixel) and the respective capital city. A drawback of this measure, as compared to more sophisticated travel time or travel cost estimates, is that it is less precise. However, measures that take into consideration the infrastructure development would induce reverse causality bias. This is due to the fact that places that are more dynamic economically tend to be better connected and are therefore closer to the capital city in terms of travel time. Combes and Lafourcade (2005, 346) underline the consistency of our metric by showing that simple distance measures "do a very good job in capturing transport costs in cross-section analysis". Nevertheless, in Section F, we report estimates using travel time based on OpenStreetMap instead.

[10] We log-transform distance to the capital city using the natural logarithm to account for the exponential relationship suggested by Fig. 3. The qualitative intuition behind the log-transformation is that the effects of isolation from the capital city are decreasing with distance from the capital city. Yet, given that the relationship in Fig. 3 is strongly confounded and should therefore be taken with caution, we confirm the adequacy of the log-transformation statistically based on the Akaike information criteria applied to our more sophisticated BDD model.

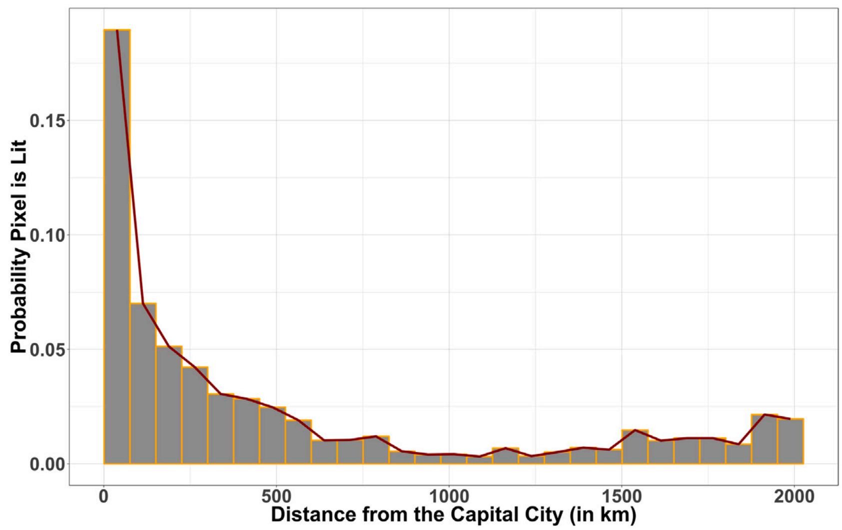

Fig. 3. Isolation from the capital city — Nighttime lights. *Note:* This figure plots the share of lit pixels over distance from the capital city. The population within a range of 20 km from the capital city that is omitted by default from all estimations (see Section 1.2). Each bar represents an area of 75 km. The figure is based on own calculations using 2016 VIIRS nighttime lights from EOG, Colorado School of Mines.

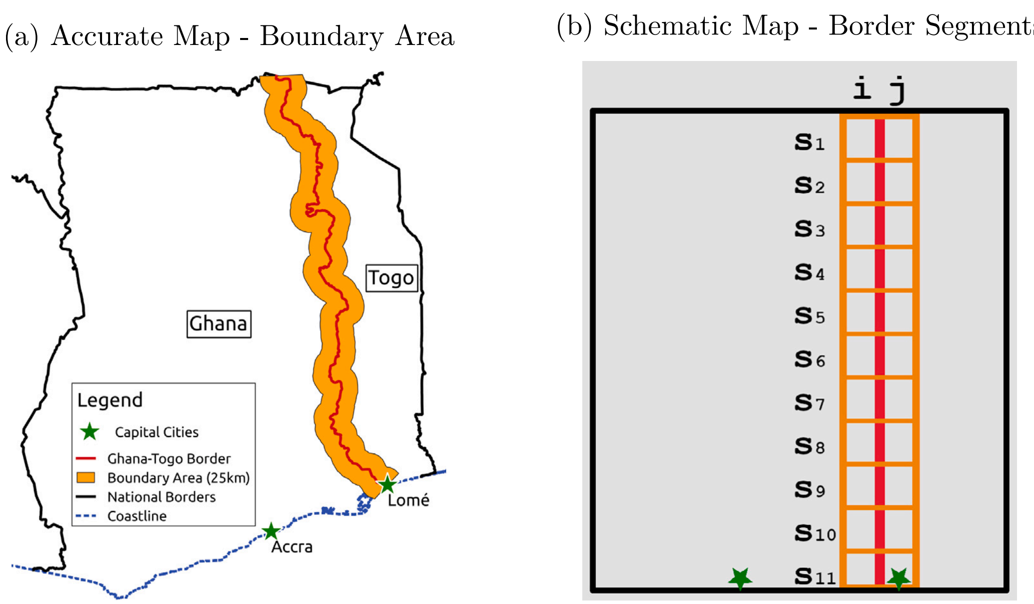

Fig. 4. The Ghana-Togo border. *Note:* The graphs are based on own calculations using 2016 VIIRS nighttime lights from EOG, Colorado School of Mines.

when considering the national boundary between Ghana and Togo (see Fig. 4), distance from the capital city increases for both sides from South to North. The problem is that (un-)observable factors such as distance from the coast or climatic conditions simultaneously evolve along the boundary. As a consequence, a pooled BDD would still be confounded by unobservables.

We overcome this problem by subdividing shared national boundary areas into smaller and more homogeneous segments and conduct the BDD within these segments. In Fig. 4, s_1-s_{11} sketch such segments for the example of the Ghana-Togo border schematically. Technically, we implement this step by including segment fixed effects that essentially partial out anything that equally exists on either side of each boundary segment. Hence, under the assumption that segments are balanced with regard to geographic covariates, this procedure solves the problem of spurious geographic characteristics. We therefore reduce our sample to a small buffer of 25 km around those boundary segments and conduct balancing tests on observables. Yet, we still need to account for (i) the switch in the country and hence the institutional environment as well as (ii) national boundaries that coincide with ethnic boundaries. Firstly, since country characteristics are common across pixels within a country, we can resolve the former by using country fixed. Therefore, our BDD can be interpreted as a localized DID that compares the relative performance of different areas within a country relative to their respective counterfactual segment sides. Secondly, we can avoid that ethnic boundaries confound our estimation by nesting each segment within a partitioned ethnic homeland p. Thereby, this procedure does not only balance geographical covariates[11] but also historical, political

[11] Michalopoulos and Papaioannou (2014, 172) provide an in-depth discussion about the origin of Sub-Saharan African national boundaries and conclude that "differences in geography-ecology, location, and natural resources across the border within partitioned ethnic homelands are small and not systematically linked to differences in national institutions". Conducting a range of balancing tests, we validate that local (un-)observable characteristics are also balanced with respect to isolation from the capital city.

Table 1
OLS results.

	Dependent variable:							
	Probability pixel is Lit in 2016 (VIIRS)				Log light density in 2016 (VIIRS)			
	OLS		Ethnicity FE		OLS		Ethnicity FE	
	All (1)	Border (2)	All (3)	Border (4)	All (5)	Border (6)	All (7)	Border (8)
Log distance from the capital city	−0.020*** (0.005)	−0.021*** (0.006)	−0.025*** (0.005)	−0.014** (0.005)	−0.068*** (0.021)	−0.083*** (0.026)	−0.101*** (0.023)	−0.065*** (0.024)
Geography Cov.	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	37	37	37	37	37	37	37	37
Ethnicity FE	NO	NO	706	351	NO	NO	706	351
Observations	3,518,146	416,667	3,518,146	416,664	3,518,146	416,667	3,518,146	416,664
Adjusted R^2	0.080	0.082	0.130	0.133	0.069	0.069	0.126	0.120

Note: This table reports OLS and boundary area regression results based on Eq. (3). In order to avoid capturing the break between the capital city and the hinterlands, we exclude 20 km around each capital city from our sample. To prevent misassignment of detected nightlights between countries due to blooming, we exclude 3 km on each side of the border. The boundary area regressions ('Border') are restricted to all pixels with centroids within the range of 25 km from shared national borders. The 'Geographical Cov.' include: distance from the coast (in km), elevation (in m), ruggedness (in % slope), % surface covered with water, mean annual temperature, minimum average temperature during the coldest month, maximum average temperature during the warmest month (in °C), crop caloric index, annual precipitation (in mm), longitude and latitude (projected in km). The 'Ethnicity FE' are based on the ethnic homelands in the 'Tribal Map of Africa' (Murdock, 1959). Standard errors in parenthesis are clustered by ethnic homeland. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

and cultural framework conditions. Furthermore, we include polynomials of our running variable *Distance from the Boundary in km* (DFB) for each ethnic homeland in each country separately into our model. These polynomials pick up any potentially remaining heterogeneity within segments.

Eq. (4) presents our main BDD model equation.

$$Y_i = \beta CAP_i + \varphi X_i + b_c + b_s + \sum_{n=1}^{3} \lambda_{n,c,p} DFB_i^n + \xi_i \tag{4}$$

Placebo Tests:

A potential caveat might stem from the circumstance that isolation from the capital city always simultaneously means isolation from a major city and market. In order to affirm that it is in fact isolation from the political center that is driving the effects of isolation from the capital city, we run placebo tests. If hosting the political center is in fact the key characteristic of capital cities with respect to the effects under scrutiny, then the effects of isolation from other major cities within the country should be fundamentally different. For this purpose, we create PLC, representing the log of *distance from the largest non-capital city (in km)*, as a new variable.[12] We then include PLC into Eq. (4) and compare the estimated coefficients for capital and largest non-capital city isolation. However, this placebo test might be confounded by the fact that capital cities tend to be the largest city within the country. To this end, we decompose the effect of isolation from a city into a city type (capital vs. largest non-capital city) and city size effect (big vs. small city in terms of city population). We do so by partialling out the size effect by additionally including interactions between CAP and PLC with their respective population counts.

$$Y_i = \beta_1 CAP_i + \tau_1 CAP_i \times Pop_{cap,c} + \beta_2 PLC_i + \tau_2 PLC_i \times Pop_{plc,c} + \varphi X_i + b_c + b_s + \sum_{n=1}^{3} \lambda_{n,c,p} DFB_i^n + \epsilon_i \tag{5}$$

2. Empirical analysis

2.1. OLS

The results of the OLS estimations based on Eq. (3) for a variety of alternative specifications can be found in Table 1. As becomes clear from the table, irrespective of the precise model specification, isolation from the capital city is significantly negatively related to both the probability and the intensity with which a pixel is lit. A one percent increase in distance from the capital city, on average, decreases the probability that a pixel is lit by around 0.015 percentage points and the nightlight density by roughly approximated around 0.07 percent.[13] Figure A8 presents the respective OLS estimates conducted for each country separately. Figure A8a compares the estimates of the full sample to those of the boundary sample using extensive nightlights corresponding to columns (1) and (2). Likewise, Figure A8b corresponds to the intensive margin corresponding to columns (5) and (6).

The associated balancing tests, for the example of distance from the coast and crop caloric index, can be found in Table A10.

2.2. Border discontinuity graphs

In the next step, the goal is to overcome the imbalance in location-specific characteristics with respect to the treatment intensity of isolation from the capital city. Yet, prior to moving to the most elaborate BDD model based on Eq. (4), we undertake a simplified, yet more intuitive, graphical approach.

We begin by subdividing all national boundaries into segments of 50 km line length with a buffer of 50 km on either side (see A9 for an illustrative map).[14] Each segment side belongs to a different country (and capital city). Next, we determine the average distance to the capital city for each segment side and assign them into the group 'close' if they are relatively closer to their capital city as their opposing boundary segment and into the group 'far' otherwise. Through this procedure, we obtain two groups that are balanced with respect to location-specific covariates but with systematically different distances from their respective capital cities. Thereby, this procedure enables us to assess the impact of crossing the boundary from 'far' to 'close' to the capital city on nightlight density while keeping geographical factors constant.

Fig. 5 plots the border discontinuity graphs with 5(a) referring to the extensive and 5(b) to the intensive scale of nightlights. Areas on the left are on average 830 km and areas on the right 430 km away from the capital city. The graph indicates a large jump of around 25%

12 In order to avoid collinearity with the capital city, we further require the largest non-capital city to be at least 50 km away from the capital city.

13 Please note that one needs to be cautious about the interpretation of the estimate on the intensive margin as discussed in Section 1.1.

14 To obtain balanced subgroups, we drop segments where the minimum distance from the border on either side is greater than 5 km or the maximum distance less than 45 km (which occurs mostly around very uneven boundaries). This reduces our sample from 729,093 to 480,149 pixels.

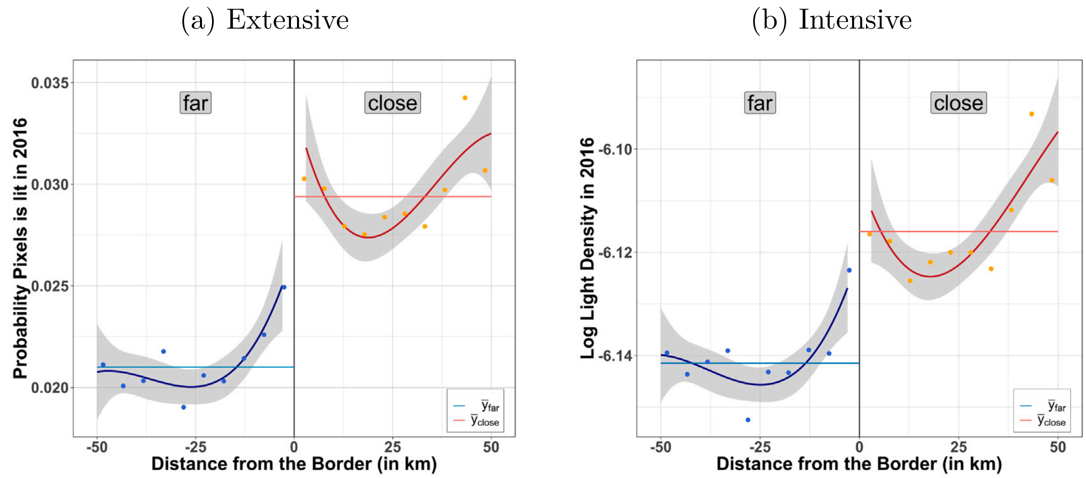

Fig. 5. Boundary discontinuity graphs. *Note:* The graphs illustrate the graphical BDD. The gray buffer around the lines represent the 95% confidence interval. The bins on the left-hand side are, with an average distance of 830 km, relatively far from the capital city and represent a total of 241,241 pixels. In contrast, pixels on the right-hand side are, with an average of around 430 km, relatively close to the capital city and represent 238,908 pixels. The graphs are based on own calculations using 2016 VIIRS nighttime lights from EOG, Colorado School of Mines.

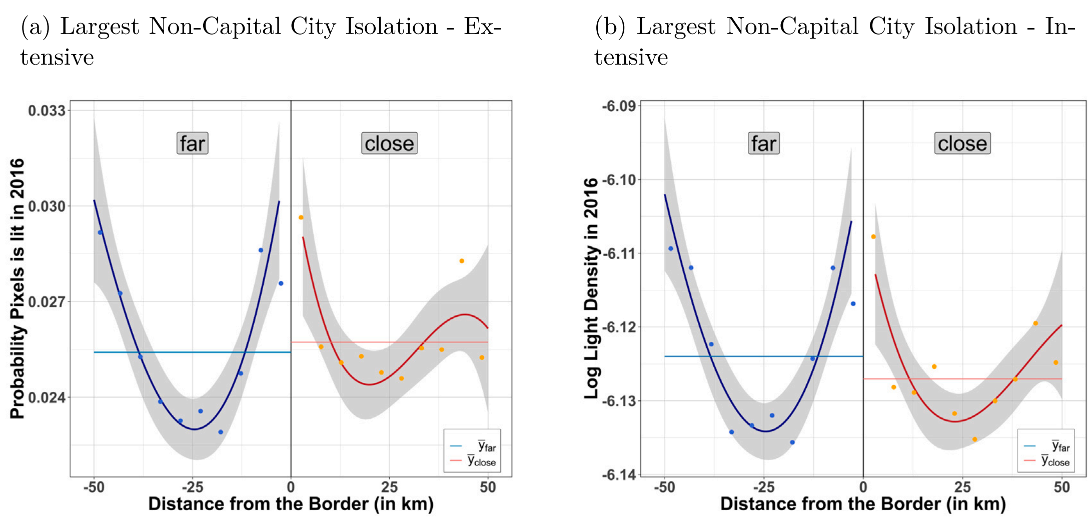

Fig. 6. Boundary discontinuity graphs — Placebo. *Note:* The graphs illustrate the placebo tests regarding the graphical BDD. The gray buffer around the lines represent the 95% confidence interval. The bins on the left-hand side are, with an average distance of 820 km, relatively far from the largest non-capital city and represent a total of 238,980 pixels. In contrast, pixels on the right-hand side are, with an average of around 440 km, relatively close to the largest non-capital city and represent 237,153 pixels.

in the probability with which pixels are lit when moving from relatively remote to areas near the capital city.

Even if (un-)observable geographical factors should by construction be balanced between the two regimes ('far' and 'close'), this needs to be empirically confirmed. Figure A6 illustrates the respective graphs for a range of geographical indicators. All covariates, except for distance from the capital city, move smoothly across the cutoff and do not exhibit significant discontinuities. Based on the balancing tests, we can thus conclude that the jump in nightlight density stems from differences in isolation from the capital city.

A remaining concern is that the results might be confounded by country characteristics. For example, supposing that small countries perform better economically, and given that small countries tend to constitute the 'close' group, we would expect to see comparable patterns even in the absence of effects induced by isolation from the capital city. Moreover, it might be that the effects are a result of isolation from a major city rather than isolation from the political center. Yet, if either of the two concerns were valid, we should observe a similar result when using the location of other major cities instead. Fig. 6 depicts the graphs when conducting the analogous analysis but for isolation from the largest non-capital city.

As it turns out, the placebo graphs clearly indicate that there are no effects associated with isolation from other cities.[15] Yet, despite these highly encouraging results, at this stage, we cannot be entirely sure that the estimated effects are causal. While the graphical BDD, balancing and placebo tests give strong support to our hypothesis, in the next step, we need to properly account for the switch between countries and ethnic homelands at the cutoff.

2.3. Boundary regression discontinuity

In order to tackle the remaining shortcomings pointed out in Section 2.2, we move to a more sophisticated BDD regression model based on Eq. (4). In this setting, the switch between countries at the boundary cutoff is accounted for using country fixed effects. Furthermore, we identify arbitrary borders by exclusively using border pieces that divide ethnic homelands. Additionally, we nest our boundary segments within

[15] The respective balancing graphs, once again, indicate that (un-)observable geographical factors are balanced and move smoothly across the cutoff (see Figure A7).

Table 2
Boundary discontinuity estimation.

	Dependent variable:							
	Probability pixel is Lit in 2016 (VIIRS)				Log light density in 2016 (VIIRS)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log distance from the capital city	−0.023** (0.010)	−0.025** (0.010)	−0.031** (0.012)	−0.031** (0.013)	−0.104** (0.048)	−0.112** (0.048)	−0.137** (0.058)	−0.143** (0.061)
	Polynomials for: distance from the border × country × ethnicity (305 groups)							
2nd order	x	x	–	–	x	x	–	–
3rd order	–	–	x	–	–	–	x	–
4th order	–	–	–	x	–	–	–	x
Geography Cov.	NO	YES	YES	YES	NO	YES	YES	YES
Country FE	36	36	36	36	36	36	36	36
Segment FE	569	569	569	569	569	569	569	569
Observations	168,620	168,620	168,620	168,620	168,620	168,620	168,620	168,620
Adjusted R^2	0.175	0.177	0.182	0.185	0.155	0.156	0.161	0.164

Note: This table reports our main BDD regression results corresponding to Eq. (4). In order to avoid capturing the break between the capital city and the hinterlands, we exclude 20 km around each capital city from our sample. To prevent misassignment of detected nightlights between countries due to blooming, we exclude 3 km on each side of the boundary. The 'Geographical Cov.' include: distance from the coast (in km), elevation (in m), ruggedness (in % slope), % surface covered with water, mean annual temperature, minimum average temperature during the coldest month, maximum average temperature during the warmest month (in °C), crop caloric index, annual precipitation (in mm), longitude and latitude (projected in km). Boundary segments corresponds to a buffer of 25 km around border pieces of 50 km line length and are entirely nested within a restricted ethnic homeland based on the 'Tribal Map of Africa' (Murdock, 1959). The observations are weighted such that each segment side has the same aggregated weight as its counterfactual. Standard errors in parenthesis are clustered by boundary segment. *p < 0.1; **p < 0.05; ***p < 0.01.

the restricted partitioned ethnic homelands to prevent ethnic shifts within segments (see Section 1.2).

Table 2 presents the BDD results for the extensive (columns (1)-(4)) and intensive (columns (5)-(8)) scales of nightlight density. Columns (1) and (5) exclude all geographical covariates and serve as a reference to assess the extend to which potentially omitted location-specific characteristics might confound our estimates. When comparing column (1) to (2) and column (5) to (6), it becomes clear that our identification strategy proves to be effective. Whether or not we include an extensive set of geographical covariates changes the magnitude of our estimates only by a small and statistically insignificant margin. With the exception of ruggedness, all balancing tests confirm that in our BDD model, (un-)observable factors are balanced with respect to treatment intensity — the coefficients are either insignificant and/or very close to zero and economically negligible (see Table A11). The models in columns (2)-(4) as well as (6)-(8) feature an increasing number of polynomials of the running variable, distance from the border. In order to allow for a sufficient degree of flexibility regarding the dynamics of nightlights around the boundary, we choose third order polynomials as our default option. Consequently, applying our BDD estimation framework, we can verify that isolation from the capital city has a negative causal impact on economic development. A one percent increase in distance from the capital city decreases the probability of a pixel to be lit by 0.031 percentage points corresponding to 0.12 times the average probability to be lit (2.5%) and the nightlight intensity by roughly approximated 0.14 percent.[16] The causal estimates are therefore of a slightly higher absolute magnitude than the OLS and boundary area estimates (see Table 1). This differential is likely triggered by the fact that OLS estimates are confounded by local economic conditions. One such example are the economically high performing mining areas in the South-Eastern part of DR Congo far away from the capital city Kinshasa.

Regarding inference, it is important to account for spatial autocorrelation which is why we cluster standard errors at the boundary segment level by default. Alternatively, when double-clustering standard errors at the country and country-pair border level for our baseline estimates in columns (3) and (7), we obtain −0.031* (0.017) and −0.137* (0.081) respectively, and when double-clustering at the country and broad ethnicity family level instead, we obtain −0.031* (0.018) and −0.137 (0.084) respectively (Cameron et al., 2011). Furthermore, we apply the methodology by Conley (1999), that accounts for arbitrary spatial dependence within a radius around each unit with and without Bartlett correction for various distance cutoffs (50, 100, 200, 500 or 1000 km; see Table A14). These alternative cluster specifications tend to yield slightly larger but overall similar standard errors.

2.4. Placebo tests

In this section, we use our BDD framework to test whether the driving characteristic of isolation from the capital city is rooted in isolation from the political center or, alternatively, based on isolation from a major city within the country. In order to answer this question we compare the effects of isolation from the capital city to isolation from other major cities within the country, the largest non-capital cities, using our estimation approach specified in Eq. (5).

The results in Table A15 indicate very clearly that the effects of isolation from the capital city differ fundamentally from those of isolation from the largest non-capital city. While, the impact of isolation from the capital city is significantly negative across all model specifications,[17] the effects associated with isolation from the largest non-capital city are insignificant and very close to zero. This result holds when decomposing isolation from a city into a city type and city size effect (see column (6) and (8) where we additionally control for the interactions of capital and largest non-capital city isolation with their respective city population counts). These results imply that the type of a city (capital vs. other cities) is more important than the city size. We conclude that hosting the political center of the country is the driving force behind the effects of remoteness from the capital city.

2.5. Sensitivity analysis summary

This section contains a summary of the robustness and sensitivity tests (see Section E in the appendix for more detail). In Table A2, we show that the results are robust with regard to reducing the bandwidth of the segments around the boundary from 25 km to 15 km, only exclude pixels within 1.5 km instead of 3 km around the boundary,

[16] Please note that one needs to be cautious about the interpretation of the estimate on the intensive margin as discussed in Section 1.1.

[17] Due to some collinearity between capital and largest non-capital city isolation, the coefficient of isolation from the capital city is slightly lower as compared to Table 2.

and applying a varying degree of zero up to fourth order polynomials of the running variable. We then show that the results are stable when increasing the sample restriction from excluding 20 km (default) around the capital city to 50, 75 and 100 km (Table A3). In Figure A4, we demonstrate that the results are not driven by an individual country or boundary. Further, in Table A4, we examine if there are heterogeneities between groups of countries. We find that the effects seem to be more relevant in democracies, as opposed to autocracies, and more relevant in relatively underdeveloped countries. In Table 2, we show that the pattern of newly lit pixels since 1992 is also negatively associated to remoteness. This finding supports the view that the adverse effects of isolation from the capital city are still actively shaping local economic growth as opposed to reflecting a persistent pattern from the past. We also show that the representation of ethnicities i.e. whether they are a minority or majority within the country are not driving the effects. In addition, we demonstrate that the implications of isolation from the capital city go beyond population agglomeration and hold when controlling for population density or using measures of light per capita as dependent variable (see Table A5). We also show that our results hold when controlling for distance to the closest river, waterbody, mine, city of varying thresholds and regional capital city[18] within the country (see Tables A6 and A7). Finally, in Table A8, we cross-validate our findings using the DHS wealth index as an alternative measure of economic performance.

Consequently, based on a wide range of sensitivity tests, we conclude that our results are highly robust to a wide range of alternative specifications and considerations. The robustness results thereby confirm our estimated negative causal impact of remoteness from the capital city on economic performance.

3. Mechanisms

So far, we have shown that isolation from the political center within the country, the capital city, has strong adverse causal net effects on local economic performance. Since isolation from the capital city itself is not an economic variable, there must be a more concrete economic link between remoteness from the capital city and economic performance.

The provision of public goods is a fundamental driver of economic development (Besley and Ghatak, 2006; Dittmar and Meisenzahl, 2019) and Campante and Do (2014) find that US states with isolated capital cities provide less public goods. This result might reflect aggregations of the local economic patterns that are under scrutiny in this study and might be a result of low levels of public goods in isolated areas. Using a fixed effects OLS model, Michalopoulos and Papaioannou (2014) find that distance from the capital city is negatively correlated with law enforcement, which represents a public good in the wider sense. The authors' finding can therefore be interpreted as early suggestive evidence that points at reduced levels of public goods in African regions isolated from the capital city.

Using our BDD model, in this section, we show that a variety of local public goods are undersupplied in isolated areas which supports the view that the level of public goods provision constitutes an important mediator between isolation and economic development. In a subsequent step, we shed light into the causes of the low levels of public goods provision in remote areas and investigate political representation and accountability as potential mechanisms. While the results on political representation are ambiguous, the results on accountability clearly suggest that dysfunctional feedback and accountability mechanisms are relevant with regard to the effects. Lastly, we investigate two alternative potential channels that might constitute important mediators: Market access and conflict. We show that neither market access nor conflict are likely to be relevant with regard to the observed patterns.

3.1. Public goods

Based on rounds 5, 6 and 7 of the Afrobarometer,[19] we generate an index on the provision of public goods reflecting whether a cluster is provided with paved roads, electricity grid access, piped water and a sewage system. The public goods index is the average of binary responses about the availability of the respective provisions. Consequently, the index can take the values of 0, 0.25, 0.5, 0.75 and 1 corresponding to the respective share of public goods being present. Table 3 combines the results of OLS, boundary area and BDD regression models, similar to those in Section 2. We include a range of cluster and geography controls by default into all models. This includes a dummy variable corresponding to whether the cluster is located in an urban or rural area as this is directly related to public goods provision. However, since the degree of urbanization is an outcome of remoteness and thereby endogenous to the model, the estimated absolute magnitudes constitute lower bound estimates.[20] Furthermore, it should be noted that the Afrobarometer dataset has less observations than the nightlights sample. In order to avoid the sample size from getting too small, we do not restrict the ethnic homelands with a negative buffer before defining the boundary segments. Moreover, since Afrobarometer respondents are clustered in enumeration areas, with in some cases just one or two clusters per segment side, we do not account for distance from the boundary disaggregated but rather focus on capturing the general relationship.

A one percent increase in isolation from the capital city decreases the probability index of public goods provision by around 10 percentage points.[21] This relationship also holds, albeit with a slight upward bias, for the OLS and boundary area regressions.

To cross-validate our findings on public goods we use alternative geocoded measures of public goods including (i) a large dataset on roads based on Michelin maps that were geocoded and digitized by Jedwab and Storeygard (2022) based on which we create dummies indicating whether a pixel intersects with a road or tarred road and (ii) an extensive dataset on the location of health facilities across the African continent assembled by Maina et al. (2019) based on which we compute distance to the closest health facility (including public and private lower tier health centers and hospitals), the closest hospital as well as the closest public health facility (public health center or hospital).

Column (2) in Table A16 indicates that a one percent increase in distance from the capital city reduces the probability of a pixel to be connected to a tarred road by 1.9 percentage points. Columns (4) and (5) report that a one percent increase in distance from the capital city increases the distance to the closest higher tier hospitals or publicly provided health facility by around 0.4 and 0.6 percent respectively. In contrast, for coarser measures like the availability of any type of road (column (1)) or any medical center (column (3)), there are no

[18] We define the regional capital city as the first-level administrative capital city as defined in the global administrative unit layer (GAUL) by the Food and Agriculture Organization of the United Nations (FAO). We retrieved information about the name of the respective regional capital city from various sources including Wikipedia and geocoded the data using OpenStreetMaps. In a last step, we manually examined and corrected the shapefile of regional capital cities to avoid geocoding errors.

[19] The Afrobarometer sample comprises 26 out of the 38 countries in our sample. The following countries are not covered: Angola, Central African Republic, Chad, Congo, Djibouti, DR Congo, Equatorial Guinea, Eritrea, Ethiopia, Guinea-Bissau, Mauritania and Rwanda.

[20] When excluding the urban dummy, the estimated coefficient corresponding to Table 3 column (3) is -0.124^{**} (0.057). Additionally or alternatively measuring agglomeration as the mean population density in a 5 or 10 km buffer around the cluster has no significant impact on the estimated coefficient.

[21] The corresponding placebo tests and associated F-tests indicate that the effects are indeed specific to isolation from the capital city and do not hold for the largest non-capital cities.

Table 3
Channel analysis: Public goods provision (Afrobarometer).

	Dependent variable: Public goods index		
	OLS (1)	Boundary Area (2)	BDD (3)
Log distance from the capital City	−0.020** (0.009)	−0.034*** (0.012)	−0.088** (0.038)
	Polynomials for: distance from the border		
3rd order	–	–	x
Cluster Cov.	YES	YES	YES
Geography Cov.	YES	YES	YES
Country × Round FE	73	71	63
Segment FE	–	–	138
Observations	11,959	1868	1069
Adjusted R^2	0.480	0.487	0.670

Note: This table reports the regressions on the impact of isolation from the capital city on the level of public goods provision using the Afrobarometer survey. The 'Cluster Cov.' include the average age, age squared and sex of all respondents in the cluster. The 'Geographical Cov.' include: distance from the coast (in km), longitude and latitude (projected in km) and whether the cluster is located in an urban or rural setting. Column (1) correspond to the full sample OLS regression, columns (2) to the 25 km boundary area regression and column (3) to the BDD regression. Boundary segments corresponds to a buffer of 25 km around border pieces of 50 km line length and are entirely nested within an ethnic homeland based on the 'Tribal Map of Africa' (Murdock, 1959). In column (1), the observations are weighted according to the Afrobarometer survey weights. In column (3), the observations are weighted such that each side of a segment has the same aggregated weight as its counterfactual. Standard errors in parenthesis are clustered by Afrobarometer cluster and ethnic homeland (columns (1) and (2)) and Afrobarometer cluster and boundary segment (column (3)). *p < 0.1; **p < 0.05; ***p < 0.01.

significant differences between areas close and far from the capital city. This finding underlines that it is important to use detailed data and take into consideration the quality when evaluating public goods provision.

We conclude that people in areas isolated from the capital city receive significantly less and lower quality public goods and services from their political leaders as compared to those closer to the capital city. Public goods are therefore likely to be an important mediator between isolation from the capital city and economic development.

However, it is not obvious why the provision of public goods in isolated areas is reduced. It might be that for economic reasons such as high transport costs, lack of specialized labor and intermediary goods the provision of public goods is simply more costly and therefore reduced in isolated areas. In context of India's national rural road program, Asher et al. (2018) document that the cost of road construction is the same in areas close and far from regional headquarters. While we do not have access to data to explicitly test for this potential channel in our context, these findings are indicative that the cost of public goods provision such as road infrastructure is generally similar across locations. Furthermore, if the cost of certain public goods would be a central mechanism, it should not primarily be determined by distance from the capital city but rather by remoteness from cities and markets in general. Yet, the fact that our placebo tests indicate that distance from other major cities has no comparable effect on public goods (Table A18), and that the effects of remoteness from the capital city are not primarily associated to market access or remoteness from the regional capital or closest city (see Table 7 and A7) puts the cost argument as a key driver into question. We therefore consider it more likely that there are political mechanisms at play that lead to a reduced public goods provision in areas isolated from the capital city.

In the next step, we empirically investigate two potential political explanations. Firstly, geographical isolation might translate into political isolation and thereby exclusion from government resources. For example, isolated areas might be less represented within the incumbent government and therefore benefit less from ethnic or regional favoritism (Hodler and Raschky, 2014; Dreher et al., 2019). Another explanation could be that public goods might be lower due to dysfunctional feedback and accountability mechanisms. Political agents might simply lack the incentives to provide those in isolated areas with public goods.

3.2. Public goods and political representation

We start by investigating whether political representation and 'political favoritism' are relevant in this context and test whether segment

Table 4
Channel analysis: Political representation balancing tests.

	Dependent variable: Political representation							
	Region of birth of leader (1/0)			EPR power coalition status (in years since 2000)				
	All (1)	Since 2000 (2)	Ongoing (3)	Irrelevant (4)	Powerless (5)	Junior (6)	Senior (7)	In power (8)
Log distance from the capital city	−0.026 (0.039)	−0.152*** (0.032)	−0.091*** (0.027)	−2.569*** (0.838)	−1.096** (0.530)	2.278*** (0.785)	1.386** (0.667)	3.664*** (0.909)
Population share of region	1.232*** (0.308)	1.188*** (0.247)	0.837*** (0.224)	–	–	–	–	–
Country FE	35	35	35	33	33	33	33	33
Segment FE	568	568	568	531	531	531	531	531
Observations	1138	1138	1138	1064	1064	1064	1064	1064
Adjusted R^2	0.438	0.347	0.248	0.468	0.704	0.442	0.612	0.564

Note: This table reports the balancing tests on political representation with regard to isolation from the capital city. The observational unit in these models are the BBD boundary segments. The dependent variables in column (1)–(3) are dummies indicating whether a head of state came from the same admin-1 region as the boundary segment side (since independence, since 2000 and only referring to incumbent state leaders). The dependent variables in columns (4)–(8) correspond the total number of years a segment side has spent under the respective power access status in the period between 2000 and 2018 (more information on these categories can be found in Section A). Boundary segments corresponds to a buffer of 25 km around border pieces of 50 km line length and are entirely nested within a restricted ethnic homeland based on the 'Tribal Map of Africa' (Murdock, 1959). Standard errors in parenthesis are clustered by boundary segment. *p < 0.1; **p < 0.05; ***p < 0.01.

Table 5
Channel analysis: Perception of political leadership and accountability.

	BDD Model with dependent variable z-score of:				
	Trust in political leaders (1)	Government corruption perception (2)	Government performance evaluation (3)	Frequency of news consumption (4)	Advocate checks and and balances (5)
Log distance from the capital city	0.191*** (0.061)	−0.078* (0.043)	0.171*** (0.064)	−0.139** (0.066)	−0.094** (0.041)
	Polynomials for: distance from the border				
3rd order	x	x	x	x	x
Household Cov.	YES	YES	YES	YES	YES
Geography Cov.	YES	YES	YES	YES	YES
Country × Round FE	70	71	71	71	71
Segment FE	140	140	140	140	140
Observations	7812	6705	6593	8113	7763
Adjusted R^2	0.178	0.164	0.202	0.169	0.135

Note: This table reports the regressions on the impact of isolation from the capital city on the perception of political leaders and accountability. The 'Household Cov.' include: age, age squared and sex of respondent. The 'Geographical Cov.' include: distance from the coast (in km), longitude and latitude (projected in km) and whether the household is in an urban or rural setting. Columns (1)–(3) correspond to trust, corruption perception and performance evaluation of their national political leadership. Column (4) corresponds to the frequency of news consumption and column (5) to the extent to which respondents are advocating a system of checks and balances to monitor the actions of their political leaders. All models are BDD regressions using 'Segment FE' for boundary segments of 50 km length with a buffer of 25 km that are nested within an ethnic homelands based on the 'Tribal Map of Africa' (Murdock, 1959). All observations are weighted such that each side of a segment has the same aggregated weight as its counterfactual. Standard errors in parenthesis are clustered by Afrobarometer cluster and boundary segment. *p < 0.1; **p < 0.05; ***p < 0.01.

sides farther away from the capital city exhibit a lower access to power. For this purpose, we examine whether the national leaders are more likely to come from the region of segment sides closer to the capital city using an updated version of the database by Dreher et al. (2016, 40-41). Since measuring an area's political representation and access to power solely based on the head of state might not sufficiently reflect the overall power access, we complement the analysis using the Ethnic Power Relations Core Dataset 2019 (EPR) (Vogt et al., 2015) and combine it with spatial information about the location of the respective politically relevant groups (Wucherpfennig, 2011). The results in Table 4 indicate that a one percent increase in distance from the capital city decreases the probability that the incumbent political leader comes from the region of the segment side by 9 percentage points. In contrast, it turns out that a one percent increase in isolation increases the number of years participated in the ruling government by 3.6 years (within a period of 18 years since 2000).[22] Since the results go in opposite directions, it remains ambiguous which of the two outweighs the other. Given that these results indicate that isolated areas are not systematically excluded from power, we conclude that political representation is unlikely to be the central mechanism.

3.3. Public goods and accountability

Next, we examine whether accountability is relevant to the mechanism between isolation and public goods provision. The idea behind this channel is that due to information frictions isolated citizens are less aware about government actions and, as compared to their counterparts close to the capital, penalize their leaders less for a low provision with public goods. As a consequence, the marginal benefit of politicians to provide local public goods is reduced in isolated areas.

We begin by analyzing how people in different geographical locations relate to their political leaders. Given the reduced provision of public goods, we might expect that isolated groups demonstrate mistrust towards their government. However, as it turns out, people farther isolated from the capital exhibit a significantly higher level of trust in their political leadership (see column (1) in Table 5). The results in Table A17 demonstrate that the increased trust in politicians is associated with the ruling party but not with the opposition party suggesting that the reason for the higher trust does not stem from a generally higher level of trust or credulity in isolated areas. Instead, it seems that the increased trust in state leaders is a result of a lower corruption perception and a higher performance evaluation of national leaders (see columns (1) and (2) in Table 5). These patterns support the view that isolated citizens are not aware of their disadvantaged position and therefore do not demand a higher provision of public services. Isolated citizens might trust their national leaders more because they know less about them. In line with this view, we find significant imbalances with regard to the frequency of news consumption which is considerably smaller in isolated areas (see Table 5).[23] The limited exposure of media and information might also be the reason why isolated citizens are less aware of the importance of accountability mechanisms in politics and are less inclined to advocate for checks and balances on the government (Table 5).

To confirm that it is information frictions and not other differences between areas close and far from the capital city that lead to an asymmetric perception and trust in political leaders, we need to show that the difference in the perception of political leaders changes when their performance changes. Hence, if our hypothesis was true, we should observe that isolated citizens adjust their perception and evaluation of the political leadership less when the level of misgovernance and corruption changes. We can test this empirically by creating a panel of Afrobarometer rounds 5 (2011–2013), 6 (2014–2015) and 7 (2016–2018) and add information on government performance using the corruption perception index (CPI) by Transparency International as a proxy.[24] We define the 'corruption level' as $100 - CPI$, hence ranging from 0 to 100 with higher values indicating higher levels of corruption.

[22] A simple explanation for this phenomenon might be that incumbent governments tend to include isolated groups into the government to counteract secessionist aspirations. Another possible reason could be that isolated groups are striving to have an impact politically and overcompensate for their geographical isolation.

[23] This result is in line with Campante and Do (2014) who find that people further away from US state capitals are less informed about state politics.

[24] Transparency International defines corruption as 'abuse of entrusted power for private gain' and produces the CPI every year based on a variety of sources including assessments from several international institutions as well as a range of surveys with experts. Unfortunately, we cannot integrate earlier rounds of the Afrobarometer because the CPI uses a new methodology since 2012 and some of Afrobarometer questions that we use are not available for earlier rounds.

Table 6
Channel analysis: Dynamic political support.

	Dependent variable:					
	Corruption perception		Trust in political leaders		Vote for government	
	Panel (1)	BDD-Panel (2)	Panel (3)	BDD-Panel (4)	Panel (5)	BDD-Panel (6)
Log corruption level × Log dist CAP	−0.392*** (0.113)	−0.464 (0.703)	0.177* (0.100)	1.318** (0.576)	0.165*** (0.058)	0.963** (0.448)
	Polynomials for: distance from the border					
3rd order	–	x	–	x	–	x
Log corruption level	*Absorbed*	Yes	*Absorbed*	Yes	*Absorbed*	Yes
Log distance from the capital city	Yes	Yes	Yes	Yes	Yes	Yes
Geography controls	Yes	Yes	Yes	Yes	Yes	Yes
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes
Cnt × Ethn × Round FE	Yes	No	Yes	No	Yes	No
Country FE	No	Yes	No	Yes	No	Yes
Ethnicity FE	No	Yes	No	Yes	No	Yes
Round FE	No	Yes	No	Yes	No	Yes
Segment × Round FE	–	161	–	161	–	149
Observations	77,712	4089	86,678	4755	63,137	3195
Adjusted R^2	0.158	0.108	0.193	0.152	0.280	0.226

Note: This table reports the regressions on how Afrobarometer respondents adjust their beliefs about corruption among politicians, trust into the political leadership and whether they would vote for the incumbent government with regard to changes in degree of political misconduct as measured by the CPI as well as with regard to how far away they live from the capital city. The 'Household Cov.' include: age, age squared and sex of respondent. The 'Geographical Cov.' include: distance from the coast (in km), longitude and latitude (projected in km) and whether the household is in an urban or rural setting. The dependent variable in columns (1)–(2) is the normalized corruption perception among political leaders, in columns (3)–(4) it is the normalized level of trust into the political leadership and in columns (5)–(6) it is a dummy indicating whether the respondent would vote for the incumbent government if there was an election held. All observations are weighted such that each side of a segment has the same aggregated weight as its counterfactual. Standard errors in parenthesis are clustered by Afrobarometer cluster and ethnicity × round. $^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

In Table 6, we analyze how citizens update their beliefs about their political leaders over time using a panel including all respondents[25] and a panel reduced to boundary segments. The estimate on the interaction of the corruption level and log distance from the capital city explicitly compares how people further from the capital city react relative to those closer to the capital city when the corruption level changes. The results indicate that when the corruption level rises, isolated citizens increase their corruption perception less than those closer to the capital city, vice versa. Similarly, isolated citizens lose less trust and reduce their marginal propensity to vote for the incumbent government less when the level of corruption and misgovernance is rising, vice versa.

Using the CPI as a proxy for government performance would be problematic when comparing levels across countries, as the level of the CPI could be related to endogenous characteristics such as institutions that could also be related to how citizens perceive the government perception of citizens. However, by including country fixed effects, we specifically focus on how changes in corruption relate to changes in perception and voting. One of the disadvantages of focussing on changes is that it introduces even larger measurement error in proxying government performance using the CPI. Since this measurement error is likely to be idiosyncratic and orthogonal to unobservables, the estimates suffer from attenuation bias — hence the absolute magnitude of the effects should be interpreted as a lower bound estimate.

These results have important repercussions on the functioning of effective accountability mechanisms that keep the actions of political agents aligned with the interest of the people. Since isolated citizens are less reactive to their political agents – including both penalties for bad and rewards for good government actions – national leaders are left with reduced incentives to allocate government resources to isolated areas. From the perspective of political leaders, the marginal increase in votes from improved government performance is lower in isolated areas. This can explain why we observe a reduced level and quality of public goods and services in areas isolated from the capital city. Moreover, the corresponding placebo tests indicate that these patterns and dynamics are specific to isolation from the capital city and do not apply to isolation from the largest non-capital cities (see Tables A18 and A19).

3.4. Market access and trade

As an alternative potential channel, distance to the capital city might affect economic growth through reduced market access (Redding and Sturm, 2008; Buys et al., 2010; Bosker and Garretsen, 2012; Storeygard, 2016; Donaldson and Hornbeck, 2016; Jedwab and Moradi, 2016; Gibbons and Wu, 2019; Jedwab et al., 2017). Places that are farther away from the capital city might be farther from markets in general and face higher costs when buying and selling intermediate and final goods and services. This, in turn, might have negative consequences on the opportunities for economies of scale and productivity growth. For this reason, we test if segment sides closer to the capital city exhibit higher levels of market access, MA_s. Since in a BDD framework market access would by construction we balanced across the boundary under the assumption of open borders, for this exercise we restrict market access to within the country and keep in mind that this inevitably overestimates potential differences in market access across the border. We apply the conceptual framework of Harris (1954) and Donaldson and Hornbeck (2016) and other recent applications in the African context by Chiovelli et al. (2018) and Jedwab and Storeygard (2022) and approximate market access as:

$$MA_s \approx \sum_{d=1}^{D} \tau_{s,d}^{-\theta} N_d \tag{6}$$

In Eq. (6), $\tau_{s,d}$ refers to travel time between segment side s and all destination cities d within the country, θ represents the trade elasticity parameter that captures how trade declines with travel time, and N_d measures the market size that we approximate with the destination city population. We obtain a comprehensive database of geolocated African cities including their population size from Africapolis (OECD/SWAC, 2020) and compute travel times using OpenStreetMaps via the OSRM routing engine. Regarding the trade elasticity parameter, we follow Donaldson and Hornbeck (2016), Chiovelli et al. (2018) and Jedwab and Storeygard (2022) and use 3.8 as default but also

[25] Note that, as always, we exclude respondents within 20 km from the capital city by default.

Table 7
Channel analysis: Market access.

	Dependent variable: Market access index					
	Trade elasticity parameter					
	$\tau = 2.79$		$\tau = 3.8$		$\tau = 4.46$	
	incl. CAP (1)	excl. CAP (2)	incl. CAP (3)	excl. CAP (4)	incl. CAP (5)	excl. CAP (6)
Log distance from the capital city	−0.772*** (0.169)	−0.220 (0.193)	−0.748*** (0.275)	−0.208 (0.306)	−0.716** (0.348)	−0.205 (0.381)
Geography Cov.	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	35	35	35	35	35	35
Segment FE	551	551	551	551	551	551
Observations	1104	1104	1104	1104	1104	1104
Adjusted R^2	0.692	0.666	0.630	0.611	0.607	0.592

Note: This table reports the results on market access statistics. For each segment side we estimate a market index indicator based on Eq. (6) using the OSRM routing engine and applying different trade elasticity parameters. Columns (2), (4) and (6) exclude the capital city itself as a destination market. The 'Geographical Cov.' include a segment side's average of distance from the coast (in km), elevation (in m), ruggedness (in % slope), % surface covered with water, mean annual temperature, minimum average temperature during the coldest month, maximum average temperature during the warmest month (in °C), crop caloric index, annual precipitation (in mm), longitude and latitude (projected in km). Boundary segments corresponds to a buffer of 25 km around border pieces of 50 km line length and are entirely nested within a restricted ethnic homeland based on the 'Tribal Map of Africa' (Murdock, 1959). Standard errors in parenthesis are clustered by boundary segment. *p < 0.1; **p < 0.05; ***p < 0.01.

report results when alternatively using 2.79 and 4.46 based on the estimations conducted by Simonovska and Waugh (2014). The results in Table 7 indicate that there is no significant different in market access in areas close or far from the capital city when we exclude the capital city itself irrespective of which trade elasticity parameter we chose. Moreover, the fact that market access is significantly reduced when including the capital city itself is not surprising as distance to the capital city mechanically decreases market access if the capital city is itself defined as a market. Nevertheless, since capital cities constitute important markets within the country, these effects might be significant. Yet, if the capital city actually mattered as a market rather than a capital city, we should observe similar effects for remoteness from other major markets within the country. The fact that, even when accounting for city and hence market size, the coefficients associated with the largest non-capital cities are insignificant (see Table A15) raises doubt on the relevance of market access in this context.

Another way of testing for this channel makes use of the fact that the shared national boundaries in our sample feature different degrees of border permeability with regard to trade. If borders did not constitute barriers for trade, in our BDD design, counterfactual pixels on both sides of the boundary would by construction have the same market access. Therefore, if market access was indeed a relevant channel, we should observe that the effects of remoteness from the capital city are strongest at relatively closed and lower at relatively open national boundaries. In Table A20, we therefore test whether the impact of isolation from the capital city is lower at boundaries within trade blocs such as within free trade agreements (FTA), customs and monetary unions. For this purpose, we include interactions between *Log Distance from the Capital City* and dummies indicating low barrier boundaries into our main BDD model (see Eq. (4)). In columns (1) and (2) in Table A20, we focus on boundaries within FTAs. The results suggest that the effects are stronger within FTAs than at more restrictive boundaries which is in contrast to the idea that market access is driving the results. In columns (3) and (4), we tighten the criterion for relatively open borders and only consider customs unions and in columns (5) and (6) only those that also share a common currency. In both cases, we cannot reject the hypothesis that the effects at relatively open boundaries are any different than at restrictive ones.

3.5. Conflict

There is vast empirical evidence that conflict has negative implications for economic development (see for example Ray and Esteban (2017) for a general overview and Serneels and Verpoorten (2015) or Besley and Reynal-Querol (2014) for evidence from the African continent). Further, there are multiple ways in which isolation from the capital city might affect conflict, hence ultimately economic performance. Since a conflict or protest farther away from the capital represents a lower threat to a government (Johnson and Thyne, 2018; Campante et al., 2019), the state might be less inclined to prevent or resolve such isolated conflicts. Also, the capacity of a state to counter conflicts in isolated areas might simply be restricted and even attract conflict parties to target remote areas (Müller-Crepon et al., 2021). Moreover, a potentially lower state presence might impact the propensity for ethnic cleavages and conflict. Lastly, conflict might be a result of inequalities between areas close and far from the capital city and thereby reinforce the adverse implications of isolation from the capital city. On the other hand, conflict might be less prevalent in isolated areas because isolated citizens consume the news less frequently and potentially have less media and communication channels to get access to information or coordinate for protest (Manacorda and Tesei, 2020).

In order to assess whether conflict is actually relevant in this context, we test whether there is any pattern of increased or perhaps even decreased conflict in isolated areas. To this end, we use the publicly available ACLED dataset of conflicts by type (Violent Events, Demonstration Events and Non-Violent Action) (Raleigh et al., 2010). Out of the total 88,853 conflict events in our sample countries between 01.01.2000 and 27.11.2019, a total of 3,446 fall into the area of our boundary segments (www.acleddata.com). We aggregate the frequency of conflict that fall within each segment side and run BDD regressions with segment sides as the observational unit (see Table 8). Since conflict frequency might directly increase with population density, in columns (5)-(8), we additionally account for the total population count in each segment side. Our results demonstrate that there is no significant relationship between distance from the capital city and the frequency of any type of conflict (or all types of conflicts aggregated). This result is in contrast to Campante et al. (2019) who find that conflict is more likely to emerge closer to the capital city. One reason for the different findings could be related to spatial spillovers of conflicts across the border along ethnic lines which is common in Africa (Bosker and de Ree, 2014; Michalopoulos and Papaioannou, 2016). As a results we might underestimate (or even overestimate) the true impact of remoteness on conflict. However, even if this was the case, as long as conflict has a similarly adverse effect on economic performance irrespective of whether it originates or was spilled over to a segment side, it is very unlikely to be related to the difference in economic outcomes between segment sides close and far from the capital city.

To conclude, our analysis suggests that public goods provision is an important mediator between remoteness from the capital city and economic performance. Furthermore, our results support the view that dysfunctional accountability mechanisms are important regarding the reduced level of public goods provision. In contrast, based on our

Table 8
Channel analysis: Conflict.

	Dependent variable: Conflict frequency (ACLED)							
	Viol (1)	Demo (2)	Non-V (3)	All (4)	Viol (5)	Demo (6)	Non-V (7)	All (8)
Log distance from the capital city	0.356 (0.720)	0.061 (0.632)	0.130 (0.146)	0.547 (1.344)	0.413 (0.732)	0.186 (0.573)	0.151 (0.149)	0.751 (1.318)
Population count in segment side	–	–	–	–	0.026 (0.021)	0.056** (0.026)	0.010* (0.006)	0.092* (0.050)
Country FE	35	35	35	35	35	35	35	35
Segment FE	568	568	568	568	568	568	568	568
Observations	1138	1138	1138	1138	1138	1138	1138	1138
Adjusted R^2	0.415	0.055	0.188	0.325	0.423	0.247	0.246	0.377

Note: This table reports the balancing tests on conflict with regard to isolation from the capital city. The observational unit in these models are the BBD boundary segments. The dependent variables are instances of conflict by type in the respective side of the boundary segment in the period between 01.01.2000 and 27.11.2019. Column (1) refers to 'violent conflicts', column (2) to 'demonstrations', column (3) to the number of 'non-violent actions' and column (4) aggregates all three kinds of conflict (for more information on these categories please refer to the ACLED homepage at: https://www.acleddata.com/resources/general-guides/). Boundary segments corresponds to a buffer of 25 km around border pieces of 50 km line length and are entirely nested within a restricted ethnic homeland based on the 'Tribal Map of Africa' (Murdock, 1959). Standard errors in parenthesis are clustered by boundary segment. *p < 0.1; **p < 0.05; ***p < 0.01.

analysis, it is unlikely that market access, trade or conflict are relevant with regard to the implications of isolation from the capital city.

4. Conclusion

We investigate the impact of isolation from the capital city on economic development in Sub-Saharan Africa using extensive remote sensing data and large collections of geocoded and survey data. We obtain quasi-random variation in treatment at arbitrarily set national borders that divide ethnic homelands with similar geographical, social and historical characteristics. Conducting our analysis in a BDD regression framework, we deliver tangible evidence that isolation from the capital city imposes strong adverse effects on the level of local economic performance. We perform a series of alternative specifications, balancing and robustness tests that underline that our estimates are causal. Moreover, comparing the effects of isolation from the capital city to isolation from other major cities confirms that hosting the political center is the driving force behind the effects of isolation.

In addition, we investigate potential channels through which isolation from the capital city might affect economic performance: public goods provision, market access and conflict. We document that remoteness from the capital city, as opposed to other major cities, is linked to a significant drop in the level of public goods provision. In order to understand the imbalances in public goods, we explore two potential explanations: (i) geographical isolation translates into political isolation and thereby exclusion from government resources and (ii) due to limited accountability political leaders have lower incentives to allocate government resources to isolated areas. Our findings regarding political representation are ambiguous — the head of state is more likely to come from regions closer to the capital city but remote regions are more often part of the coalition in power. In contrast, our findings provide clear support for the accountability channel. Despite receiving less public goods, isolated citizens have more trust in their national political leaders, evaluate their performance better, believe less that they are corrupt or that their actions should be monitored. At the same time, people in isolated areas follow the news less frequently. We interpret this as reflecting an asymmetry in information about political affairs between areas far and close from the capital. We confirm this hypothesis empirically by showing that citizens in isolated areas are less sensitive to changes in the quality of governance — they are less likely to withdrawal government support in times of rising misgovernance and corruption but also reward them less for good governance. As a consequence, political leaders that seek to gain popular support with limited government resources are incentivized to allocate more public goods to areas closer to the capital where the expected political return to investment is higher i.e. where the same investments return more votes. We therefore conclude that dysfunctional accountability mechanisms are likely to be a root cause behind the unequal spatial distribution of public goods and economic development in Sub-Saharan Africa.

Our findings are novel in the literature and provide new insights into the political economy of the location of the capital city (Campante and Do, 2014; Campante et al., 2019). Additionally, we provide new insights into the literature regarding the limited institutional outreach of the state beyond the capital city (Herbst, 2000; Michalopoulos and Papaioannou, 2013) and the literature on power sharing and political representation in SSA (Francois et al., 2015). Furthermore, we add to the literature about information, accountability and public goods provision (Besley and Burgess, 2002; Strömberg, 2004; Guriev et al., 2020). Last but not least, by identifying proximity to the capital as an important dimension of spatial inequality, we contribute to the debate about the causes of the very high levels of regional economic disparity in Sub-Saharan Africa.

The results of this study underline the importance of considering political and, in particular, accountability mechanisms when seeking to understand the reasons for the large differences in living standards across African regions. Accordingly, policy makers should aim at strengthening information and feedback channels between citizens and their political leaders to improve and align public policy more with the interest of the people. Ensuring a good functioning of local media markets or increasing the awareness about the importance of active civic engagement in the political process represent two viable actions to this end. Such measures have the potential to indirectly draw the attention of political leaders towards increasing investments into public goods in isolated areas, which could provide remedy to the local economy in places that are currently lagging behind.

Data availability

This study used third party data that the author does not have permission to share. Details of the datasets used and links to where the data can be obtained are included in the Online Appendix. Requests to access the data should be directed to the data suppliers.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jdeveco.2023.103214.

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