From Connection to Coordination: High-Speed Internet and Protests in Africa

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Abstract

What is the role of broadband Internet in shaping political participation in Africa? This study leverages the staggered arrival of submarine Internet cables and the terrestrial backbone network in Africa to examine the influence of high-speed Internet on protests. Combining large-scale cross-country surveys on political behaviors and disaggregated data on conflict events, robust difference-in-differences estimates indicate a significant increase in both the likelihood of protest participation and the frequency of protests. This effect is particularly observed in countries that actively exercise political rights and civil liberties. The analysis explores two key mechanisms—information dissemination and coordination facilitation—with the latter being the predominant channel of explanation.

JEL Classifications: L96; O18; D72

Keywords: Governance; Political Mobilization; Protest; High-speed Internet; Sub-Saharan Africa

Introduction

As Al Gore declared in the 1994 Telecommunication Development Conference (ITU)[1], the rise of the Internet in the 1990s promised a new era where Information and Communication Technologies (ICTs) would be a catalyst for fundamental liberties, democratic processes, and public discourse (Howard 1993). Theoretical frameworks such as Diamond's (2010) concept of 'Liberation technology' articulates the impact of ICTs in empowering communities, reshaping interactions, and invigorating civic engagement (Katz 1997 ; Oates 2003). The role of ICTs, and particularly the Internet and related services, in events like the Arab Spring (Tufekci and Wilson 2012 ; Khamis, Gold, and Vaughn 2012) and Sub-Saharan Africa's 'Third Wave of Protests' (Branch and Mampilly 2015 ; Mateos and Erro 2021) underscores their potential as democratizing forces in developing countries, aligning with Diamond's view (Weare 2002; Mudhai 2003; Ben Ali 2020). However, the Internet might also limit democratic freedoms and foster misinformation. Morozov (2011) coined the term 'Freedom Recession' to highlight the risks associated with ICT proliferation, such as increased censorship and the curtailment of democratic freedoms (e.g., expression, protest, voting rights, and organizational affiliations)[2]. Additionally, the spread of misinformation (Vosoughi, Roy, and Aral 2018) poses significant threats to the formation of political beliefs and attitudes.

In light of these contrasting perspectives, the aim of this paper is to investigate the relationship between broadband Internet access and political behaviors. To do so, I employ a difference-in-difference methodology to evaluate how the exposition to broadband Internet[3] impacts political mobilization, with a particular focus on protests in Sub-Saharan Africa. Additionally, I disentangle the mechanisms through which information dissemination and coordination enhancement operate and examine how these effects vary within different institutional contexts.

Assessing the impact of broadband Internet in developing regions presents methodological challenges, primarily due to endogeneity and data constraints. This study refines the approach pioneered by Hjort and Poulsen (2019), exploring how temporal changes associated with the introduction of submarine cables intersect with spatial variations in broadband access. Unlike in developed countries where existing fixed telecom networks often serve as instrumental variables (Czernich 2012; Falck, Gold, and Heblich 2014; Campante, Durante, and Sobbrio 2018), this study leverages the phased deployment of submarine fiber-optic cables between 2009 and 2014 as a natural experiment. By utilizing the proximity to backbone networks as an instrument, as suggested by Miner's research (Miner 2015), this approach introduces exogenous variation in Internet access, thereby mitigating potential biases[4].

Data from geolocated Afrobarometer surveys across ten coastal Sub-Saharan countries, encompassing two survey waves before and two survey waves after the broadband enhancements, forms the empirical

[1]"To promote; to protect; to preserve freedom and democracy, we must make telecommunications development an integral part of every nation's development. Each link we create strengthens the bonds of liberty and democracy around the world." (Gore 1994)

[2]Dictators can perceive ICTs as a mean of strengthening their hold on the power. The Internet can strengthen their control over the population and facilitate the identification of political opponents.

[3]Broadband Internet is defined by the Federal Communications Commission as access to high-speed Internet at minimum speeds of 25 Mbps downstream and 3 Mbps upstream, utilizing various technologies including fiber, wireless, cable, DSL, and satellite.

[4]Only terrestrial cables established before the introduction of submarine cables are included, ensuring that the analysis captures the causal effects of broadband connectivity.

basis of this study. The treatment year is identified as the year a country first connects to a submarine fiber-optic cable, with treatment groups defined by proximity to existing backbone infrastructure. Individuals closer to the cables, within a specified radius (1200 meters), are expected to experience greater Internet speeds and access quality, influencing their ability to engage with online content (and potentially participate in collective actions). The identification strategy aims to compare groups of individuals who live near the terrestrial network to those who live further away, whereas the progressive arrival of submarine cables from Europe enabled the connected countries to access high-speed Internet. The analysis is augmented by ACLED data, aggregated at the 0.1×0.1 degrees cell level. The spatial analysis also considers the distance from terrestrial cables as a crucial factor in defining treatment and control cells, aiming to assess the comparative effects in cells near the terrestrial network against those positioned further away, as the phased arrival of submarine cables ushered in enhanced Internet access in these areas.

Cell phones have revolutionized the information environment by decentralizing and amplifying the dissemination of information (Bailard 2009). Extensive empirical literature in developing countries explores the deployment of communication technologies and their multifaceted impacts (Jensen 2007; Jenny C. Aker 2010; Jenny C. Aker, Ksoll, and Lybbert 2012; Jack and Suri 2014; Jenny C. Aker and Cariolle 2023). A significant focus has been placed on the political and governance implications of ICTs, particularly in the context of broadband Internet. For example, studies such as Guriev, Melnikov, and Zhuravskaya (2021) have demonstrated that in countries without Internet censorship, the expansion of 3G networks correlates with decreased government approval and increased support for populist parties. Similarly, Cariolle, Elkhateeb, and Maurel (2024)'s research using Afrobarometer data across 25 African countries indicates that Internet usage for information access adversely affects the demand and perception of democracy. Moreover, Donati (2023) revealed that in South Africa, mobile Internet availability in 2016 significantly affected voter turnout and shifted vote shares, with information access and enhanced coordination playing pivotal roles. Additionally, Hatte, Loper, and Taylor (2023) highlighted that the Facebook "Free Basics" initiative has promoted the electoral success of female candidates in Africa by enhancing their online visibility.

While existing research has addressed the impact of ICTs on democratic institutions, such as political accountability (Jenny C. Aker, Collier, and Vicente 2017) and electoral fraud (Gonzalez 2021), this study broadens the quantitative analysis of ICTs' role in political mobilization within developing countries—a relatively underexplored area. It examines the likelihood of individuals participating in protests over the past year, focusing on how mobile and fixed broadband Internet access affects this probability, particularly through specific online content and social networks. Unlike previous research, which primarily addressed the effects of 2G networks in conflict scenarios (Pierskalla and Hollenbach 2013; Bailard 2015), this research explores explicitly the more advanced capabilities of broadband technology and its distinct influence on political mobilization. Manacorda and Tesei (2020) have explored the dynamics of economic downturns and expanded 2G coverage in Africa from 1998 to 2012 and their impact on political protests, emphasizing the crucial role of information flow and peer influence in fostering protest participation. Building on this foundation, this study aims to ascertain whether the influence of broadband Internet on protest participation is consistent across different political and economic environments, effectively testing the unconditional nature of this effect. Some recent studies also delve into the effects of social networks on political mobilizations, referencing the influence of Facebook's language availability on protests (Fergusson and Molina 2019) and analyzing how social media platforms facilitate the spread of protests and strikes in China (Qin, Strömberg, and Wu 2021).

The findings of this paper suggest that the arrival of submarine cables in Africa significantly increases the likelihood of participation in protests and the frequency of such events. This paper states that this effect is due to exposure to broadband internet and unconditional to economic trends and conditions. This effect is particularly noted in “free” countries, where political rights and civil liberties are actively exercised. The analysis investigates two primary mechanisms—information dissemination and coordination facilitation—with enhanced coordination emerging as the principal driver behind the observed impact. This relationship has undergone numerous robustness tests, suggesting a causal effect.

The rest of the paper is structured as follows: Section attempts to comprehend what the arrival of optical fiber underwater cables implies for access to broadband connectivity as well as for political behavior and attitudes in Sub-Saharan Africa in order to add additional depth to the study topic and some contextual elements. Section describes the data. Section describes the methodology, including the difference-in-difference approach and the data sources used. Section presents the empirical findings, analyzing the impact of broadband Internet on political protests. Section discusses the implications of these findings, exploring the mechanisms of information dissemination and coordination and to what extent the institutional context plays a role in this relationship. Finally, Section concludes.

Context

This section provides a detailed background to enhance understanding of the arrival of optic-fiber submarine cables, the subsequent expansion of broadband Internet, and its potential implications in Africa. It supports the methodological framework of this study and explores potential mechanisms that might link broadband Internet exposure to political mobilization.

Submarine optic-fiber cables, backbone network and International broadband connectivity in Sub-Saharan Africa

Since the late 1990s, Sub-Saharan African countries have witnessed exponential mobile cellular and mobile broadband network growth. Mobile technology can be considered a “leapfrog” technology, which has been able to circumvent the need for extensive fixed network infrastructures to reach the majority of the African population (Jenny C. Aker and Cariolle 2023). This has resulted in Internet users accessing the Internet via mobile devices rather than the traditional method of using a computer (Napoli and Obar 2013). The prevalence of mobile Internet access, especially in middle and low-income African countries, underscores this trend (GSMA 2019).

Remarkably, by 2020, the coverage of at least a 2G network extended to 88.4% of the African population, a stark increase from the 10% coverage in 1999. Moreover, mobile broadband accessibility experienced significant growth, with coverage rising from 51.3% in 2015 to 77.4% in 2020. This growth signifies a robust expansion in telecommunications penetration, which escalated from 1.7% in 2010 to 33.1% by 2019 (ITU 2020). As illustrated in Figure 1, the progressive deployment of submarine fiber-optic cables plays a crucial role in this narrative, enhancing international broadband connectivity and shaping the digital landscape of Sub-Saharan Africa.

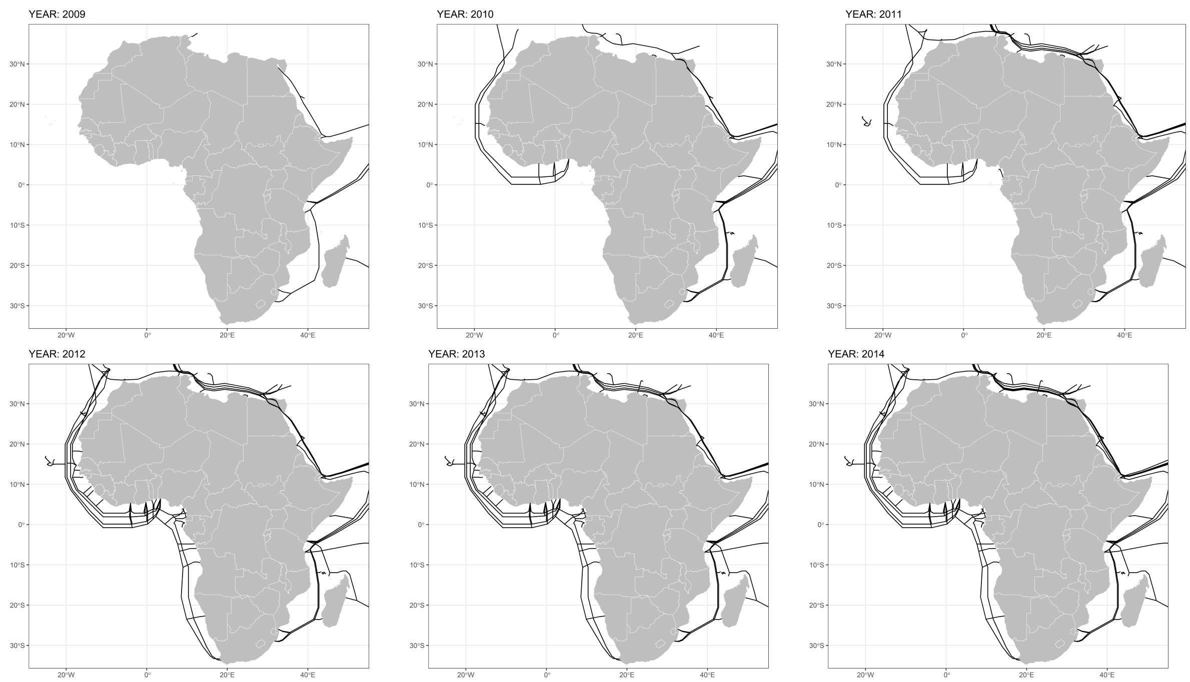

Figure 1: The gradual arrival of optic-fibre submarine cables in Sub-Saharan Africa

Satellites and submarine cables (associated with backbone cable network) are the two ways to get broadband international connectivity[5]. Submarine cables are the preferred choice for their cost-efficiency, offering lower expenses for operators per subscriber and reduced international connectivity costs (Mason 2011). In contrast, satellite communications, despite suffering from higher latency and jitter issues (Analysys Mason 2013), provide essential access to remote and hard-to-reach areas where laying cables is not feasible or too costly. This strategic preference has led operators to extensively use submarine cables to broaden network infrastructures, particularly emphasizing cables linking Sub-Saharan African countries directly with Europe.

As illustrated in Figure 2, each submarine cable is connected to a terrestrial network known as a backbone network that connects the entire country (Gelvanovska, Rogy, and Rossotto 2014). This backbone or the core network, typically operated by national telecom providers, is engineered to facilitate the transfer of substantial data volumes across vast distances using lines with high bandwidth capacity[6]. The backbone network plays a crucial role in distributing Internet traffic nationwide, leveraging expansive fiber cables for the bulk of data transmission.[7] The final phase of connectivity, known as the 'last mile', bridges the gap to the end-users through a combination of fiber or copper cables and

[5]The international connectivity is the international telecommunications capacity "that binds together the networks of countries and major cities" (https://www.itu.int/en/ITU-T/studygroups/2013-2016/03/Pages/iic.aspx, accessed January 2024)

[6]During the period of this study, the terrestrial Internet infrastructure in nearly all African countries was developed and maintained by a national telecom operator. Each country is covered by only one backbone network before the arrival of optic-fibre submarine cables.

[7]The route of backbone networks adheres to stringent economic and logistical criteria to optimize operational efficiencies and reduce costs. In coastal countries for example, a critical objective is to ensure connectivity to international

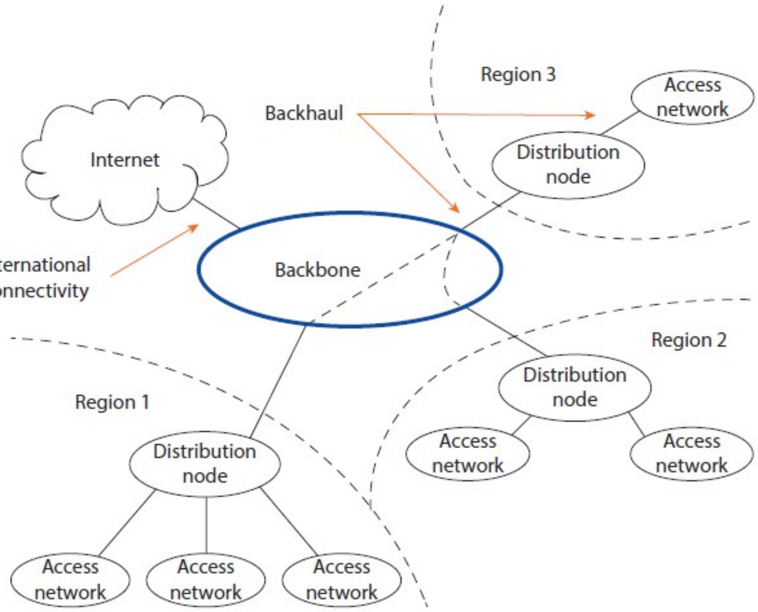

Figure 2: Network Components of Broadband Infrastructure (Source: World Bank, 2014)

mobile antennas supporting various generations of mobile data technologies (3G, 4G, 5G), ensuring comprehensive digital access.

The last mile (both antenna and fixed networks, e.g. xDSL) reaches the end user directly, although the quality of the Internet speed reduces rapidly as the distance to the core network increases, depending on the technology used[8]. As shown in Figure 9 in the Appendix, the number of antennas decreases with the distance from the backbone. Thus, between 2012 and 2016, 43.7% of new 3G antennas located between 0 and 10 km from the backbone cables were less than 1200 meters and 44.2% of new 4G antennas[9]. Figure 13 in the Appendix shows the evolution of the location of antennas in Senegal between 2012 and 2019; we can see a location that is first and foremost along the existing submarine cables before the arrival of submarine cables in 2010. Thus, some relatively more remote antennas can

networks by integrating backbone networks with submarine cable landing points. The network design also considers the country's topographical constraints, with planners strategically minimizing expenditures and terrain-related technical difficulties. Additionally, backbone networks are designed to efficiently connect major urban centers and densely populated areas with the highest demand for connectivity. Also the synergy with other infrastructural developments is important; during the construction of roadways or electrical grids, backbone networks are frequently installed or enhanced to leverage shared costs and infrastructure pathways. https://cio-wiki.org/wiki/Backbone_Network, accessed in June 2024

[8]For fixed network (copper network) the attenuation decreases very quickly 1.5 km after the splitter, depending on the technology (ADSL, VDSL, ADSL2…). For mobile networks (cell phone antennas), the signal quality decreases rapidly after a 1km distance as shown in Figure 10 from Karray and Jovanovic (2013).

[9]The location of antennas and the creation of new antennas is obtained via OpenCell-ID (https://opencellid.org/) which is an open cellular dataset. This database, in addition to giving the date of entry of the antenna in the database, which can be used as a proxy for the date of commissioning, allows one to know the technology of the antenna (GSM, UMTS, LTE), the owner operator … From the location of the antennas, it is possible to find the mobile coverage of each technology (2G, 3G, 4G).

be connected, especially via microwave technology[10].

The SEACOM cable, initiating its service in 2009, represents the first major submarine optic-fiber cable connecting Marseille to Mumbai via key African ports like Djibouti, Mombasa, Sar Es Salaam, Maputo, and Mtunzini. From 2009 to 2012, this pioneering project was followed by multiple deployments, significantly expanding international broadband access along the majority of Sub-Saharan Africa's coastal regions (Table 11). Considering the substantial proportion of African Internet content hosted overseas (Kende and Rose 2015), submarine cables from Europe have been instrumental in significantly enhancing both the bandwidth and the Internet penetration rates across Sub-Saharan Africa (BBC, 2009[11]; State of the Internet Report, 2012[12]). Notable increases in bandwidth and Internet penetration by approximately 3 to 5 percentage points in regions connected by these cables underscore the transformative impact of this infrastructure (Cariolle 2021). This development marks a significant milestone for African countries engaged with the global broadband revolution[13]. Additionally, broadband Internet significantly improves content accessibility and usage patterns. For example, Skouby et al. (2014) analyzed broadband capacity requirements for households and small businesses. The findings, detailed in Table 1, highlight that optimal web browsing and seamless social network access demand a baseline level of broadband speed, measured in Mbps. Such levels of performance are contingent upon the availability of robust broadband Internet infrastructure.

There is a significant increase in internet penetration across subsaharan Africa, rising from a mere 2% in 2005 to 37% by 2023 (ITU, 2024). However, this growth in connectivity does not uniformly extend across all demographic sectors. When looking at our sample, statistical analysis shows a correlation between internet usage and urban residency (correlation coefficient = 0.144), education (correlation coefficient = 0.136 for primary education), and age (negative correlation with age, coefficient = -0.137), which suggests that younger, better-educated individuals in urban areas are more likely to use the in-

[10] Mostly via radio-relay system which is a signal transmission system (GSMA 2018).

[11] BBC. (2009, July 23). Kenya cable ushers in broadband era. BBC News. Retrieved May 23, 2022, from http://news.bbc.co.uk/2/hi/africa/8163900.stm

[12] Communications, Ascendant. "Akamai Releases Fourth Quarter 2012 'State of the Internet' Report." Response Source Press Release Wire. Response Source, April 23, 2013. https://pressreleases.responsesource.com/news/77353/akamai-releases-fourth-quarter-2012-state-of-the-internet-report/.

[13] Makeni, J. (2009, April 8). Will Africa join Broadband Revolution? BBC News. Retrieved May 24, 2022, from http://news.bbc.co.uk/1/hi/world/africa/7987812.stm

Table 1: Download capacity requirement (in Kbps or Mbps) for different services and uses

Capacity Requirement	Services and uses
80 kbps	VoIP calling
Broadband Internet (> 512 Kbps)	
2 Mbps	Video conferencing
3–10 Mbps	Browsing
10 Mbps	Social Networks
10 Mbps	Streaming videos
Very high-speed Internet (> 30 Mbps)	
10–100 Mbps	File sharing/download (documents, images, videos)

ternet daily. Conversely, a slight negative correlation exists with being female (correlation coefficient = -0.090), indicating lower usage rates among women. These disparities underscore a demographic skew towards a more urban, educated, and predominantly young male population having better access to digital resources. This demographic bias is significant as it influences the nature of political mobilization and the representativeness of online activism, potentially excluding rural, older, and less educated populations with differing views and participation levels in political processes.

Democracy, Mass Mobilizations and Telecom Infrastructures

The widespread expansion of broadband Internet around the world depends crucially on key telecommunications infrastructures, such as fiber-optic submarine cables, which play a central role. These cables are strategically valuable but are not only technologically significant; they can trigger various socio-economic effects in connected areas. A kind of techno-optimism about their deployment is tangible among the players in the sector, reflected in the discourse of the operators who, organized in conglomerates, are in charge of deploying fiber optic submarine cables. For instance, Funke Opeke's commentary on the Main One cable—which connects Europe to Africa—underscores its significant impact in lowering Internet costs and increasing bandwidth speeds, ushering Africa into the digital era[14]. This enhanced connectivity is instrumental in unlocking economic potential and bolstering social dimensions such as improved communication, heightened awareness, and increased governmental transparency[15].

This connectivity fosters economic opportunities and improves aspects of social life, including communication, awareness, and governmental transparency[16]. Miner's (2015) analysis underscores the influence of high-speed Internet expansion on political landscapes, particularly in dismantling long-standing political monopolies in Malaysia. These developments underscore the imperative for detailed investigation into the extensive political and socio-economic ramifications of broadband Internet's proliferation in Sub-Saharan Africa, pointing to its potential as a powerful tool for democratic engagement and political mobilization.

The 'Third Wave of Protests' across Sub-Saharan Africa underscores the pivotal role of the Internet in fueling modern social movements (Mateos and Erro 2021). These movements, characterized by demands for greater institutional accountability and democratic reforms (Cheeseman 2019), showcase a profound dissatisfaction with existing political structures (Branch and Mampilly 2015). In Senegal and Burkina Faso, movements like *YEM (Y'en a Marre)* and *Balai Citoyen* have leveraged social media, especially Facebook, to drive their activism. These platforms have been instrumental in event coordination, engaging the diaspora, and circulating key information and visuals—ranging from protest scenes to confrontations with the police. The capacity to share photos and videos and forge online ac-

[14] Kermeliotis, B. C. C. P. A. T. (2012, January 10). Underwater cables bring faster Internet to West Africa. CNN. Retrieved November 30, 2021, from https://edition.cnn.com/2012/01/10/business/funke-opeke-cable-internet/index.html

[15] Funke Opeke, discussing the Main One fiber-optic submarine cable's connection from Europe to Africa through various points, highlighted its role in advancing the information age in Africa, touching upon the benefits for educational institutions, business opportunities, social awareness, better communication, and government transparency.

[16] Funke Opeke speaking about the Main One fiber-optic submarine cable connecting Europe to Africa via Morocco, the Canary Islands, Senegal and Côte d'Ivoire said "When you think of Africa coming into the information age, you think of educational institutions, you think of business opportunities, you think of social awareness, better communication, transparency in government."

tivist communities has significantly amplified awareness and facilitated coordinated actions. This new dimension of activism highlights the Internet's transformative influence on political mobilization, challenging established political norms and fostering innovative avenues for protest and discourse.

A member of the *Balai Citoyen* national coordination in Ouagadougou recounted in September 2018, *"Social media was extensively used to broadcast our real-time activities. We shared visuals of people camping at the Revolution Square, the chases with the riot police, and the clashes. We believed that exposing these brutalities and repression would spark outrage and attract more supporters"* (Translated from French). Similarly, a leader from *Y'en a Marre* in Dakar, August 2018, shared, *"The Internet has significantly boosted our visibility both in Senegal and internationally. We utilize the power of social networks to spread our messages and reach as many 'minds' as possible with* Y'en a Marre *[...] You've seen the impact of our university of commitment. People could follow us everywhere, thanks to the live broadcasts we did on Facebook"* (Translated from French)[17].

While the democratizing potential of the Internet is well-recognized, it's important to note that authoritarian regimes have adeptly utilized New Information and Communication Technologies to consolidate their power. Insights from Morozov (2011) highlight how such regimes manipulate digital platforms to extend their influence over citizens, thereby reinforcing their authoritarian rule. The complex relationship between Internet access and political dynamics suggests that increased online engagement might paradoxically facilitate government efforts to galvanize support in authoritarian contexts. This nuanced impact of the Internet on political landscapes underlines the critical need for careful analysis of its influence within varying governance frameworks, recognizing that its effects might not uniformly align with democratic ideals but could inadvertently empower regimes that strategically harness digital tools for their ends.

Data

To address the research question effectively, I require geolocalized survey data on political attitudes and behaviors, detailed records of event locations and their frequencies, and precise mappings of key telecommunications infrastructure. Additionally, I integrate supplemental information at cell and country levels to construct robust control variables and facilitate a heterogeneity analysis.

Backbone's location and submarine cables' activation date The *African Terrestrial Fibre* (AfTerFibre) database[18] is an open data project that provides a mapping of most of Africa's terrestrial fiber optic infrastructure. This database lists crucial information on the backbone network across African countries, detailing the paths of terrestrial Internet cables, their deployment locations, the operators managing them, and their phases of installation. The network configuration as of 2009[19] is illustrated

[17] Dimé, Mamadou, et al. "« Afrikki Mwinda »: Y'en a Marre, Balai Citoyen, Filimbi et Lucha – Catalyseurs d'une Dynamique Transafricaine de l'engagement Citoyen." Africa Development / Afrique et Développement, vol. 46, no. 1, 2021.

[18] https://afterfibre.nsrc.org/

[19] For this econometric methodology, particular attention is directed toward infrastructure established before 2009, the year that marks the initiation of optic-fiber submarine cable implementation in the region. This specific focus allows for the isolation of effects attributable to these new introductions from those of existing infrastructure.

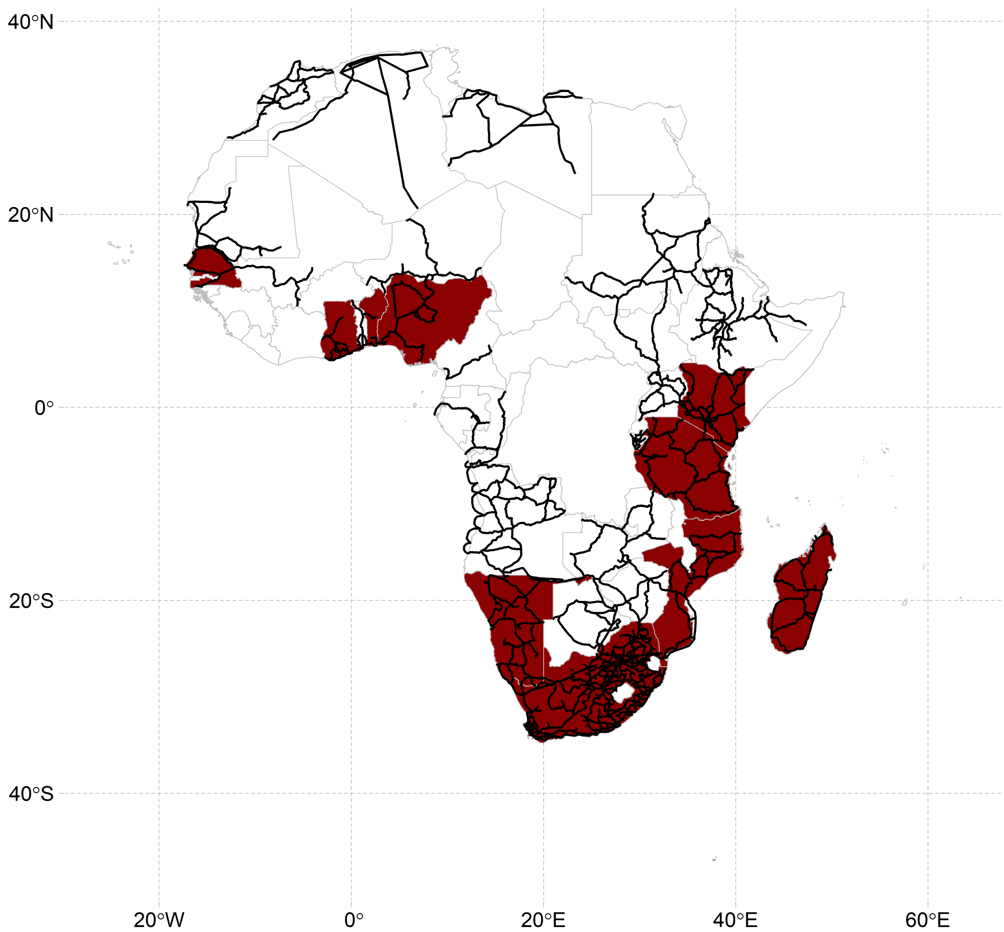

Figure 3: This map illustrates the ten Sub-Saharan African countries included in our study—Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania—highlighting the routes of existing backbone cables operational prior to the introduction of submarine cables. These countries were specifically selected based on several criteria: each had at least two waves of Afrobarometer surveys conducted both before and after the arrival of submarine cables in 2009, detailed data on terrestrial cable routes existing before 2009 were available, and their coastal locations ensured a clear delineation of the treatment related to submarine cable access.

in Figure 3 with black lines indicating the routes of these cables, offering a precise geographical depiction of the connectivity landscape prior to the arrival of submarine cables.

Additionally, the arrival dates of these submarine cables in each country, as depicted in Figure 1, are sourced from Infrapedia[20]. This source provides data concerning each submarine cable's construction and activation years. These dates are referenced in Table 2, underpinning the temporal framework for the econometric analysis.

Political Attitude and Behavior: Individual Level Data from Afrobarometer This study utilizes geolocated data from the Afrobarometer[21], which has been systematically collecting opinion polls in multiple African countries since 1999, with the first survey wave encompassing 37 countries by 2021[22]. The Afrobarometer surveys, which capture public attitudes towards democracy, governance, and a range of social and economic issues, have progressively included more countries across the seven subsequent waves, thus facilitating a robust longitudinal analysis. This study focuses on ten coastal countries with survey data available both before and after the introduction of submarine cables[23]: Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania.

I focus on key variables derived from face-to-face interviews conducted in the Afrobarometer surveys. These variables encompass three main dimensions: political mobilization, political attitudes, and digital practices. The main set of variables of interest enters the field of political mobilization, capturing a spectrum of civic engagement activities as reported by respondents. Among a list of actions that citizens can take, respondents were asked if they had personally taken any of these actions in the past 12 months. Each survey asks about participation in a protest in the past 12 months and whether the respondent has recently participated in a community meeting, discussed politics, is an active member of an association, or joined with others to address an issue. I focus on the likelihood that the individual has or has not participated in a protest. This question was coded into an indicator variable by separating those who participated in a protest at least once in the last 12 months from those who did not participate at all. I have added variables related to political attitudes, the frequency of use of information sources (monthly, weekly, or several times a day), and the demand for democracy. The Afrobarometer also includes Internet usage variables from round 4. Respondents are asked if they use the Internet and, if so, how often: monthly, weekly, or several times a day. I create various dummy

[20] www.infrapedia.com.

[21] The geolocated data of the observations employs an advanced geographic coding system by AidData recommended by Roodman (2024). A trained team performed the geocoding of the Afrobarometer data using a rigorous double-blind process. This involved two independent coders assigning geographic coordinates to each location. Additional quality control measures were implemented to ensure accuracy (BenYishay et al. 2017).

[22] Afrobarometer. (2021). Afrobarometer. Retrieved December 1, 2021, from https://afrobarometer.org/countries. The geocoding process utilized in this study aims to maximize the precision of location data. However, any residual inaccuracies in geolocation could lead to misclassifications of individuals relative to infrastructure, such as proximity to backbone networks. Such misplacements might result in either overestimating or underestimating the treatment effect, depending on whether individuals are incorrectly classified as being closer to or further from key infrastructure than they are. Despite efforts to ensure accuracy, if any misclassification remains, it is hoped to be random.

[23] The timing of these survey waves provides a valuable opportunity for pre-trend analysis. The first four rounds of the Afrobarometer survey were conducted prior to the introduction of optic-fiber submarine cables in Africa, beginning in 2009. This pre-trend analysis is crucial for evaluating the impact of the widespread deployment of broadband Internet on the political, social, and economic dimensions captured by the Afrobarometer.

Table 2: Year of the different waves of the Afrobarometer surveys and date of arrival of the first submarine fiber-optic cables by country

Country	**Survey**	**Treatment**
Benin	(2005, 2008, 2011, 2014)	2010-Q3
Ghana	(2005, 2008, 2012, 2014)	2010-Q3
Kenya	(2005, 2008, 2011, 2014)	2009-Q3
Madagascar	(2005, 2008, 2013, 2015)	2010-Q3
Mozambique	(2005, 2008, 2012, 2015)	2009-Q3
Namibia	(2006, 2008, 2012, 2014)	2012-Q2
Nigeria	(2005, 2008, 2013, 2015)	2010-Q3
Senegal	(2005, 2008, 2013, 2014)	2010-Q3
South Africa	(2006, 2008, 2011, 2015)	2009-Q3
Tanzania	(2005, 2008, 2012, 2014)	2009-Q3

Note: This table outlines the study's data structure across three columns. The first column enumerates the ten countries included in the sample. The second column details the dates of the Afrobarometer surveys conducted in each country, starting with wave 3 and continuing through to wave 6. The third column specifies the treatment date when each country first received fiber optic submarine cable connectivity, marking the onset of enhanced broadband access.

variables based on the intensity of Internet usage.

Cell-Level Characteristics I build cells of 0,1 $\times$ 0,1 degrees[24]. These cells allow to add location fixed effects in the specification and integrate different controls at the cell level. I use satellite data measuring light intensity, which is traditionally used as a proxy for an area's development level. This development indicator is available for 4 periods: 2002, 2005, 2008, and 2013. Following the recommendations of Gibson et al. (2021), I use VIIRS[25] night lights data, which are considered to be more accurate to predict economic activity in rural areas and spatial inequality in urban areas than DMSP[26] night lights data.

Tracking Protests with Objective Data : ACLED The Armed Conflict Location & Event Data Project (ACLED) is an extensive, geolocated database documenting political violence and protests globally, including regions like Africa, the Middle East, Latin America, the Caribbean, and various parts of Asia, Europe, and the United States. ACLED records event details such as dates, involved parties, casualties, and event types. Based on a cell level of 0.1 $\times$ 0.1 degrees for all 10 countries, I was able to use the geolocation of "protest" or "riot" type events to determine for each year whether there had been a mass mobilization event within each cell. In this way, I constructed a binary variable at the cell level that was equal to 1 when an event for the year under consideration had taken place and 0 otherwise. The database aggregates data annually for each cell, summing up all protests and riots to provide an objective view of political mobilization in all the countries covered.[27]

Assessing Freedom and Democracy in Selected Countries: Freedom House Proxy Freedom House annually evaluates global freedom since 1972 (House 2020). Their 2021 assessment covered 210 countries and territories. Their data, encompassing political rights, civil liberties, and freedom status, are widely used as proxies for democracy measures (Högström 2013). The Freedom House Index categorizes countries based on the average of political rights and civil liberties into three statuses: free, partly free, or not free. In 2013, this classification placed five countries of our sample as "free" (Benin, Ghana, Namibia, Senegal, South Africa) and five as "partly free" (Kenya, Madagascar, Mozambique, Nigeria, Tanzania).

Methodology

This section outlines the methodological framework designed to assess the influence of enhanced broadband Internet accessibility on political mobilization, analyzed through two distinct approaches. First, I investigate the impact of broadband Internet availability on individuals' propensity to par-

[24] 0.1 degrees correspond roughly 10 kms

[25] Visible Infrared Imaging Radiometer Suite

[26] Defense Meteorological Satellite Program

[27] There is a potential source of measurement error that can bias event reporting, which may disproportionately favor certain areas. For instance, larger cities often benefit from more comprehensive international media coverage, potentially leading to an overestimation in the results, especially since firms are more commonly situated in urban settings. In our analysis, geographical differences in reporting that are constant over time are accounted for through the inclusion of cell-level fixed effects, which help mitigate these potential distortions.

Table 3: Summary Statistics Before and After the Submarine Cable Arrival (1)

	Before			After		
Variable	**Control (1.2-10km)**	**Treated (0-1.2km)**	**Difference**	**Control (1.2-10km)**	**Treated (0-1.2km)**	**Difference**
Dependent variables						
	N=9920	N=4765		N=12095	N=6464	
Individual Characteristics and Education						
Age	36.348	35.484	-0.864***	36.821	35.911	-0.91***
	(0.145)	(0.247)		(0.131)	(0.22)	
Female	0.503	0.505	0.002	0.506	0.504	-0.002
	(0.005)	(0.009)		(0.005)	(0.008)	
Urban	0.536	0.629	0.093***	0.58	0.681	0.101***
	(0.005)	(0.009)		(0.004)	(0.007)	
Primary educ	0.687	0.685	-0.002	0.715	0.723	0.007
	(0.005)	(0.008)		(0.004)	(0.007)	
Secondary educ	0.286	0.275	-0.01	0.316	0.328	0.012
	(0.005)	(0.008)		(0.004)	(0.007)	
University educ	0.031	0.023	-0.008**	0.085	0.092	0.008*
	(0.002)	(0.003)		(0.003)	(0.004)	
Economic Characteristics						
Unemployment	0.311	0.314	0.002	0.275	0.277	0.002
	(0.005)	(0.008)		(0.004)	(0.007)	
Bad living conditions	0.705	0.697	-0.008	0.667	0.661	-0.006
	(0.005)	(0.008)		(0.004)	(0.007)	
Nightlight intensity	17.04	16.208	-0.831*	21.395	19.088	-2.307***
	(0.215)	(0.367)		(0.201)	(0.339)	
Participate in a protest	0.164	0.147	-0.016*	0.101	0.11	0.009*
	(0.004)	(0.006)		(0.003)	(0.005)	

Note: The sample consists of Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, and Tanzania. The treatment group includes individuals within 0 to 1200 meters from the nearest terrestrial cable, while the control group comprises individuals located beyond 1200 meters and up to 10 kilometers away. This distance cap ensures comparability among individuals. In the Table, 'Before' refers to data from Afrobarometer survey rounds 3 and 4, while 'After' pertains to rounds 5 and 6, aligning with the timing of broadband Internet access improvements.

Table 4: Summary Statistics Before and After the Submarine Cable Arrival (2)

Variable	Before: Control (1.2-10km)	Before: Treated (0-1.2km)	Before: Difference	After: Control (1.2-10km)	After: Treated (0-1.2km)	After: Difference
Political Behaviors and Attitudes						
Vote in the last elections	0.78	0.805	0.025***	0.793	0.782	-0.011*
	(0.004)	(0.007)		(0.004)	(0.007)	
Trust in Presidency	0.65	0.671	0.021*	0.585	0.603	0.018**
	(0.005)	(0.008)		(0.005)	(0.008)	
Preference for Democracy	0.74	0.762	0.022**	0.742	0.749	0.007
	(0.005)	(0.008)		(0.004)	(0.007)	
Satisfied with democracy	0.54	0.614	0.074***	0.534	0.537	0.003
	(0.005)	(0.009)		(0.005)	(0.008)	
Freedom of Thought	0.86	0.894	0.034***	0.869	0.883	0.014***
	(0.004)	(0.006)		(0.003)	(0.005)	
Freedom to join organisations	0.919	0.92	0.001	0.914	0.924	0.01**
	(0.004)	(0.007)		(0.003)	(0.004)	
Free vote	0.95	0.956	0.007	0.953	0.956	0.004
	(0.003)	(0.005)		(0.002)	(0.003)	

Note: The sample consists of Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, and Tanzania. The treatment group includes individuals within 0 to 1200 meters from the nearest terrestrial cable, while the control group comprises individuals located beyond 1200 meters and up to 10 kilometers away. This distance cap ensures comparability among individuals. In the Table, 'Before' refers to data from Afrobarometer survey rounds 3 and 4, while 'After' pertains to rounds 5 and 6, aligning with the timing of broadband Internet access improvements.

Table 5: Summary Statistics Before and After the Submarine Cable Arrival (3)

Variable	Before Control (1.2-10km)	Before Treated (0-1.2km)	Before Difference	After Control (1.2-10km)	After Treated (0-1.2km)	After Difference
Information Access and Internet Use						
News on radio (weeks)	0.854	0.847	-0.007	0.799	0.805	0.007
	(0.004)	(0.006)		(0.004)	(0.006)	
News on TV (weeks)	0.587	0.613	0.026**	0.632	0.653	0.021***
	(0.005)	(0.009)		(0.004)	(0.007)	
News on Newspaper (weeks)	0.587	0.613	0.026**	0.632	0.653	0.021***
	(0.005)	(0.009)		(0.004)	(0.007)	
Internet Use (weeks)	0.118	0.106	-0.012	0.231	0.235	0.004
	(0.005)	(0.008)		(0.004)	(0.007)	
Internet Use (days)	0.049	0.03	-0.019***	0.138	0.136	-0.002
	(0.003)	(0.005)		(0.003)	(0.005)	
	N=99522	N=53826		N=99522	N=53826	
Number of protests	0.005	0.044	0.039***	0.033	0.223	0.19***
ACLED data (Cell Level) - Adjacent Cells						
	(0.002)	(0.002)		(0.006)	(0.009)	
Pr(Protest > 0)	0.003	0.014	0.011***	0.014	0.051	0.037***
	(0)	(0)		(0.001)	(0.001)	
	N=437121	N=53826		N=437121	N=53826	
Number of protests	0.005	0.044	0.039***	0.032	0.223	0.191***
ACLED data (Cell Level) - All Cells						
	(0.001)	(0.001)		(0.002)	(0.005)	
Pr(Protest > 0)	0.003	0.014	0.012***	0.012	0.051	0.039***
	(0)	(0)		(0)	(0.001)	

Note: The sample consists of Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, and Tanzania. The treatment group includes individuals within 0 to 1200 meters from the nearest terrestrial cable, while the control group comprises individuals located beyond 1200 meters and up to 10 kilometers away. This distance cap ensures comparability among individuals. In the Table, 'Before' refers to data from Afrobarometer survey rounds 3 and 4, while 'After' pertains to rounds 5 and 6, aligning with the timing of broadband Internet access improvements. The statistics describing ACLED data are analyzed at cell level. Cells through which a terrestrial cable passes are considered as treated.

ticipate in protests. Second, using a cell-level analysis, I objectively assess how broadband Internet availability affects the likelihood of protest events.

Individual-Level Analysis: Assessing Propensity to Participate in a Protest

Figure 4 is a map that illustrates the data that lay the foundation for the impact evaluation method used to answer our research question. It delineates two distinct buffer zones surrounding the backbone cables. The first buffer, extending up to 1200 meters from the backbone, defines the "connected" area, while the second buffer, spanning from 1200 meters to 10 kilometers, defines the control area. Individuals within these buffers are marked on the map using colored dots, and their inclusion in the study depends on their location in these designated zones. This distinction facilitates the classification of individuals into either the treatment or control group based on their proximity to the backbone infrastructure[28]. I leverage two primary sources of variation to assess the propensity to participate in protests: temporal variation, as depicted in Figure 1, based on the gradual arrival of optic-fiber submarine cables in the coastal countries of Sub-Saharan Africa[29]; and spatial variation, which is based on the proximity of respondents to the nearest backbone network, illustrated in Figure 5. As the distance from the backbone network increases—considering the sparse backhaul infrastructure in the region—the likelihood of accessing broadband Internet (both mobile and fixed) significantly diminishes.

I refine the robustness and precision of my analysis by building on the approach of Hjort and Poulsen (2019) and by adding additional waves to expand the sample size. The inclusion of two additional waves from the Afrobarometer surveys—waves 3 and 6—also enriches the analysis by enabling a thorough examination of pre-treatment trends. This expansion is critical for affirming the parallel trends assumption, a key component of difference-in-differences analyses.

The analysis benefits from more precise geolocation data and refined definitions of the treatment group following Roodman (2024). Recent advancements in the geocoding of survey locations by AidData (BenYishay et al. 2017) provide more reliable geographic coordinates, facilitating a more detailed spatial analysis. A critical adjustment in this study is the revision of the criteria for defining the treatment group. Unlike the 500-meter baseline used in the study by Hjort and Poulsen (2019), this analysis employs a 1200-meter radius from any backbone infrastructure as the threshold for considering an area "treated". This adjustment is informed by technical considerations regarding signal attenuation in both fixed networks (e.g., copper) and mobile antenna coverage.

In the baseline specification, I use a connection radius of 1200 meters to distinguish the treated individuals from the "control" individuals. Eq (1) quantifies the relationship between the chances of having participated in a protest for a given location and period on the one hand and on the other hand if a location is connected to a submarine Internet cable arriving from Europe via a terrestrial backbone cable:

$$Y_{ijct} = \alpha + \beta \times SubCables_{ict} \times Connected_i + \delta_j \times Connected_i + \zeta \times X_{ij} + \gamma_{ct} + \epsilon_{ijct} \quad (1)$$

[28] Notably, the distribution of these points mirrors the underlying population densities, necessitating the application of weights in regression analyses to maintain representativeness.

[29] Following the methodology of Hjort and Poulsen (2019), landlocked countries are excluded from this study due to the ambiguous nature of their treatment through coastal neighbors.

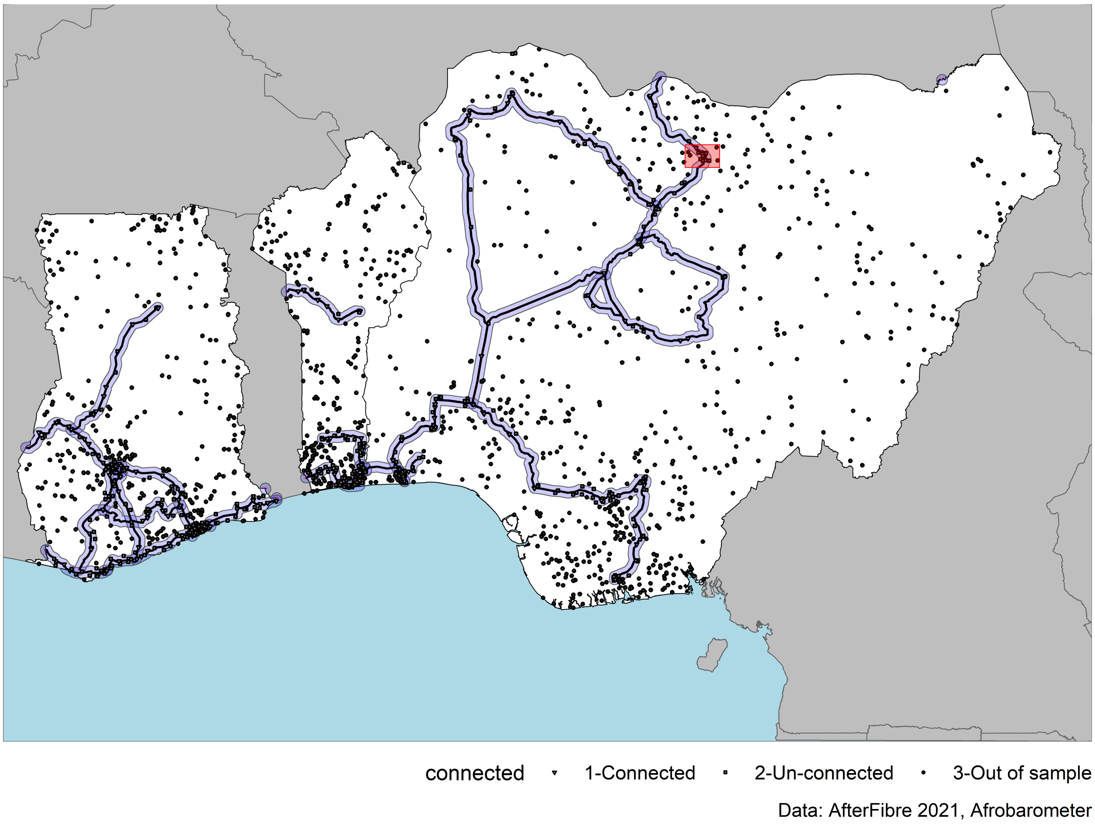

Figure 4: This map highlights three countries from the sample, showcasing all geolocated observations from the Afrobarometer database. Utilizing the Afterfibre database, it displays the routes of backbone cables that were in place before the introduction of submarine cables. Along these routes, two buffer zones are delineated: one extending from 0 to 1200 meters from the backbone and another from 1200 meters to 10 kilometers. These buffers categorize the connectivity status of individuals within these zones. The red rectangle over Nigeria provides a zoomed-in view to demonstrate the study's methodological approach more clearly.

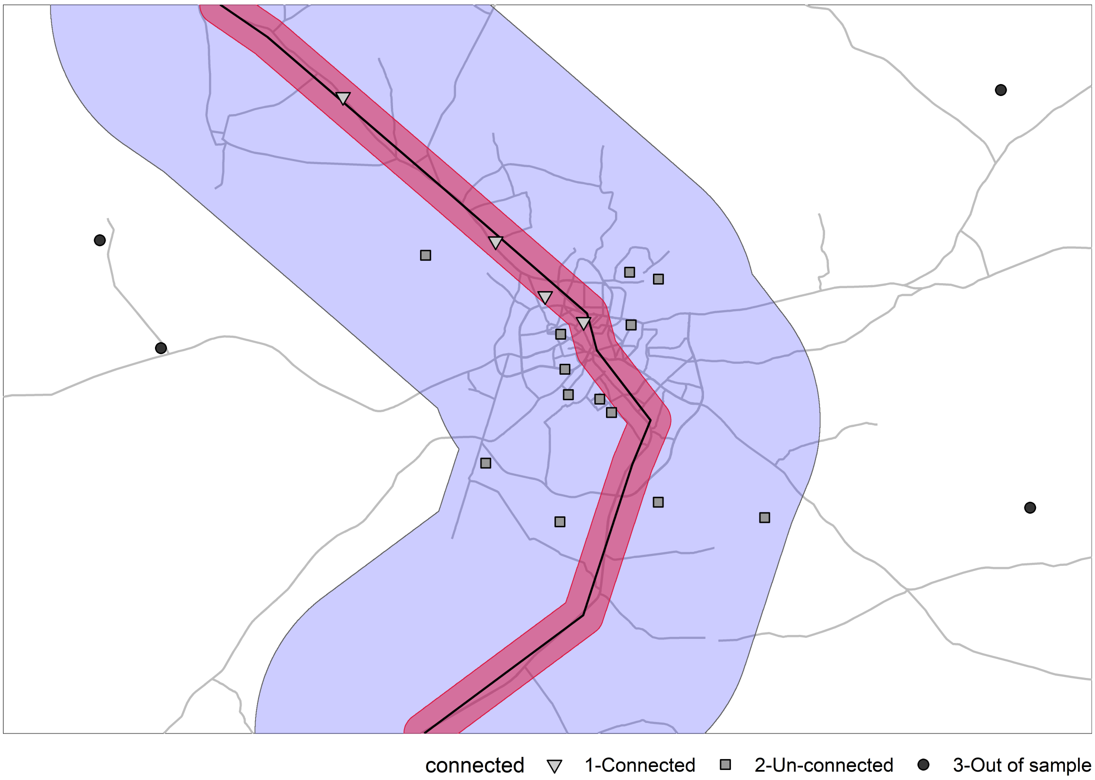

Figure 5: This map centered on Kano, Nigeria, details the methodology approach for this study. The black line marks the actual location of the existing backbone cable. The distance to the backbone defines the respondent's status (connected or control), and buffers have been drawn to show how individuals are integrated into the treatment or control group. All individuals outside the two buffers are excluded from the sample. The color of the individuals shows the treatment status.

where Y_{ijt} is a governance outcome for individual i in cell j in country c, and time period t. Then, $SubCables_{ict}$ is a dummy variable indicating whether the submarine cable was in service in the country c and thus whether fast Internet was available in the country at time t. $Connected_i$ corresponds to the treatment and control group variable based on the distance with backbone cables. X_{ij} is a vector of individual and cell level controls, including nighttime light intensity, whether the individual is urban or not, the age, the gender, and whether the individual has a primary education. The δ_j coefficient captures time-invariant differences in governance outcomes between treatment and control groups. γ_{ct} gives country-specific time period fixed effect.

Cell-Level Analysis: Evaluating Broadband's Influence on Protests and Riots Incidences

To objectively measure the impact of broadband on protests and riots, I supplemented the declarative survey data with information from the Armed Conflict Location & Event Data Project (ACLED). This approach integrates the geographic locations of submarine cables with data on the occurrence and timing of protests and riots, employing a spatial resolution of 0.1 × 0.1 degrees[30]. This analysis covers all sampled countries from 2000 to 2017. The treatment status of cells is determined by the passage within the cell of a backbone cable already in service before the arrival of fiber optic submarine cables in 2009. Following the methodology of Berman et al. (2017), this study conducts two primary analyses: the first includes all cells without a backbone as the control group, while the second considers only those cells directly adjacent to treated cells, applying a neighboring-pair fixed effects approach (Acemoglu, García-Jimeno, and Robinson 2012; Buonanno et al. 2015; Lambais 2020).

To address the local determinants of protests and enhance the exogeneity of our approach, I also exploit variations in high-speed Internet availability due to the deployment of submarine fiber-optic cables. Eq (2) assesses the relationship between the occurrence of protests and riots at the cell-year level and the presence of a terrestrial backbone cable linked to an optic-fiber submarine Internet cable. This analytical framework aims to isolate the influence of enhanced connectivity on the frequency and distribution of protests within the studied regions.

$$Y_{jt} = \alpha + \beta \times SubCables_{jct} \times Connected_j + \zeta_j + \gamma_{ct} + \epsilon_{jt} \tag{2}$$

In this model, (j, t, c) represent cell, year, and country, respectively, where ζ_j captures cell fixed effects and γ_{ct} denotes country and year fixed effects. The dependent variable, Y_{jt}, captures the incidence of mobilization events at the intersection of cell and year. Mobilization, encompassing protests and riots, is quantified in two distinct manners: firstly, through a binary variable indicating the occurrence of at least one protest or riot within a cell in a given year; secondly, via an alternative metric that accounts for the total number of protests and riots. Our coefficient of interest, β, pertains to the interaction term between $SubCables_{jct}$ and $Connected_j$. This coefficient is instrumental in quantifying the effect on the likelihood of event occurrences triggered by a significant improvement in Internet speeds, deemed to be exogenous, consequent to the deployment of submarine fiber-optic cables.

In addition, the estimation of Eq (2) includes cell-fixed effects in order to control for time-invariant

[30] Equivalent to approximately 10 × 10 km at the equator.

co-determinants of political mobilization and economic activity at the local level. The country × year fixed effects are also included to filter out any time-varying country-level characteristics that affect the occurrence of protests or riots.

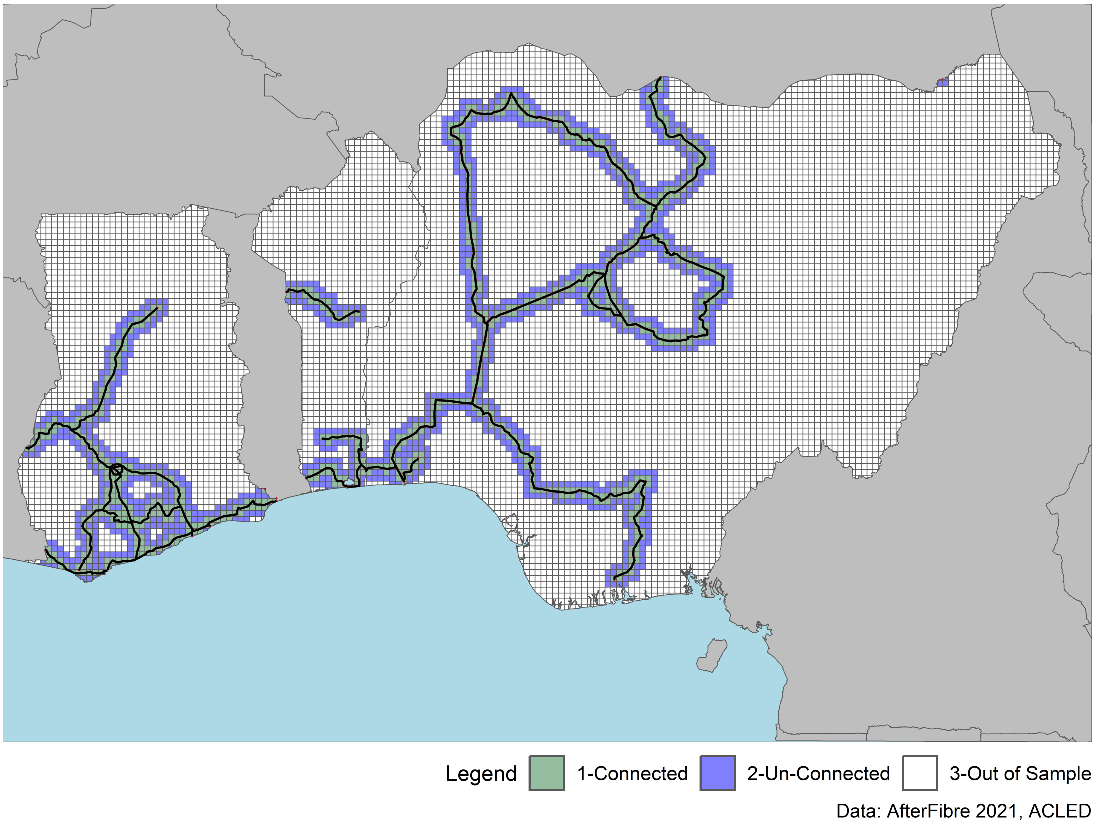

Figure 6: This map displays a grid of 0.1 by 0.1-degree cells covering three sample countries. Utilizing the Afterfibre database, it illustrates the routes of backbone cables existing prior to the introduction of submarine cables. Cells intersected by these terrestrial cable routes are labeled as connected. Adjacent cells not intersected by the cables are labeled as unconnected.

Validity of the identifying assumptions

Following Kahn-Lang and Lang (2020) recommendations on Diff-in-diff and pre-trend analysis, it is essential to examine whether the control and treatment groups are not only identical in "trends" but also in "levels" and if not, include some variables as controls in the model. Through a detailed examination presented in Tables 3, 4, and 5, this study scrutinizes the disparities in observable attributes between the treatment and control groups before (specifically, during the two rounds preceding the intervention: rounds 3 and 4) and after the introduction of broadband Internet (round 5 and 6). These attributes encompass both individual and economic factors and the key outcomes of interest relevant to this investigation. It is important to remember that the treatment group is characterized by its proximity to the backbone network, thereby possessing a greater technical potential for broadband connectivity.

The two groups are substantially different in terms of individual and cell characteristics, according to descriptive research comparing treatment and control units for governance outcomes and a few control factors. In terms of individual attributes, there was no significant difference in gender distribution between the groups. However, the treatment group was significantly younger than the control group, a trend that persisted following the deployment of optic-fiber submarine cables. While the educational levels between the two groups showed no significant difference initially, a gap emerged at the "university" level following the introduction of broadband access. From an economic development point of view, differences are observed by the light intensity throughout the night; control group cells exhibited higher levels of light intensity, indicating greater economic activity compared to those in the treatment areas post-intervention. Prior to and following the deployment of submarine cables, no statistically significant disparity in unemployment rates was observed between the two groups, and the same is true for the declared level of bad living conditions. The proportion of urban inhabitants in the treatment group, standing at 62.9%, is notably higher than the 53.6% observed in the control group, a difference that persists post-treatment. The inclusion of similar and enough urban and rural people in the two groups allows us to rule out a solely urban effect and more readily detect an effect related to the arrival of optic-fiber submarine cables. Despite these precautions, a significant disparity in urbanization levels between the treated and control areas remains evident, with a larger fraction of individuals in the treatment group identifying as "urban" compared to their counterparts in the control group.

There are major differences in usage across the groups when it comes to potential sources of information for individuals: observations in the treated group are more inclined towards television and newspapers for gathering information, a trend that continued beyond the treatment date. Post-treatment, this group also showed a higher propensity for radio usage as an information source. Notably, a divergence in daily Internet use between the treatment and control groups disappeared after the introduction of broadband. Additionally, prior to the treatment, the treatment group displayed greater satisfaction with existing institutions and a more pronounced preference for democracy. Their likelihood of having voted in recent elections did not significantly change following the treatment. However, post-treatment, the probability of engaging in protest activities in the past year increased in the treatment group (11%) compared to the control group (10.1%). The treated group initially exhibited a higher level of satisfaction and preference for democracy and a greater sense of freedom in expressing their thoughts. Yet, after the broadband intervention, these differences in democratic satisfaction and preference ceased to be statistically significant between the two groups.

Before the arrival of submarine cables, the difference between the chances of a protest or riot in a cell considered treated was significantly higher. This difference increased in subsequent periods. Before the arrival of the submarine cables, the chances of there being a protest or riot in a given year in a treated cell was 1.4%, while in the control cells, this rate was 0.3%. After the arrival of the submarine cables, this rate increased in both zones but was greater in absolute terms in the treated zones, reaching 5.1% compared with 1.4% for the control zones.

Prior to the deployment of submarine cables, the likelihood of witnessing a protest or riot within cells designated as treated was significantly higher than in control cells. This disparity became more

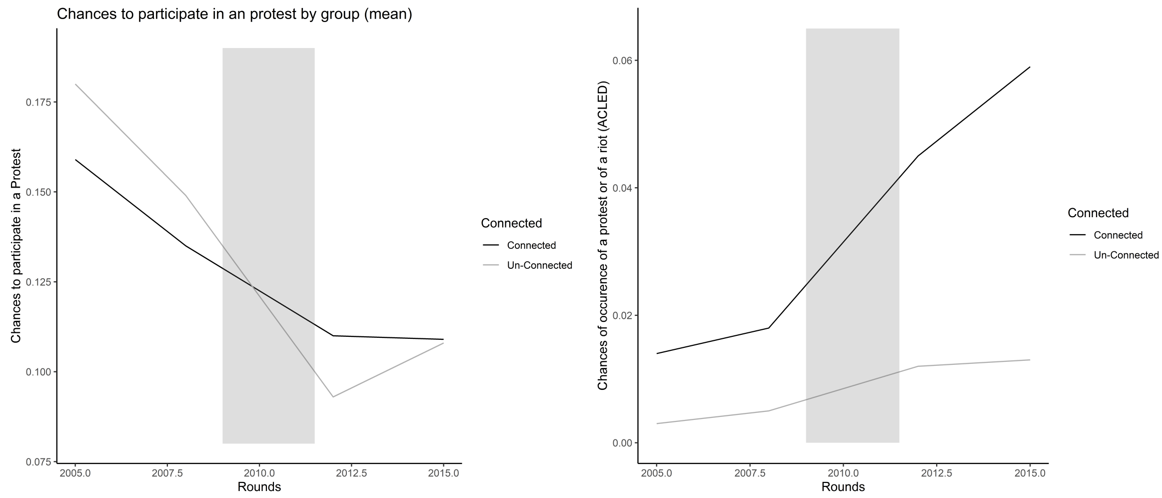

Figure 7: Left-hand panel displays the proportion of individuals within specified groups who participated in at least one protest over the past 12 months, across each available survey wave. The treatment group includes individuals within 1200 meters of the nearest backbone cable, while the control group comprises those located between 1200 meters and 10 kilometers away. On the right, each point represents the proportion of cells in which at least one protest or riot occurred during the specified year. Here, 'treated cells' are those intersected by a terrestrial cable, whereas 'adjacent cells' serve as the control group.

pronounced in periods following the introduction of submarine cables. Specifically, before the cables' introduction, the probability of experiencing a protest or riot within a year stood at 1.4% in treated cells, as opposed to a mere 0.3% in control cells. Subsequent to the cables' arrival, the incidence rate escalated in both regions but did so more markedly within the treated areas, peaking at 5.1%, in stark contrast to a 1.4% increase observed within the control areas. This data highlights a clear augmentation in political activism, especially in regions directly impacted by the advent of enhanced broadband infrastructure.

The validity of the empirical methodology rests on the assumption that the evolution of the shares of "protesters" in the areas near and far from the backbone would have been similar in the absence of the arrival of the submarine fiber optic cables. We should observe identical trends between 2005 and 2008, given that the period during which the submarine cables from Europe were gradually connected to Africa extends from 2009 to 2014. The ensuing survey wave in 2012 encapsulates the expanded influence of broadband connectivity. To ascertain the feasibility of our identification strategy, I examine the parallel trends assumption by graphically comparing the annual participation rates in at least one event between individuals within 1.2 kilometers of a backbone and those between 1.2 and 10 kilometers away. Illustrated in Figure 7, this comparison reveals that, while trends align between 2005 and 2008, they start to deviate from 2008 to 2012, corroborating our hypothesis for causal identification. Specifically, the proportion of "protesters" in the treated regions begins to exceed that in the control regions during this period.

A similar pattern is discerned when analyzing ACLED data, where Figure 7 charts the annual occurrence of protests or riots across cells linked to the backbone versus those unconnected. Trends maintain parallelism from 2005 to 2008 but diverge notably from 2008 to 2012, affirming our causal identification hypothesis. Post-introduction of submarine cables, the frequency of protests or riots in treated areas not only surpasses that in control areas but does so by a widening margin, underscoring the transformative impact of broadband expansion on political mobilization.

Results

Submarine cable arrival and Internet use

I use the distance from the backbone network as a proxy for Internet usage is a methodologically robust approach with precedents in governance and political economy studies, such as those conducted by Miner (2015). This section aims to statistically validate the use of geographic proximity to backbone infrastructure as an effective proxy for broadband Internet access and use. The inclusion of an Internet usage question in the fourth round of Afrobarometer surveys allows us to see how the arrival of broadband Internet in Sub-Saharan African countries has affected Internet use as a function of distance from the backbone network.

I classified individuals into groups based on their proximity to the nearest backbone: (0-1.2kms; 1.2-3kms; 3-5kms; 5-7kms; >7kms). The analysis then utilized the following econometric model to evaluate the interaction between the timing of broadband introduction and the geographic distance group:

$$Y_{ijt} = \alpha + \beta \times SubCables_{ict} \times DistGroup_i + \delta_j \times Cell_j + \gamma_{ct} + \epsilon_{ijct} \tag{3}$$

Here, $Y_{ij(i)t}$ is a binary variable indicating whether individual i in cell j at time t uses the Internet on a weekly or daily basis. The interaction term $SubCables_{ict} \times DistGroup_i$ quantifies the differential impact of proximity to the backbone on Internet usage rates.

Figure 8 displays the estimation results from this model, revealing a significant increase in daily Internet usage for individuals located within 1.2 kms of a backbone following the deployment of submarine cables. This finding corroborates the hypothesis that proximity to backbone infrastructure significantly enhances Internet accessibility.

Further empirical analyses assess the broader implications of increased broadband on political mobilization. Table 6 details the regression results, showing a 2.9 percentage point increase in the probability of daily Internet use in areas connected to the submarine cables. This increase can be attributed to two principal effects: a price effect, where the entry of submarine cables significantly lowers the cost of international connectivity as documented by (Kende and Rose 2015), potentially influencing retail prices and boosting demand for mobile and fixed-line services; and a quality effect, where enhanced data transmission speeds improve user experience and access to a wide array of digital content, thereby increasing the utility and perceived value of Internet subscriptions.

Main results

Table 7 shows that the introduction of submarine cables, which significantly enhances broadband access, increases the probability that an individual within the treated group will participate in a protest

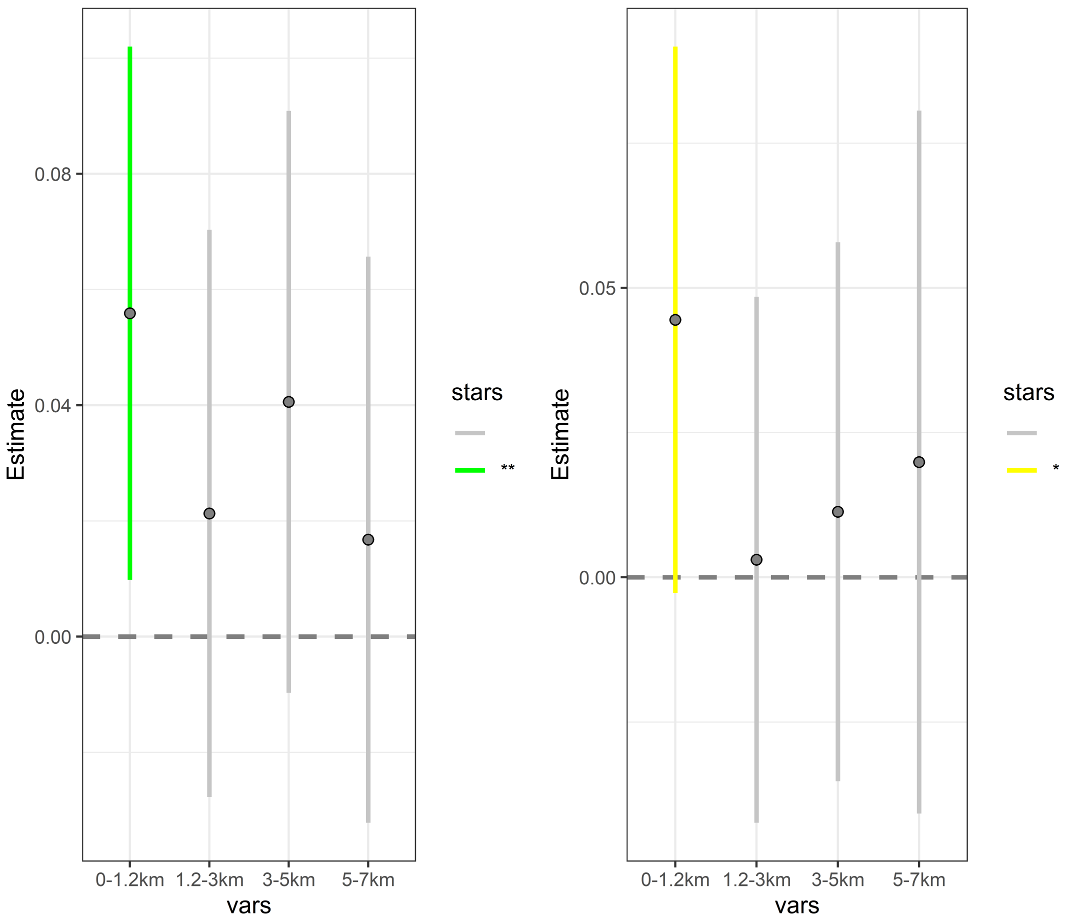

Figure 8: These graphs depict the evolution of interaction coefficients between various distance groups (0-1.2 km; 1.2-3 km; 3-5 km; 5-7 km; >7 km) and the introduction of fiber optic submarine cables. On the left, the plotted coefficients relate to a dummy variable indicating individuals' daily Internet use. On the right, the coefficients correspond to a dummy variable reflecting whether an individual has participated in a protest in the past 12 months. Each graph illustrates the differential impact of proximity to fiber optic cables on Internet usage and protest participation.

Table 6: Submarine Cable Arrival and Internet Use

	Internet Use			
	Daily (0/1)		Weekly (0/1)	
	(1)	(2)	(3)	(4)
SubCable×Connected	0.029**	0.029**	0.032*	0.036
	(0.015)	(0.015)	(0.017)	(0.022)
Country×Year	Yes	Yes	Yes	Yes
GADM2×Connected	Yes	No	Yes	No
Cell×Connected	No	Yes	No	Yes
Num.Obs.	25 402	25 402	25 402	25 402
R2	0.166	0.196	0.206	0.236

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Individuals are considered connected if they are closer than 1.2 km to the backbone network. Internet use (0/1) data come from Afrobarometer. Time FEs are years. The outcome of the model (1) and model (2) is a dummy variable indicating if the individual is using the Internet every day. Location FEs for the model (1) are the reported location at the level GADM (Database of Global Administrative Areas) level 2. Location FEs for model (2) are the reported location at the 10*10 Cell level. The outcome of model (3) and model (4) is a dummy variable indicating if the individual is using Internet every week. Location FEs for the model (3) are the reported location at the level GADM (Database of Global Administrative Areas) level 2. Location FEs for the model (4) are the reported location at the 10*10 Cell level. Robust standard errors clustered at the level of location FEs.

by approximately 3.8 percentage points, as evidenced in column (5) incorporating cell fixed effects and control variables.

Columns (3) and (6) explore the influence of the distance from terrestrial cables—a continuous measure of treatment—on protest participation likelihood. The findings reveal a negative relationship: as the distance to the backbone cable increases by one kilometer, diminishing potential access to high-speed Internet, the probability of an individual engaging in protest activity subsequent to the arrival of submarine cables decreases by 0.5 percentage points. I changed the outcome of eq (3) to focus specifically on whether an individual i in cell j during time period t had participated in a protest in the previous year. This adjustment revealed that the significant effect (at the 10% significance level) was predominantly observed within the group located 0 to 1.2 kilometers from the nearest backbone cable, as illustrated in Figure 8.

Table 7: Submarine Cable Arrival and Chances to Participate in a Protest

	Chances to Participate in a Protest					
	(1)	(2)	(3)	(4)	(5)	(6)
SubCable×Connected	0.039***	0.037***	−0.005*	0.037***	0.038***	−0.005*
	(0.013)	(0.013)	(0.003)	(0.014)	(0.014)	(0.003)
Country×Year	Yes	Yes	Yes	Yes	Yes	Yes
GADM2×Connected	Yes	Yes	Yes	No	No	No
Cell×Connected	No	No	No	Yes	Yes	Yes
Num.Obs.	32 478	32 226	32 226	32 478	32 226	32 226
R2	0.074	0.080	0.080	0.107	0.113	0.113

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Individuals are considered connected if they are closer than 1.2 km to the backbone network. The outcome of models (1), (2), (4) and (5) is a dummy variable indicating if the individual have participated in a protest in the last 12 months. Models (3) and (6) are based on a continuous treatment. Time FEs are years. Location FEs for the model (1), (2) and (3) are the reported location at the level GADM (Database of Global Administrative Areas) level 2. Location FEs for the model (4), (5) and (6) are the reported location at the 10*10 Cell level. Models (2), (3), (5) and (6) include control variables: nighttime lights intensity, urban, age, female, primary education. Robust standard errors clustered at the level of location FEs.

These results may not mean that connected individuals are more inclined to attend protests. It may be an effect of the Internet and social networks on the tendency of individuals to assume their protest activities. If more individuals in connected areas have access to social networks, they may be more informed about the protest activities of other citizens and have more confidence in reporting their own protest activities, knowing that other citizens are reporting them on social networks. Therefore, they are more likely to report to interviewers that they participated in a protest in the past 12 months.

Robustness

I confirm that the estimation of the effect of broadband Internet on protest likelihood is robust to variations in the defined "treatment" radius around the backbone cables. Figure 12 demonstrates this through a series of estimates for various connection radii, revealing that the estimated effect diminishes and loses significance as the radius extends beyond 2.5 kilometers, although it remains significant well past the initial 1200-meter radius used in our baseline analysis.

To further test the robustness of these findings, I systematically removed each country from the sample and re-estimated Eq (1). The results, detailed in Tables 14 and 15, consistently show that the positive and significant effect of broadband on protest participation is not driven by any single country.

As an additional check, I excluded individuals residing near landing points—where submarine cables connect to the terrestrial network—limiting the sample to observations more than 20 kilometers away. This adjustment aims to mitigate any urban bias, as those living near large cities might have had differential access to high-speed Internet or distinct pre-existing propensities to protest. The results, as shown in Table 12, hold under this scrutiny and exhibit even stronger coefficients. I also removed the biggest cities of the sample in Table 13, the results remain robust.

Donut regression analyses were also conducted to address potential edge effects around the treatment boundary. By systematically excluding observations within certain proximity ranges to the backbone—specifically between 800 and 1600 meters, and adjusting the intervals in subsequent models—the results, presented in Table 17, affirm the robustness of our findings across various configurations.

Considering the precision of geographic data as categorized by BenYishay et al. (2017), I analyzed a subset of the data with the highest location accuracy (precision levels 1 to 3). Table 19 shows that the results maintain their significance and direction, although they become nonsignificant when only the most precise data (precision level 1) is used, likely due to the reduced sample size.

Additionally, beyond employing fixed effects at the GADM2 and cell levels, the same regressions were conducted with fixed effects at the GADM1 level (regions). The results remain robust, as detailed in Table 14.

Furthermore, I experimented with varying the control group's size, excluding areas beyond 5 kilometers and incrementally adjusting the radius up to 15 kilometers to ensure comparability with connected areas. The robustness checks, detailed in Table 18, confirm that our findings are not sensitive to the inclusion of more distant and potentially less comparable control areas.

Lastly, as a placebo test, I simulated the displacement of the backbone cables by 12.5 degrees in four directions and recalculated the treatment and control groups accordingly, as illustrated in Figure 14. The regressions based on these "false" backbone locations, as shown in Table 20, yielded no significant results, reinforcing the causal inference of our original setup.

These extensive robustness checks validate that the observed impact of broadband availability on protest likelihood in Sub-Saharan Africa is consistent and causally attributable to enhanced Internet access.

Impact on the probability of occurrence of a demonstration or riot

Table 8 reports the baseline results for various sample compositions and definitions of the variables. The dependent variable is conflict incidence. We see that in all columns, the interaction term between the treatment date (the arrival of submarine cables) and the variable of being in a connected cell (determined by the fact that a backbone cable was crossing the cell before 2009), is positive and significant at the 1 percent level. This means that the arrival of submarine cables, which allowed a significant increase in the availability of high-speed Internet, increased the probability of protests and riots in cells crossed by a backbone cable. Column (1) shows the results of estimating model (2) over the entire sample of cells, with the coefficient showing that the arrival of undersea fiber optic cables increased by 2.2 percentage points the chances that a protest or a riot occurred in connected cells. This result is consistent with the neighbor-pair fixed effects approach in column (2). Column (3) by using the number of protests and riots that occur each year in each cell as an outcome, with the whole sample. Thus, the arrival of fiber optic submarine cables increased the average number of protests and riots in connected cells by 0.114. Column (4), which relies on an estimate based only on connected cells and neighboring cells, shows similar results.

Table 8: Submarine Cable Arrival and Chances of occurence of a protest in a Cell

	Protest Incidence		Number of Protests	
	(1)	(2)	(3)	(4)
SubCable×Connected	0.022***	0.020***	0.114***	0.110***
	(0.001)	(0.001)	(0.014)	(0.014)
Country×Year	Yes	Yes	Yes	Yes
Cell×Connected	Yes	Yes	Yes	Yes
Num.Obs.	1 035 720	360 522	1 035 720	360 522
R2	0.315	0.360	0.484	0.498

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The analysis includes data from Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Cells intersected by a backbone network are classified as 'connected'. The dependent variable across all models is a dummy indicating whether at least one protest occurred within a cell in a given year, as used in models (1) and (2). In models (3) and (4), the outcome measures the total number of protests occurring within a cell in a given year. Temporal fixed effects are controlled by year, and spatial fixed effects are applied at the 10x10 km cell level. The control group for models (1) and (3) comprises all cells not designated as treated. For models (2) and (4), the control group includes only cells adjacent to treated cells. Standard errors are robust and clustered at the cell level.

Understanding how Fast Internet Affects Political Attitudes and Behaviors in Sub-Saharan Africa

This section delves into how the arrival of optical-fiber submarine cables, and the consequent expansion of broadband Internet availability in Sub-Saharan Africa, influences protests. The role of broadband Internet in facilitating participation in protests and bolstering collective action is examined through two primary channels.

Information vs Coordination

The proliferation of broadband Internet, with its vast array of content and accelerated information dissemination, potentially affects protest activities by enriching public awareness on political and so-

Table 9: Estimates of the effect on the arrival of submarine cables on political attitudes

Outcomes	Estimates	Estimates (with controls)
Trust Presidency	0.000 (0.021)	-0.001 (0.021)
Trust Parliament	0.017 (0.018)	-0.001 (0.021)
Trust Rulling Party	0.028 (0.022)	0.021 (0.018)
Trust Police	0.000 (0.018)	0.001 (0.015)
Perception corruption Presidency	0.010 (0.019)	0.010 (0.019)
Perception corruption Parlement	0.017 (0.016)	0.017 (0.016)
Perception corruption Government	0.020 (0.015)	0.019 (0.015)
Perception corruption Police	0.031*** (0.011)	0.030*** (0.011)
Satisfied with Democracy	0.004 (0.018)	0.004 (0.018)
Radio	0.025* (0.013)	0.025* (0.013)
TV	0.003 (0.021)	0.004 (0.021)
Newspaper	0.003 (0.021)	0.004 (0.021)
Chances to Join Others to Raise an Issue	0.029* (0.016)	0.029* (0.016)
Discuss Politics	0.008 (0.018)	0.008 (0.018)
Vote	-0.002 (0.015)	-0.003 (0.015)
Interest in Public Affairs	-0.016 (0.018)	-0.017 (0.018)
Freedom of Thought	-0.004 (0.016)	-0.006 (0.016)
Freedom to Vote	-0.008 (0.011)	-0.007 (0.011)
Freedom to Join orgas	-0.002 (0.012)	-0.002 (0.012)
Active Member of religious group	-0.036 (0.025)	-0.036 (0.025)
Active Member of community group	0.027* (0.015)	0.026* (0.015)

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa and Tanzania. Time FEs are years. Location FEs are the reported location at the level of Grid-cells of 0.1*0.1 decimal degrees, which is roughly 10*10 km. Individuals are considered connected if they are closer than 1.2 km to the backbone network. Robust standard errors clustered at the level of location FEs.

cial issues, thereby changing citizens' perceptions and beliefs. Such an increase in protest participation likelihood may stem from "enhanced information" dissemination capabilities and "enhanced coordination" mechanisms (Manacorda and Tesei 2020). Enhanced information provides insights into socio-political issues, while enhanced coordination, facilitated by broadband-enabled social media platforms, improves the efficiency of collective mobilization efforts. Specifically, by providing information on whether one's peers will participate in an protest, broadband Internet through social medias can increase the responsiveness of citizens in their peer's propensity to participate in a protest through a better horizontal communication.

To figure out which channel wins out over the others, I firstly estimate the effect of submarine cables arrival on the perception about institutions and the government. If we perceive a deterioration in the perception of these institutions, this would corroborate the effect of information as a vector for participation in a protest, which would then explain the motivations of protesters. I estimated Eq (1) and replace the outcome with the satisfaction with democracy and trust in institutions as shown in Table 9. The analysis revealed no massive and negative impact on democratic and institutional perceptions. Indeed, we do not perceive any negative effects on trust in institutions (President, Parliament, ruling party, police). Furthermore, an examination aimed at detecting any erosion in institutional reputation, focusing on perceived corruption, was conducted by assessing the effect of submarine cable introduction on corruption perceptions across the same institutions. I find no significant effect other than an increase in the perception of police corruption.

I estimated Eq (1) and replaced the outcome with the use of various information sources (radio, television, and newspaper). The arrival of submarine cables, which significantly increased the availability of high-speed Internet, positively impacted the use of radio as a source of news, but did not affect television or newspaper usage. It means that despite the broadened access to online platforms, radio remains the dominant news source for most Africans, likely due to its affordability and accessibility. This absence of a negative impact on traditional media suggests that conventional sources and online content are not substitutes. Consequently, informational dynamics seems non-critical in explaining the relationship between high-speed Internet access and the propensity to engage in protest activities.

To investigate the potential for improved coordination among citizens facilitated by broadband Internet, I utilized the variable that describes the likelihood that an individual reported that he or she had ever joined with others to raise an issue or would do so if given the opportunity as a proxy for individuals' aptitude to coordinate. In the same way as before, I estimated Eq (1) by replacing outcome with a dummy variable that separates those individuals who responded that they do not want to join with others to raise an issue from those who have already done so or would do so if they had the opportunity. Thus, I find that the arrival of submarine cables has a positive impact on the chances that individuals will be inclined to stand together with others to raise an issue. The analysis revealed that the deployment of submarine cables could enhance individuals' propensity to unite with others for communal advocacy. Additionally, an examination of survey responses related to an individual's engagement in community groups or associations allowed for further differentiation. By creating a binary classification of active versus inactive or non-associated members, it was observed that the introduction of fiber optic submarine cables arrival markedly increases the likelihood of active participation in community groups.

These insights highlight the pivotal role that coordination plays in mediating the effects of high-speed

Internet access on political mobilization. This suggests that enhanced connectivity goes beyond merely promoting individual participation; it significantly bolsters the dynamics of collective action within communities. Similar to how mobile phones revolutionized the information landscape (Bailard 2009), broadband Internet access has the potential to vastly improve the coordination among individuals, especially through social networks. This enhanced connectivity could facilitate the surmounting of collective action problems (Olson Jr 1971), thereby fostering greater in-group cooperation and coordination.

Analyzing Broadband's Impact on Democratic Aspirations: A Test of the Liberation Technology Hypothesis

Beyond the explanatory channels, it is worth assessing how the arrival of fiber optic submarine cables influences perceptions related to the exercise of fundamental freedoms, thereby evaluating Diamond's theory of "liberation technology" (2010). Initial findings indicate that the increased availability of broadband Internet does not significantly alter the likelihood of individuals exercising their freedoms, such as voicing opinions, voting, or expressing political views as seen in Table 9.

Table 10: Submarine Cable Arrival and Chances to Participate in a Protest

	Free		Partially Free	
	(1)	(2)	(3)	(4)
SubCable×Connected	0.049***	0.048***	0.016	0.018
	(0.016)	(0.016)	(0.025)	(0.025)
Country×Year	Yes	Yes	Yes	Yes
GADM2×Connected	No	No	No	No
Cell×Connected	Yes	Yes	Yes	Yes
Num.Obs.	18 816	18 706	13 662	13 520
R2	0.105	0.110	0.109	0.115

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Models (1) and (2) analyze data from five countries classified as 'free' by Freedom House: Benin, Ghana, Namibia, Senegal, and South Africa. Models (3) and (4) focus on five countries rated as 'partially free': Kenya, Madagascar, Mozambique, Nigeria, and Tanzania. Individuals are considered 'connected' if they reside within 1.2 km of the backbone network. The dependent variable in all models is a dummy indicating whether an individual participated in a protest in the last 12 months. Temporal fixed effects are applied by year, while spatial fixed effects correspond to the 10x10 km cell level reported location. Models (2) and (4) include control variables: nighttime lights intensity, urban, age, female, primary education. Robust standard errors clustered at the level of location FEs.

Furthermore, this analysis delves into how the relationship between the introduction of submarine cables and protest participation varies according to the freedom level of traditional media, based on data from Freedom House. It posits that in countries with more restricted traditional media, the potential for Internet censorship increases, despite the technical challenges of censoring a decentralized network like the Internet. Countries were categorized into two groups: those with "free" traditional media and those with "partially free" media. The findings, outlined in Table 10, reveal that the positive impact of increased Internet availability on protest participation is significantly positive only in countries classified with "free" traditional media.

These observations align with Guriev, Melnikov, and Zhuravskaya (2021), who found that 3G network deployment diminishes government approval exclusively in contexts where the Internet remains uncensored. This suggests that in environments with tighter information controls, particularly concerning the Internet, the capacity for public mobilization is diminished. Such evidence challenges Diamond (2010)'s assertion regarding the liberating influence of new technologies, indicating that the broader context of media freedom plays a crucial role in realizing the democratic potential of broadband Internet expansion.

Conclusion

In this paper, I evaluate the impact of broadband Internet on collective action within Sub-Saharan Africa, leveraging the exogenous variation provided by the staggered introduction of fiber-optic submarine cables from Europe between 2009 and 2014. The analysis employs an identification strategy that combines the timing of submarine cable connectivity at specific landing points with a proxy for individual Internet access, based on proximity to terrestrial backbone networks.

Empirical results indicate an increase in daily Internet usage corresponding with the arrival of submarine cables. Using data from the Afrobarometer and the Armed Conflict Location & Event Data Project (ACLED) across ten countries, I applied a difference-in-difference approach to identify a significant positive effect of high-speed Internet on the probability of participating in protests and the occurrence of protest events. This relationship was validated through a series of robustness checks, reinforcing the causal impact of broadband accessibility on political mobilization. It thus appears that the effect of broadband Internet on the likelihood of participating in a protest is unconditional on economic conditions, unlike the effects identified with older telecom technologies (such as 2G).

The analysis also explores the mechanisms driving this relationship, focusing particularly on the role of enhanced coordination as a facilitator of protest participation. Despite exploring the "liberating" effect of ICTs as theorized by Diamond, the findings do not support a positive impact on perceived democratic freedoms, such as freedom of expression, organizational participation, or voting rights. However, the analysis does reveal a significant positive effect of broadband Internet on the likelihood of individuals joining with others to raise an issue, as well as on active participation in community groups. These results underscore the importance of coordination mechanisms in mediating the relationship between high-speed Internet access and political mobilization. This positive relationship between Internet broadband and the likelihood of taking part in a demonstration is only found in democracies.

These findings suggest that while broadband Internet enhances collective action capabilities, its effects on broader democratic freedoms are complex and require further exploration to fully understand their scope and limitations within the context of economic development and political change.

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Appendix

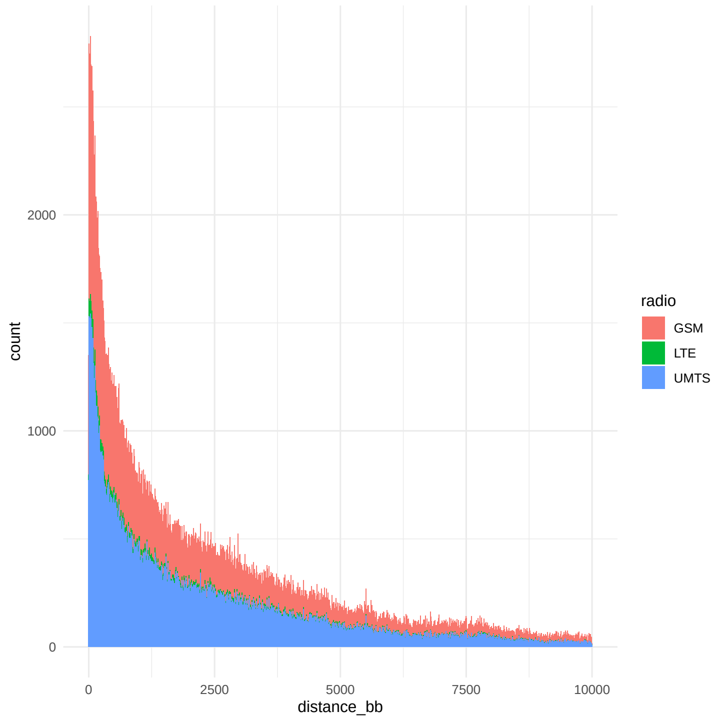

Figure 9: Density of the number of new antennas (2G, 3G, 4G) between 2012 and 2016 in relation to the distance to the backbone for the 10 countries in the sample.

Table 11: Europe/Africa Fibre-Optic Submarine Cables since 2009

Year	Name	Technology (Design capacity)	Landing Points
2009	SEACOM/Tata TGN-Eurasia	Fibre-optic (1.28 Tbps)	Dar Es Salaam, Tanzania; Djibouti City, Djibouti; Jeddah, Saudi Arabia; Maputo, Mozambique; Mombasa, Kenya; Mtunzini, South Africa; Mumbai, India; Zafarana, Egypt
2010	Glo-1	Fibre-optic (2.5 Tbps)	Accra, Ghana; Lagos, Nigeria
2010	MainOne	Fibre-optic (1.28 Tbps)	Abidjan, Ivory Coast; Accra, Ghana; Lagos, Nigeria; Dakar, Senegal
2012	Africa Coast to Europe (ACE)	Fibre-optic (12.8 Tbps)	Cotonou, Benin; Kribi, Cameroon; Abidjan, Ivory Coast; Bata, Equatorial, Guinea; Libreville, Gabon; Banjul, Gambia; Accra, Ghana; Suro, Guinea-Bissau; Conakry; Guinea; Monrovia, Liberia; Nouakchott, Mauritania; Lagos, Nigeria; Dakar, Senegal; Freetown, Sierra-Leone; Duynefontein, South-Africa; Sao-Tome, Sao-Tome and Principe
2012	West Africa Cable System (WACS)	Fibre-optic DWDM (14.5 Tbps)	Sangano, Angola; Limbe, Cameroon; Praia, Cape-Verde; Pointe-Noire, Congo; Abidjan, Ivory Coast; Muanda, Congo Dem Rep; Accra, Ghana; Swakopmund, Namibia; Lagos, Nigeria; Yzerfontein, South-Africa; Lome, Togo

Table 12: Submarine Cable Arrival and Chances to Participate in a Protest (excluding landing points areas)

	Chances to Participate in a Protest			
	(1)	(2)	(3)	(4)
SubCable×Connected	0.047***	0.045***	0.044***	0.044***
	(0.014)	(0.014)	(0.015)	(0.016)
Country×Year	Yes	Yes	Yes	Yes
GADM2×Connected	Yes	Yes	No	No
Cell×Connected	No	No	Yes	Yes
Num.Obs.	27 266	27 046	27 266	27 046
R2	0.081	0.086	0.119	0.124

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Individuals are considered connected if they are closer than 1.2 km to the backbone network. The outcome of all models is a dummy variable indicating if the individual have participated in a protest in the last 12 months. Time FEs are years. Location FEs for the model (1) and (2) are the reported location at the level GADM (Database of Global Administrative Areas) level 2. Location FEs for the model (3) and (4) are the reported location at the 10*10 Cell level. Models (2) and (4) include control variables: nighttime lights intensity, urban, age, female, primary education. Robust standard errors clustered at the level of location FEs.

Table 13: Submarine Cable Arrival and Chances to Participate in a Protest (excluding the biggest cities)

	Chances to Participate in a Protest			
	(1)	(2)	(3)	(4)
SubCable×Connected	0.028**	0.027*	0.025*	0.025*
	(0.014)	(0.014)	(0.015)	(0.015)
Country×Year	Yes	Yes	Yes	Yes
GADM2×Connected	Yes	Yes	No	No
Cell×Connected	No	No	Yes	Yes
Num.Obs.	26 941	26 735	26 941	26 735
R2	0.081	0.087	0.116	0.123

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Individuals are considered connected if they are closer than 1.2 km to the backbone network. The outcome of all models is a dummy variable indicating if the individual have participated in a protest in the last 12 months. Time FEs are years. Location FEs for the model (1) and (2) are the reported location at the level GADM (Database of Global Administrative Areas) level 2. Location FEs for the model (3) and (4) are the reported location at the 10*10 Cell level. Models (2) and (4) include control variables: nighttime lights intensity, urban, age, female, primary education. Robust standard errors clustered at the level of location FEs.

Table 14: Submarine Cable Arrival and Chances to Participate in a Protest (GADM1 Fixed Effects)

	Chances to Participate in a Protest		
	(1)	(2)	(3)
SubCable×Connected	0.033*** (0.012)	0.033*** (0.012)	-0.004* (0.002)
Country×Year	Yes	Yes	Yes
GADM2×Connected	No	No	No
Cell×Connected	No	No	No
Num.Obs.	32,478	32,226	32,226
R2	0.047	0.052	0.053

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Individuals are considered connected if they are closer than 1.2 km to the backbone network. The outcome of all models is a dummy variable indicating if the individual have participated in a protest in the last 12 months. Time FEs are years. Location FEs for the model (1), (2) and (3) are the reported location at the level GADM (Database of Global Administrative Areas) level 1. Models (2) and (3) include control variables: nighttime lights intensity, urban, age, female, primary education. Robust standard errors clustered at the level of location FEs.

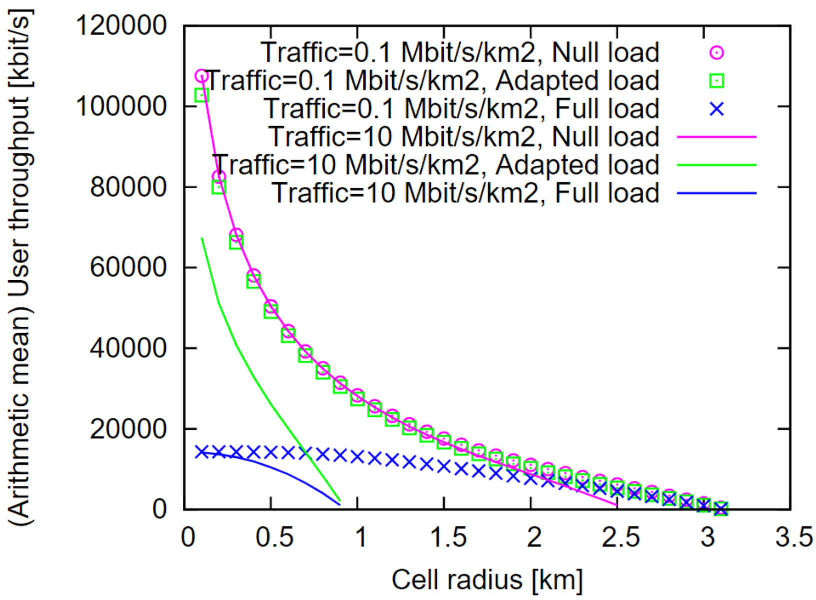

Figure 10: Mean user throughput as function of the cell radius for different load situations (Source: Karray and Jovanovic 2013).

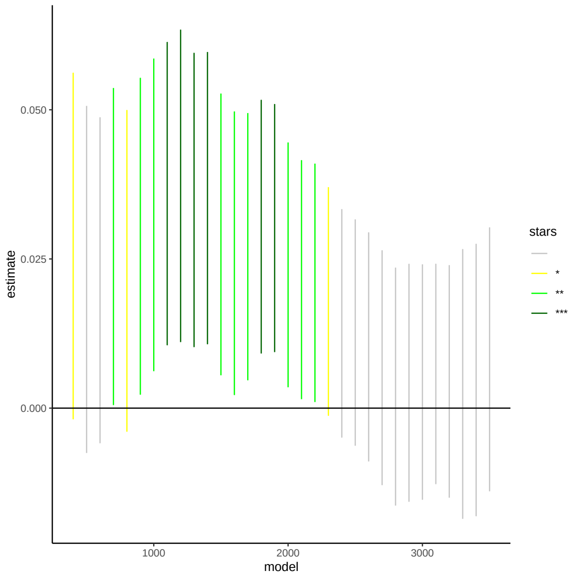

Figure 11: Variation of Connection Radius - Effect of the arrival of submarine cables on the chances to part.

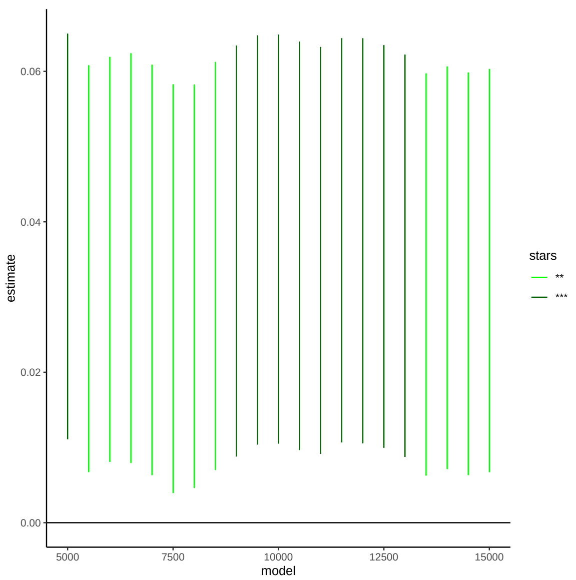

Figure 12: Variation of Size of the control group - Effect of the arrival of submarine cables on the chances to part.

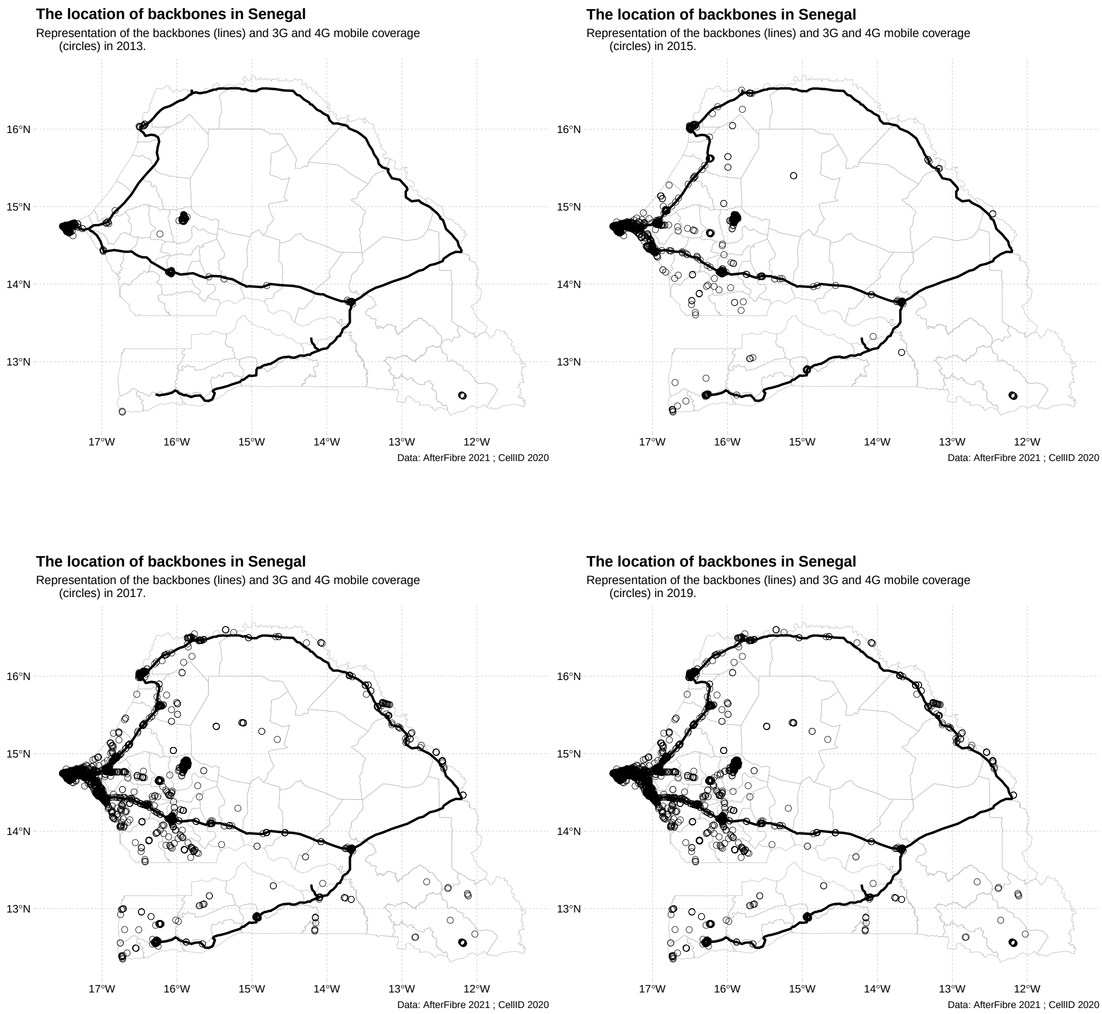

Figure 13: Location of 3G and 4G antennas in Senegal between 2012 and 2019 (Source: OpenCellID).

Table 15: Submarine Cable Arrival and Chances to Participate in a Protest (remove countries one by one)

	BEN	GHA	KEN	MDG	MOZ	NAM	NGA	SEN	ZAF	TZA
SubCable×Connected	0.030**	0.037**	0.036**	0.040***	0.047***	0.027*	0.038***	0.039***	0.044***	0.035**
	(0.015)	(0.016)	(0.015)	(0.014)	(0.014)	(0.015)	(0.014)	(0.015)	(0.015)	(0.014)
Country×Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GADM2×Connected	No	No	No	No	No	No	No	No	No	No
Cell×Connected	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num.Obs.	30 452	28 831	28 789	30 346	29 432	29 132	29 736	29 827	25 332	30 425
R2	0.114	0.106	0.112	0.104	0.108	0.117	0.107	0.110	0.087	0.103

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa and Tanzania. Countries are removed from the sample one by one, and the Eq (1) is estimated. Time FEs are years. Location FEs are Grid-cells of 0.1*0.1 decimal degrees, which is roughly 10*10 km. Individuals are considered connected if they are closer than 1.2 km to the backbone network. Robust standard errors clustered at the level of location FEs.

Table 16: Submarine Cable Arrival and Chances to Participate in a Protest (remove countries one by one with controls)

	BEN	GHA	KEN	MDG	MOZ	NAM	NGA	SEN	ZAF	TZA
SubCable×Connected	0.030**	0.038**	0.036**	0.041***	0.046***	0.028*	0.038***	0.039***	0.044***	0.035**
	(0.015)	(0.016)	(0.015)	(0.014)	(0.014)	(0.015)	(0.014)	(0.014)	(0.015)	(0.014)
Country×Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GADM2×Connected	No	No	No	No	No	No	No	No	No	No
Cell×Connected	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num.Obs.	30 211	28 599	28 551	30 107	29 269	28 882	29 498	29 595	25 137	30 185
R2	0.119	0.111	0.117	0.110	0.114	0.126	0.112	0.115	0.093	0.109

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa and Tanzania. Countries are removed from the sample one by one, and the Eq (1) is estimated. Time FEs are years. Location FEs are Grid-cells of 0.1*0.1 decimal degrees, which is roughly 10*10 km. Individuals are considered connected if they are closer than 1.2 km to the backbone network. Robust standard errors clustered at the level of location FEs.

Table 17: Submarine Cable Arrival and Chances to Participate in a Protest

	Without 800-1600		Without 1200-1600		Without 800-1200	
	(1)	(2)	(3)	(4)	(5)	(6)
SubCable×Connected	0.037**	0.034**	0.036**	0.037**	0.039**	0.035**
	(0.016)	(0.016)	(0.014)	(0.015)	(0.016)	(0.015)
Country×Year	Yes	Yes	Yes	Yes	Yes	Yes
GADM2×Connected	Yes	No	Yes	No	Yes	No
Cell×Connected	No	Yes	No	Yes	No	Yes
Num.Obs.	27 654	27 654	30 076	30 076	29 804	29 804
R2	0.083	0.116	0.082	0.115	0.081	0.114

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Individuals are considered connected if they are closer than 1.2 km to the backbone network. The outcome of all models is a dummy variable indicating if the individual have participated in a protest in the last 12 months. Time FEs are years. Location FEs for the model (1), (3) and (5) are the reported location at the level GADM (Database of Global Administrative Areas) level 2. Location FEs for the model (2), (4) and (6) are the reported location at the 10*10 Cell level. All Models include control variables: nighttime lights intensity, urban, age, female, primary education. Robust standard errors clustered at the level of location FEs. For each regression, I specify which individuals are excluded from the sample on the basis of their distance from the backbone.

Table 18: Submarine Cable Arrival and Chances to Participate in a Protest

	Controls: 1200-5000m		Controls: 1200-15000m		Controls: > 1200m	
	(1)	(2)	(3)	(4)	(5)	(6)
SubCable×Connected	0.032**	0.038***	0.036***	0.034**	0.029**	0.030**
	(0.013)	(0.014)	(0.013)	(0.014)	(0.012)	(0.013)
Country×Year	Yes	Yes	Yes	Yes	Yes	Yes
GADM2×Connected	Yes	No	Yes	No	Yes	No
Cell×Connected	No	Yes	No	Yes	No	Yes
Num.Obs.	24 967	24 967	36 444	36 444	64 959	64 959
R2	0.084	0.110	0.079	0.115	0.082	0.129

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Individuals are considered connected if they are closer than 1.2 km to the backbone network. The outcome of all models is a dummy variable indicating if the individual have participated in a protest in the last 12 months. Time FEs are years. Location FEs for the model (1), (3) and (5) are the reported location at the level GADM (Database of Global Administrative Areas) level 2. Location FEs for the model (2), (4) and (6) are the reported location at the 10*10 Cell level. All Models include control variables: nighttime lights intensity, urban, age, female, primary education. Robust standard errors clustered at the level of location FEs. For each regression, I specify which individuals are excluded from the sample on the basis of their distance from the backbone.

Table 19: Submarine Cable Arrival and Chances to Participate in a Protest (Precision test)

	(1)	(2)	(3)	(4)
SubCable×Connected	0.033**	0.032**	0.030**	0.030**
	(0.014)	(0.014)	(0.014)	(0.014)
Country×Year	Yes	Yes	Yes	Yes
GADM2×Connected	Yes	Yes	No	No
Cell×Connected	No	No	Yes	Yes
Num.Obs.	31 012	30 765	31 012	30 765
R2	0.075	0.080	0.109	0.114

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Individuals are considered connected if they are closer than 1.2 km to the backbone network. The outcome of all models is a dummy variable indicating if the individual have participated in a protest in the last 12 months. Time FEs are years. Location FEs for the model (1) and (2) are the reported location at the level GADM (Database of Global Administrative Areas) level 2. Location FEs for the model (3) and (4) are the reported location at the 10*10 Cell level. Models (2) and (4) include control variables: nighttime lights intensity, urban, age, female, primary education. Robust standard errors clustered at the level of location FEs.

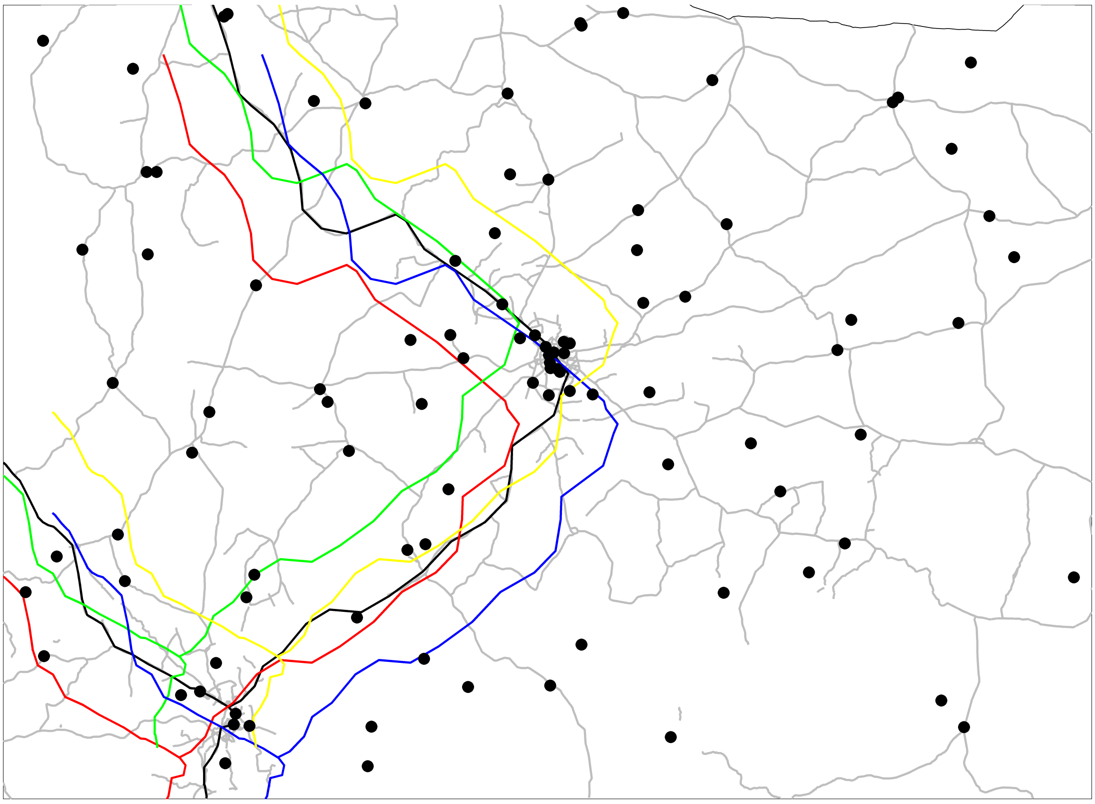

Figure 14: This map details the placebo test conducted for the study, centered on Kano, Nigeria. The black line marks the actual location of the existing backbone cable. Surrounding this, the other colored lines illustrate hypothetical displacements of the backbone cable, each shifted by 12.5 degrees in four different directions. Following these simulated shifts, the treatment and control groups were redefined based on the new positions to assess the robustness of the original findings.

Table 20: Submarine Cable Arrival and Chances to Participate in a Protest (Placebo test)

	(-0.125, -0.125)		(-0.125, 0.125)		(0.125,-0.125)		(0.125, 0.125)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SubCable×Connected	−0.024	−0.025	0.032	0.019	0.007	0.006	0.029	0.019
	(0.029)	(0.033)	(0.025)	(0.026)	(0.039)	(0.032)	(0.023)	(0.023)
Country×Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GADM2×Connected	Yes	No	Yes	No	Yes	No	Yes	No
Cell×Connected	No	Yes	No	Yes	No	Yes	No	Yes
Num.Obs.	20 253	20 253	18 727	18 727	18 250	18 250	17 717	17 717
R2	0.084	0.122	0.086	0.128	−0.512	0.132	0.089	0.131

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample consists of Benin, Ghana, Kenya, Madagascar, Mozambique, Namibia, Nigeria, Senegal, South Africa, and Tanzania. Connectivity is defined based on proximity to a 'false' backbone network, which is displaced by the degree values specified above each column. The primary outcome for all models is a dummy variable that indicates whether an individual has participated in a protest within the last 12 months. Temporal fixed effects (Time FEs) are included for each year. Spatial fixed effects (Location FEs) for models (1), (3), (5), and (7) are determined at the GADM level 2, while for models (2), (4), (6), and (8), they are determined at the 10x10 km cell level. All models control for nighttime lights intensity, urban status, age, gender (female), and primary education. Robust standard errors clustered at the level of location FEs.