Mobile Internet Technology and National Identity in Sub-Saharan Africa

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Abstract

We examine how the expansion of mobile internet infrastructure affects national identity in sub-Saharan Africa. In diverse societies where elections are contested along ethno-communal lines, we argue that access to mobile internet undermines national identity because it facilitates voter exposure to the polarizing tendencies of internet-based social media and communication platforms. Applying a difference-in-differences design on mobile coverage maps and geocoded survey data of more than 50,000 African citizens, we show that access to mobile internet reduces identification with the nation by up to 5–7 percentage points. To establish support for our electoral mechanism, we exploit as-if random variation in the timing of individuals' survey interviews relative to presidential elections, during which we argue divisive and polarizing forces are at their peak. Our analysis shows that electoral proximity intensifies the negative effect of mobile internet. These findings highlight how technological innovations can inhibit the process of state-building in diverse societies.

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1 Introduction

Innovations in communication technology have played a central role in the formation of national identities in the modern state. The widespread adoption of printing technology, for example, encouraged the use of a common written language, enabling communications between geographically dispersed groups that previously did not have the means necessary to interact with each other (Anderson, 1983). The process of engaging in common discourse and "imagining" themselves as a part of a broader community—one larger than their own ethno-communal groups—ultimately allowed citizens to develop a collective sense of belonging to their nation as a whole. The technology also provided political elites with a platform to promote an agenda establishing a common national history which would contribute to the formation of a national identity (Deutsch, 1966; Weber, 1976).[1]

Of the many advances in communications infrastructure since the invention of the printing press, mobile communications technology—mobile internet service in particular—has been arguably the most transformative. Unlike the dial-up and broadband internet, whose benefits have largely been confined to the developed world, the reach of cell phones has extended to a majority of populations in the developing world, including much of South and Southeast Asia, Latin America, and sub-Saharan Africa. The geographic extent of coverage is so broad that mobile internet is available in places where other types of infrastructural development have failed to penetrate. The parallels between the printing press and mobile internet—lowering the cost of communication, and connecting millions of previously unconnected people—may lead us to anticipate that the rapid expansion of cell phone networks over the past two decades would exert similar integrative pressures on users to develop attachments to their collective national communities.

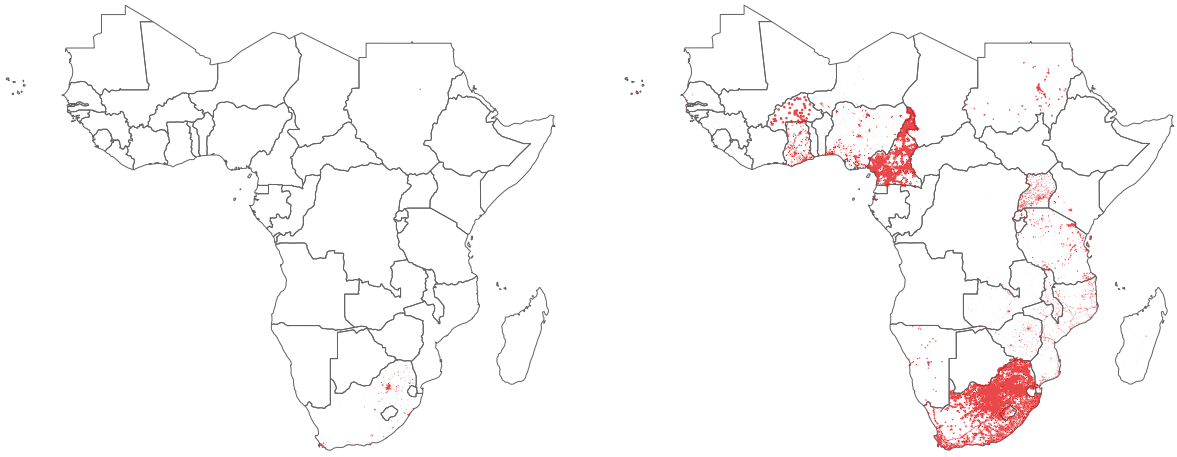
Despite these clear parallels, there are strong reasons to be more skeptical of the integrative potential of mobile internet expansion, especially in the context of the developing world where such expansion is perhaps likely to be the *most* transformative. First, the structural, institutional, and

[1] While we focus on communication technology, other scholars focus on broader aspects of modernization as a whole. An earlier literature on state-building suggests that the process of modernization facilitates the construction of a national identity (Anderson, 1983; Gellner, 2008; Weber, 1976). A recent empirical investigation by Robinson (2014) has tested these theoretical arguments and has found evidence consistent with the observation that modernization increases an individual's propensity to identify with the state.

sociodemographic characteristics of the Global South today differ significantly from those of 18th and 19th-century Western Europe, upon which much of the earlier literature linking technological innovations to the formation of a national identity has primarily focused (Gellner, 2008). Second, while its far-reaching nature might be similar to previous communications revolutions, distinctive features of mobile internet service—as a medium through which broad segments of the population gain low-cost access to internet-based infrastructure and modes of communication—may create conditions that foment polarization rather than integration (Lelkes, Sood and Iyengar, 2017; Settle, 2018).

These divergent theoretical expectations provide the motivation for our paper. In drawing the link between the expansion of mobile technology and national identity, we begin from the premise that in contexts where ascriptive (e.g., ethnic, racial, or religious) boundaries demarcate the axes of political competition, elections can serve as a catalyst for polarization between ethnocommunal groups. Mobile phone coverage, and mobile *internet* in particular, undermines identification with the nation by exposing citizens to internet-based social media platforms which provide two interacting pathways to polarization; i) an elite-driven pathway whereby citizens come into contact with the polarizing rhetoric peddled by political parties and politicians that capitalize on the opportunities provided by these new social media platforms during elections, and ii) a mass-driven pathway whereby citizens not only consume or disseminate polarizing mis/disinformation from politicians but also themselves take part in the production and reproduction of such mis/disinformation through insular, echo chamber-like networks created on social media platforms. Such polarization, we argue, results in the reinforcement or ossification of ethnocommunal loyalties, inhibiting the development of an attachment or sense of belonging to the broader national community.

In providing support for this argument, we focus our attention on the case of sub-Saharan Africa. As shown in Figure 1, Africa has witnessed an explosive expansion in mobile internet service over the past decade, with the number of people who have access to mobile internet increasing from virtually zero in 2007 to 825 million in 2019. Mobile internet service now penetrates more than



Mobile internet coverage in 2007 Mobile internet coverage in 2018

Figure 1: Maps illustrate the expansion of mobile internet coverage in sub-Saharan Africa between 2007 and 2018. Maps were created using coverage data provided by Collins Bartholomew and the GSM Association.

79 percent of Africa's population.[2] We combine detailed yearly geospatial data of mobile internet coverage and geocoded survey responses from rounds 3–7 of the Afrobarometer surveys, which measure the extent to which an individual privileges their identification with their nation relative to their communal (ethnic, regional, religious) group.

In order to identify the effect of mobile internet coverage on the extent to which citizens identify with their national community, we employ a difference-in-differences design, which exploits temporal variation in the extent of mobile internet coverage across different waves of the Afrobarometer. Using this approach, we find that expanded access to mobile internet service leads to a statistically significant decrease in an individual's propensity to identify with the nation over their ethnocommunal group by up to 5~7% points. These effects remain robust after accounting for demographic differences between individuals living with and without mobile coverage, as well as heterogeneity in local infrastructural and economic development that could potentially be correlated with service roll-out. By contrast, we do not detect any effect of the expansion of basic mobile phone service,

[2]For more information on the growth of mobile internet access see "New ITU data reveal growing Internet uptake but a widening digital gender divide," retrieved on November 26, 2020, at https://www.itu.int/en/mediacentre/Pages/2019-PR19.aspx.

which does not provide access to the internet-based social media and messaging platforms through which we argue election-driven polarization occurs.

To provide evidence of our theoretical claims, we exploit plausibly exogenous variation in the timing of individual survey respondent's interviews to the date of the presidential elections (Eifert, Miguel and Posner, 2010), during which we argue that polarizing forces are at their peak. If *mobile internet* functions as a key mechanism through which individuals are exposed to the polarizing influence of elections, we should expect people with mobile internet access to become less attached to the nation as high-salience elections draw nearer. We find that this is the case; proximity to presidential elections amplifies the polarizing effects of mobile internet coverage.

Our findings offer insights into the sociopolitical consequences of one of the most significant developments in communications infrastructure in the world. While earlier work has tied the expansion of mobile phone service to group-level outcomes such as political violence, protest, and repression (Pierskalla and Hollenbach, 2013; Enikolopov, Makarin and Petrova, 2020; Christensen and Garfias, 2018), we show that it also has social-psychological implications for how individuals relate to their nation-state. In this sense, our work shares the orientation of Guriev, Melnikov and Zhuravskaya (2020), which finds that 3G internet reduces citizen approval of the incumbent government and increases voter disillusionment. We focus on a different but equally important dimension of state-citizen relations: how they relate to their national community. Given that the salience and persistence of ethnocommunal identities and the relative weakness of national identities have been identified as root causes of conflict and state fragility in Africa (Fearon and Laitin, 2003; Montalvo and Reynal-Querol, 2005), our findings have important implications for the study of state-building in these diverse societies.

Our research also contributes to the community of scholars working on deepening our understanding of identity—social, ethnic, religious, and national—as an outcome (Robinson, 2016; Green, 2022). Much of the work in this area has focused on how long-term processes or macrosocial structures such as colonial legacies and modernization affect ethnic or national identities (Posner, 2004; Robinson, 2014; Green, 2022). Yet a recent group of scholars has examined the effect of meso-level

factors that operate in the intermediate to short run on social identities (Peisakhin and Rozenas, 2018; Bleck and Michelitch, 2017). We join these scholars in arguing that a relatively recent development such as the expansion of mobile internet service can have consequences for how an individual defines their relationship to the nation.

2 Elections, mobile internet, and national identity

In hypothesizing the relationship between mobile communication technology and national identity in diverse societies, we begin from an important observation in the existing literature in comparative and American politics; that electoral competition has the potential to reinforce pre-existing parochial divisions in society (Ferree, 2010; Michelitch, 2015). Scholars have characterized elections as a "zero-sum contest between groups, in which gains by any one group is considered as a loss for all others (Arriola, 2012, 11). Due to the widespread perception among voters that losing in elections means being excluded from power and the ability to access the distributive capabilities of the states, politicians are incentivized to mobilize and appeal to parochial interests in ways that sharpen communal antagonisms (Wilkinson, 2006). Others have also argued that elections constitute key junctures in which the relative standing of groups is subject to inherent uncertainty, and anxieties or concerns over the loss of status or recognition intensify (Horowitz, 1985; Sambanis and Shayo, 2013). Since voters are motivated to stem these uncertainties and anxieties by expressively voting "for their group" (Brennan and Hamlin, 1998), politicians stand to benefit by utilizing campaign strategies that "evoke pride, grievances, or contempt" that are associated with parochial belongings (Gadjanova, 2017). [3]

It is under these conditions—wherein elections tend to reinforce voter attachment to their ethnocommunal identities, and politicians are incentivized to mobilize around them—that we argue that the expansion of mobile technology is likely to intensify polarization and undermine national

[3]The two strands of literature summarized briefly in this paragraph reflect the division in the study of ethnic politics regarding whether ethnic identification can be attributed to largely material versus social-psychological factors. We do not attempt to adjudicate between these two perspectives, and instead simply build on their common prediction that elections are likely to reinforce politician incentives to promote a parochial, exclusionary agenda.

identity. We specifically identify mobile *internet* technology as a channel of polarization and focus on how it facilitates voter access to the polarizing potential of online social media platforms such as Twitter and Facebook, as well as messaging services such as Whatsapp,[4] especially during periods of electioneering.

Our intuition is motivated by the extant literature that emphasizes the polarizing potential of internet-based social media in consolidated democracies of North America and Europe (Lelkes, Sood and Iyengar, 2017; Cinelli et al., 2021).[5] Rather than serving as a forum for the cross-cutting exchange of ideas and democratic dialogue, scholars have shown that these venues have become "echo chambers" in which individuals sort into clusters that share similar political opinions and attitudes, and thus seldom have the opportunity to interact with others that do not share in their beliefs (Colleoni, Rozza and Arvidsson, 2014; Settle, 2018). Furthermore, the extensive degree of self-sorting into homogeneous groups can exacerbate the well-documented tendency of individuals to selectively seek out information that reinforces their prior beliefs (Halberstam and Knight, 2016). Such exposure to like-minded individuals is associated with the adoption of more extremist positions that can lead to further polarization and radicalization (Mutz and Martin, 2001).

Furthermore, social media platforms provide fertile ground for the spread of mis/disinformation (Lazer et al., 2018; Allcott and Gentzkow, 2017). In an online environment where speech is unregulated and editorial forbearance on unchecked/unvalidated facts and stories—one of the corrective pressures that often exist in conventional print and broadcast news media—is absent, the likelihood that voters are exposed to misleading or incorrect information (otherwise referred to as fake news) on uncurated platforms such as Facebook or Twitter increases significantly. In providing corroborative evidence for this proposition, Guess, Nyhan and Reifler (2020) show that voters have been shown to be significantly more likely to visit websites with false news rather than hard news im-

[4] While these messaging services technically do not fall into traditional notions of social media, as Lupu, Bustamante and Zechmeister (2020) point out, it serves a similar purpose as Twitter and Facebook in that people join Whatsapp to i) share news and information and engage in discussion, ii) groups formed are quite large, often encompassing members outside of immediate family or friends, and iii) users often engage in communication with group members with whom they are not personally acquainted.

[5] We acknowledge that this perspective has recently been challenged by research in political science and economics. See Guess (2021) and Boxell, Gentzkow and Shapiro (2017) for examples of this work. For a comprehensive review of the literature on the political effects of the internet, see Zhuravskaya, Petrova and Enikolopov (2020).

mediately after accessing platforms such as Facebook. While some scholars have pointed out that active engagement with fake news (such as sharing) is restricted to a small subset of social media users (Guess, Nagler and Tucker, 2019; Grinberg et al., 2019), others have highlighted how the speed and breadth of fake news circulation significantly overshadow that of verified news (Vosoughi, Roy and Aral, 2018), suggesting that the reach of mis/disinformation on social media might extend far beyond the pool of individuals that actively and directly engage with such content.

The meteoric expansion of social media platforms and messaging services, alongside the expansion of mobile internet in the Global South, provide political parties and politicians with a new and potentially highly effective channel through which they can promote the parochial agenda described above (Ncube, 2019; Fisher, Gadjanova and Hitchen, 2023).[6][7] Traditionally, parties and politicians in the developing world have relied on conventional modes of campaigning such as handouts, door-to-door canvassing, or mass rallies to reach out to voters, which can become time and resource intensive (Brierley and Kramon, 2020; Paget, 2023). Facebook and Twitter, as well as messaging services such as Whatsapp, provide politicians with many advantages over these modes of campaign outreach.

These platforms facilitate broader dissemination of information regarding conventional campaign events, expanding the potential set of voters who are likely to attend. They can also allow the messages delivered in person at these campaign events to be spread far beyond the networks of voters who were physically present at the rally. But the opportunities afforded to parties and politicians do not stop there; in addition to increasing the efficacy of conventional modes of campaigning (Nyabola, 2018), social media and messaging platforms allow politicians to make direct contact with a significantly larger number of voters who would otherwise not be inclined to attend

[6]According to website *Internet World Stats* (https://www.internetworldstats.com/) Africa has an overall internet penetration rate of 46.2%. The continent is estimated to have a total of 264 million Facebook subscribers, with a penetration rate of 19.3%. This average rate masks significant variation across countries, with countries such as South Africa, and Namibia reporting significantly higher rates of 30~40 percent.

[7]While similar data for messaging services such as Whatsapp are not readily available, journalistic accounts suggest that the total number of Whatsapp users far outnumber Facebook or Twitter users, with many reporting that a large majority of internet data is consumed on Whatsapp. See *Culture Trip*, "Why Most of Africa's Data is Used on WhatsApp," retrieved June 1, 2021. https://theculturetrip.com/africa/articles/why-most-of-africas-data-is-used-on-whatsapp/.

these in-person campaign events (Rajput, 2014; Adebanjo, 2019). With social media, parties and politicians are significantly less constrained in terms of the frequency with which they can reach out to their supporters and in the extent of individual or group-level targeting or adjustment of their outreach to ensure that their message is having the intended impact (Nyabola, 2018). In addition, they obtain the ability to taint the image of their opponents relatively unhindered due to the unregulated nature of social media and can expect to see their machinations percolate through the online sphere as their supporters disseminate and reproduce these negative attacks through their own social networks (Lupu, Bustamante and Zechmeister, 2020; Cheeseman et al., 2020). Where political friends and foes are primarily defined along ascriptive group boundaries, these dynamics are likely to intensify animus towards both candidates and voters belonging to outgroups and strengthen loyalty to their own group.

Access to the mobile internet places voters directly under the influence of the polarizing social media environment cultivated by political actors. The frequent interaction with polarizing information and content is likely to set in motion the process for voters to reify their loyalties to their ethnic groups and disassociate themselves from a "national community" that their reified group loyalties undermine (Lieberman and Miller, 2021).

But it is not just through the influence of the divisive rhetoric that parties and politicians advance on internet-based platforms that leads voters down the path of polarization (Mpofu, 2019). As suggested earlier, voters themselves can engage in a class of well-documented behaviors that perpetuate or even intensify these processes of polarization; such as confining their interactions online to individuals or groups who share their parochial alignments, or selectively consuming information that reinforces rather than contradicts their own beliefs. Furthermore, independent of the intervention by politicians, they may also directly take part in the production of polarizing mis/disinformation and disseminate it through their personal online and offline networks.

The preceding discussions have highlighted the importance of mobile internet technology in shaping identities in diverse societies. We generate the following testable, empirical predictions re-

garding the impact of mobile internet service expansion.[8]

Hypothesis 1 (Mobile internet coverage): *The expansion of mobile internet service in particular, is likely to increase citizen identification with parochial ethnocommunal identities, and therefore decrease national identification.*

We have also emphasized how periods of electoral campaigning are likely to be moments where the polarizing forces are at their peak. We thus anticipate that as election campaigns intensify along the election cycle—i.e. as the day of the election approaches—voters with access to mobile internet service will be even more inclined to identify with their ethnocommunal groups, and less with their national community.

Hypothesis 2 (Mobile internet $\times$ election proximity): *The polarizing influence of mobile internet is likely to intensify as elections draw near, during which polarizing forces are their peak.*

We end this theoretical discussion with two important caveats. First, we do not make any predictions regarding the general equilibrium impacts of mobile internet access writ large, nor adjudicate whether it constitutes a net positive or negative for social, economic, or political life in Africa. Empirical research that examines the economic consequences of mobile coverage have found that it generally has a positive impact in improving generalized welfare (Aker, 2008; Aker and Mbiti, 2010), eliminating inefficiencies in commodity prices in different markets (Muto and Yamano, 2009), as well as in reducing poverty (Suri and Jack, 2016). However, other important work has reported an increase in political violence, suggesting that the net impact of mobile technologies might be unclear (Pierskalla and Hollenbach, 2013). Second, we do not intend to adjudicate whether polarization through increased mobile internet access is more an elite-driven or mass-driven process. In

[8]We note, however, that our posited mechanisms for mobile internet fail to extend to the case of *basic mobile phone service*—which provides users with "talk and text" capabilities—because it does not grant politicians or voters with access to the internet and the social media platforms that are based on internet technology nor internet-based messaging apps such as Whatsapp or Telegram.

fact, we see these two pathways as equally important and inherently intertwined, where disentangling the independent impact of each pathway is likely to be highly challenging with the data.

3 Context: Mobile Technology and Identity Politics in Africa

We study the implications of mobile internet access on elections and identity politics in a period of an unprecedented expansion of mobile communications infrastructure across the African continent. Within a span of just over a decade, the continent went from virtually no mobile internet penetration to close to 80% of the population (825 million) covered by 3G mobile service—the minimum threshold service for consistent access to the internet via mobile phones—and more than 30% with access to a rapidly expanding higher-speed infrastructure such as 4G and 5G service.

The expansion of mobile internet service has been accompanied by a surge in active social media users (numbering more than 260 million Facebook users and a much higher penetration for Whatsapp), with an overwhelming majority (93%) reporting that they primarily access social media platforms such as Facebook or Twitter via their mobile phones.[9][10] More important than the sheer number of new social media users is the manner in which social media platforms are used by those with access: there is significant reason to believe that mobile internet and social media are fast becoming fora for citizens to acquire and share information regarding politics and government.

Figure 2 presents data from 2017 Pew Global Attitudes Surveys across six Sub-Saharan African countries regarding patterns of internet and social media usage across a representative sample of adults (Pew Research Center, 2018). The top panel of Figure 2 plots the proportion of individuals who report that they use the internet for either economic or political purposes. In step with the much-discussed emergence of online mobile money solutions, slightly less than 50% of respondents

[9] See *Baobab News*, "Digital 2019: Global and African Social Media use Accelerates", retrieved at https://africa.baobab.news/*2019*/*07*/*03*/digital-*2019*-global-and-african-social-media-use-accelerates/ on November 24, 2020.

[10] The yearly growth rate in the number of social media platform users has outpaced the growth of mobile internet infrastructure itself between 2018 and 2019. Between 2018 and 2019 alone, an additional 25–30 million individuals were newly registered as mobile social media users (13–17% increase), in comparison to only an 8% increase in mobile internet users.

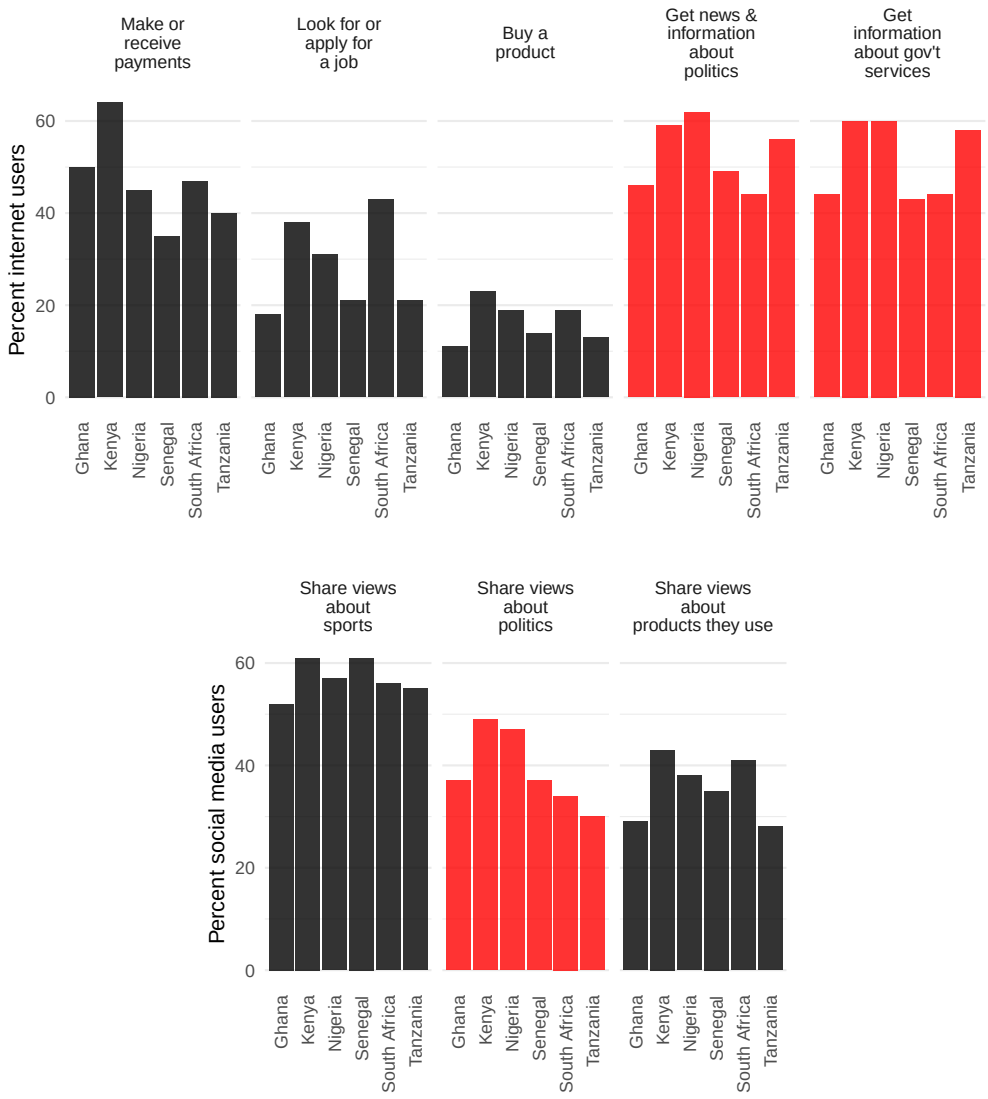


Figure 2: Africans use the internet to get news about politics and to post to social media their political views. Data source: Pew Global Attitudes Survey, Spring 2017.

across the six African countries report using the internet to make or receive payments. But more surprisingly, an even higher proportion of internet users report that they use the internet to obtain information about politics and government services. We observe similar patterns in responses to the question probing the reasons internet users post on social media platforms. As seen in the bottom panel of Figure 2, while social media users more commonly report posting to share views about sports, close to 40% of all users report using social media platforms to share their political views.[11]

[11]The Pew Global Surveys, conducted in 2017 also tracked the proportion of individuals who report that they have

The emergence of mobile internet and social media as a center of political activity is likely related to why political parties and politicians are increasingly establishing a social media presence and taking their election campaigns to these platforms. Yet as politicians turn their eyes toward social media, concerns over the potentially divisive and polarizing potential of such activities have already begun to accumulate. The 2017 presidential elections in Kenya provide a clear example of how online social media platforms can foment extreme polarization and cross-ethnic tensions and hostility. As the competition between incumbent president Uhuru Kenyatta and opposition coalition leader Raila Odinga escalated in the run-up to the elections, social media platforms were inundated with negative posts—often by politicians communicating in their ethnic group's vernacular—designed to generate anxieties about the consequences of electoral defeat in the hands of ethnic others.[12]

While these posts are too numerous to describe individually, one particular incident regarding a viral video posted on social media encapsulates the extent of these polarizing influences succinctly. This video, which was not formally claimed by any of the political parties or politicians running in the election, was uploaded to Youtube less than a month prior to the election with the ostensible objective of casting the consequences of an Odinga presidency in a negative light. In addition to sensational footage of Kenya burning in the wake of post-electoral violence and conflict, the video made explicit references to how Odinga's victory would likely result in the displacement of "whole tribes and communities."[13]

Similar concerns over the use of social media as a forum for instigating interethnic tensions were also raised during the 2019 Presidential elections in Nigeria. As the informal system of the rotational presidency between the predominantly Muslim / Hausa-Fulani-dominated north and Christian / Yoruba-Igbo-dominated south collapsed in 2015, political candidates at both the national and local levels have used the rhetoric of inter-ethnic intolerance for the purpose of negative mobilization

posted their own thoughts on political or social issues online. Respondents in African countries such as South Africa (11%), Kenya (14%), and Nigeria (17%) are significantly more likely than citizens in countries in Europe, such as Greece (6%), Hungary (5%), Poland (7%) to report that they have done so in the past year.

[12] *Voice of America*, "In Volatile Kenya, MP and Former Senator Detained Over Hate Speech Allegations", https://www.voanews.com/africa/volatile-kenya-mp-and-former-senator-detained-over-hate-speech-allegations on November 24, 2020.

[13] See https://www.france24.com/en/video/20180322-cambridge-analytica-boasts-role-kenya-election and https://www.bbc.com/news/world-africa-43471707.

(Ezeibe, 2020). Rumors attempting to dehumanize opponents and stoke fear of imminent terrorism and violence were spread by the incumbent APC and the opposition PDP and rapidly diffused throughout social media. The misinformation and hate speech circulated predominantly through social media platforms such as Twitter and Facebook during this period of intense electioneering was of such grave concern that the APC-controlled Nigerian Senate quickly drafted a draconian piece of legislation that levies severe punishment (death or life sentence) for those found guilty of engaging in hate speech.[14]

4 Data and research design

4.1 Geocoded public opinion data

To estimate the effect of new technology on national identification, we combine geocoded individual survey responses with data on the geographic extent of mobile internet coverage. We overlay the coverage maps with geocoded individual-level data from rounds 3–7 of the Afrobarometer Surveys, conducted between 2005 and 2018.[15] We note that rounds 1~6 of the Afrobarometer surveys were geocoded retroactively, to varying levels of precision. In order to avoid the risk of misclassifying individuals that fall within or outside of mobile coverage boundaries, we include only those respondents coded at the highest two levels of precision—those coded precisely to a specific location (precision code 1), and those that are coded within 25km of the exact location (precision code 2).[16]As seen in Figure 3, the combined data include individuals from 27 sub-Saharan African

[14]*Deutsche Welle*, "Nigeria bill aims at punishing hate speech with death', retrieved at https://www.dw.com/en/nigeria-bill-aims-at-punishing-hate-speech-with-death/a-*51419750* on November 24, 2020.

[15]We examine the reports available on https://www.afrobarometer.org/surveys-and-methods/sampling/ to verify that the sampling technique for Afrobarometer did not change significantly during this period, which would undermine the validity of inferences drawn from a difference-in-difference analysis using repeated cross-sections. The mode of the interview for all the surveys remained in-person face-to-face surveys, and at no point did change to computer-assisted interviews that could potentially privilege mobile-internet covered areas. For a full discussion, please refer to the supplementary appendix section A.2.

[16]The details of how the retroactive geocoding of Afrobarometer surveys for rounds 1–6 are available in http://docs.aiddata.org/ad4/pdfs/geocodingafrobarometer.pdf. Given the reliance on web-based sources to gather topographical information on the enumeration areas sampled, there is the possibility that the accuracy of geocoding is a function of the presence of mobile internet, and we are therefore trimming the data as a function of treatment. In order to account for this possibility, we conducted analyses without placing a restriction on the precision codes. Our

countries.

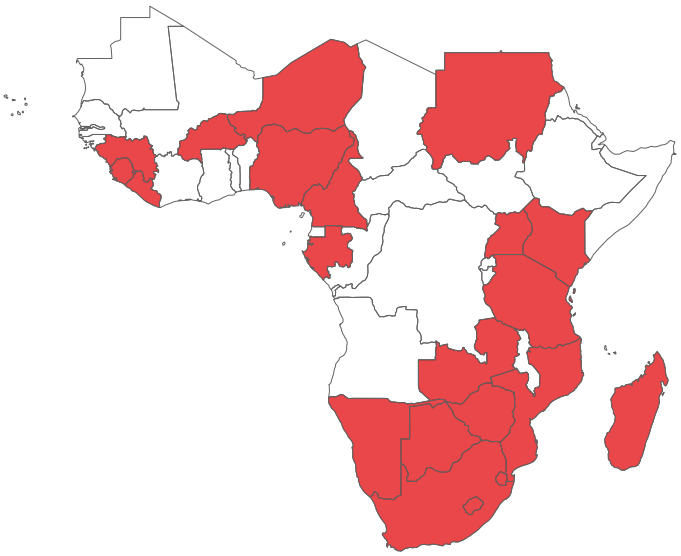


Figure 3: Countries included in the main analysis presented in the paper. To be included, a country needed to be in at least two Afrobarometer surveys for which mobile internet coverage data was available from the GSMA.

Our main dependent variable is derived from responses to the Afrobarometer question:

> *"Let us suppose that you had to choose between being a [respondent's national ID] and being a [respondent's ethnic group]. Which of the following best expresses your feelings?"*

Responses range from 1 ("I feel only [ethnic]") to 5 ("I feel only [national]"). With this measure, the strength of national and ethnic identities is defined relative to one another. Indeed, Robinson (2014) has elaborated on the benefits of employing this relative measure of national identity; first, a question item probing absolute levels of national and ethnic identification separately would require us to assume that respondents map the intensity of identification onto the scale in similar ways. Second, the relative juxtaposition of national versus ethnic identities are in line with the constructivist notion of identities that individuals hold identifications with multiple identity groups and that relative salience of one identity vis-à-vis another is more important and meaningful than the strength of attachment to a single identity by itself. For our purposes, this is useful: we conceive

results do not change substantively.

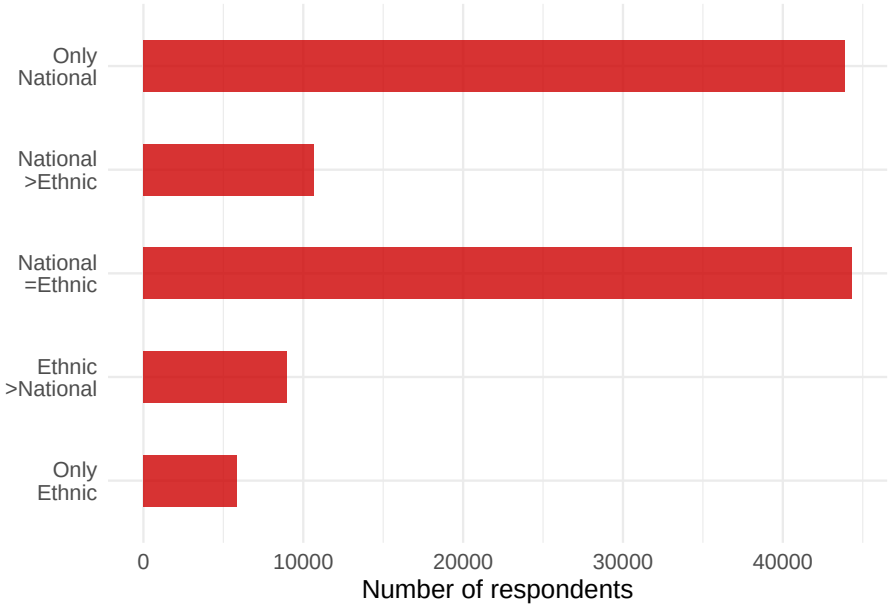


Figure 4: The distribution of national versus ethnic identification in Afrobarometer rounds 3–7. For our main outcome, we use an indicator for whether the respondent identifies more nationally than ethnically.

of ethnic and national identities to be competing to some extent. One implication, however, is that movement from, for example, "I feel more [national] than [ethnic]" to "I feel equally [national] and [ethnic]" could represent a reduction in national identification, an increase in ethnic identification, or both. Figure 4 shows the distribution of responses among geolocated respondents in Afrobarometer rounds 3~7 in our difference-in-difference setup. Our preferred outcome variable is an indicator for whether the respondent identifies more nationally than ethnically, which accounts for 49% of the sample.

4.2 Mobile service coverage data

Data on the spatial extent of mobile phone coverage is provided by Collins Bartholomew and the GSM Association, which compile coverage data from network providers. These annual maps show the geographic extent of 2G and 3G cell phone coverage, representing the ability to make phone calls and send text messages (2G), or more comprehensive access to the internet or social media platforms and online messaging apps via mobile internet connections (3G). For our analysis, we

choose the year of coverage data on a country-by-country basis, selecting the most recent coverage data collected prior to the beginning of that country's survey. In most cases, the most recent coverage information is reported less than a year prior to the survey launch. Combining survey responses with mobile coverage spatial polygons allows us to locate whether respondents fall within or outside of mobile coverage boundaries. We prefer this fine-grained geographic data over other measures because it offers information on the availability of mobile internet over the longest possible time period and lacks the confounding intrinsic to an individual's decision to *use* the internet. However, we validate this measure using self-reported mobile phone and internet use, where available and find a strong correspondence, as shown in section A.5 in the SI appendix.

4.3 Difference-in-differences strategy

To analyze the effect of mobile internet coverage on national identity, we employ a difference-in-differences (DiD) design. While a typical two-period DiD design exploits the panel data structure to include unit and time period fixed effects, we are constrained by the fact that the Afrobarometer surveys are cross-sectional; meaning that the individuals surveyed in each round in each country are different. Therefore, we use the standard approach to DiD using repeated cross-sections (Abadie, 2005; Athey and Imbens, 2006), where the first difference is whether an individual lives in an area in which, during the period of study, mobile internet coverage becomes available, and the second difference is whether an individual is surveyed in the pre-mobile coverage or post-mobile coverage period. We take special caution in identifying the "correct" control group to whom those who receive mobile coverage are compared. We are skeptical that control units that never receive coverage during our study period constitute valid counterfactuals to our treated units: given that we study a period of more than 13 years (2005–2018) during an era of rapid mobile internet expansion, individuals who are still left without mobile internet coverage at the end of this period may be fundamentally different in their sociodemographic characteristics or attitudinal dispositions from our treated units. Therefore, we prefer to compare our treated units to what we call "not-yet-treated" units that do not have coverage in any given time period but will have received coverage by the end

of our study period.

We use the following specification, which is the standard approach to DiD designs with repeated cross-sections:

$$y_{ijt} = \alpha + \beta \text{Covered}_{ijt} + \gamma \text{EverCovered}_i + \delta_j + \zeta_t + \theta X_{it} + \varepsilon_{ijt} \quad (1)$$

where y_{ijt} is an outcome for individual i in geographic area j in time period t, Covered_{ijt} is an indicator variable for whether the individual has mobile internet coverage at time t. EverCovered_i is an indicator for whether individual i is in the treatment group—whether i's location receives mobile internet during the period of our study, in line with our decision to restrict our comparison of the treated units to a more valid control group. X_{it} represents a vector of individual covariates. Geographic area (country or district) fixed effects are represented by δ_j and ζ_t represents survey round fixed effects. We cluster standard errors by locality—the level at which mobile coverage is assigned. To correct for spatial autocorrelation we also calculate Conley (1999) standard errors that account for spatial correlation between localities that fall within 500 kilometers of each other.

In addition to this approach, as an alternate specification, we aggregate (coarsen) the treatment to 0.5×0.5 degree grid cells: approximately 55×55 km. This allows us to estimate a more standard DiD model with survey-round and grid-cell fixed effects. Grid cell fixed effects hold constant any characteristics that vary between these geographic units, avoiding the potential for bias induced by systematic differences between areas that get mobile internet coverage earlier or later, which may not be fully captured by the treatment group indicator in equation 1 or control variables. In this specification, individuals are coded as treated if the majority of respondents in the grid cell during a survey wave have mobile internet coverage. Because treatment is at the level of the grid cell, we cluster standard errors by grid cell.

A recent body of literature has highlighted a number of pitfalls associated with DiD design and two-way fixed effects with time-varying (or staggered) treatment timing (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; De Chaisemartin and d'Haultfoeuille, 2020; Imai and Kim, 2019). Since our treatment (mobile internet coverage) is also time-varying, our results are potentially vul-

nerable to some of these critiques. Therefore, we apply the adjustment developed by Callaway and Sant'Anna (2021) on our main DiD analysis as well as the grid cell approach described in the preceding paragraphs.[17]

5 Main Findings

5.1 The effect of mobile internet on national identity

Table 1 reports the effect of mobile internet coverage on national identification using the DiD specification shown in equation 1 with robust standard errors clustered at the locality level in parentheses and Conley (1999) standard errors that adjust for spatial autocorrelation presented in brackets. Column (1) reports the results of a baseline specification without additional covariates, but with country fixed effects that allow us to tighten our inferences to within-country variation in over-time mobile internet coverage expansion. In line with our expectations, this baseline specification shows that gaining access to mobile internet coverage *decreases* an individual's propensity to identify with the nation (over their ethnic group) by around 6% points. Column (2) presents specifications with individual-level demographic controls for gender, age, completion of secondary education, and whether the respondent's residence is classified as urban or rural by the Afrobarometer surveys added to the baseline specification. The inclusion of these individual-level covariates does little to change the substantive negative effect of mobile internet coverage.[18]

While the robustness of the findings to the addition of these pretreatment demographic controls should assuage some inferential concerns, we further present specifications that restrict our inferences to smaller geographic units, based on the intuition that country fixed effects may be insufficient to fully absorb geographic heterogeneity. Columns (3)~(4) employ district fixed effects in lieu of country fixed effects.[19] While the size of the coefficient decreases marginally from 6.6%

[17] The results of the Callaway and Sant'Anna (2021) adjustment have not been included in the manuscript as of Wednesday 13th September, 2023, but will be discussed in more detail during the presentation at CPS, Univesity of Michigan.

[18] Analyses using the five-point identity scale as the outcome variable, for this and subsequent tables, is presented in Section A.3 in the SI appendix. The results are substantively similar.

[19] To create district-level dummies, we use the district (admin level 1) boundaries from the 2008 Global Administra-

Table 1: Effect of mobile internet coverage on national identity

	Dependent variable:					
	Identify More Nationally Than Ethnically (Binary)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet	−0.061	−0.066	−0.056	−0.057	−0.062	−0.063
	(0.011)***	(0.011)***	(0.010)***	(0.010)***	(0.019)***	(0.019)***
	[0.021]**	[0.022]**	[0.016]***	[0.017]***	[0.020]**	[0.020]**
Fixed effects	Country	Country	District	District	Grid cell	Grid cell
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	55,238	54,809	55,238	54,809	55,238	54,809

Notes: DiD results show the effect of mobile internet on national identification. All specifications include fixed effects for survey wave and either country, district, or grid cell. Columns 5 and 6 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. *Demographic controls* include (likely pre-treatment) individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. To correct for spatial autocorrelation of up to 500km, Conley (1999) standard errors are shown in brackets. *p<0.05; **p<0.01; ***p<0.001.

points to 5.7% points, the mobile internet effects remain still strongly negative and significant at p<0.001. In addition, columns (5)~(6) present specifications that aggregate the treatment to the 0.5×0.5 degree grid cell. The coefficients on mobile internet coverage do not change substantively. Combined, we believe these results provide broad evidence in support of our argument that access to mobile internet coverage will increase polarization across existing parochial identities and prevent the emergence of a collective national identity.[20] [21]

5.2 Design validation

The difference-in-differences design relies on the assumption of parallel trends—that national identification in treated and untreated areas would have followed similar patterns absent treatment.

tive Unit Layers spatial database, created by the Food and Agriculture Organization (FAO) of the United Nations. Use of 2008 boundaries for all our analyses ensures that the boundaries are pre-treatment and do not change over time.

[20] Alternate outcomes that can be used to demonstrate the polarizing effects of mobile internet are extremely limited in the Afrobarometer surveys. However, we present some evidence on an outcome—perceptions that the respondent's group is treated unfairly—which is available consistently through rounds 3–7 in SI Appendix Table A16. In line with our negative effect on national identification, we find that mobile internet increases perceptions of unfair treatment among respondents by around 2~ 3% points.

[21] The results in Table 1 hold when we include linear time trends in the specification. They are omitted due to space constraints but available upon request.

Though this assumption is untestable, its plausibility is often assessed using pre-treatment trends. Differential trends between treatment and control groups *prior to* actual changes in coverage would suggest that differential trends during the treatment period could be driven by other factors. We test whether differences in national identity precede changes in mobile coverage by estimating equation 1 with the addition of one and two period leads to the treatment variable. That is, we include the respondent's treatment status for the survey waves that occur *after* after the actual interview. Results are shown in SI Appendix Table A14. In all specifications, the effect of mobile internet coverage on national identity remains negative and statistically significant at conventional levels. Coefficients for the *leads* of mobile internet coverage, on the other hand, representing the effect of *future* mobile internet coverage on national identity, have point estimates near zero and are not significant at conventional levels. This adds confidence that our DiD approach will recover valid estimates of the effect of mobile internet coverage.

5.3 Mechanism: Elections and the intensification of polarization

Does proximity to elections moderate the effect of mobile internet coverage on national identity? Our theoretical discussions highlighted the possibility that the polarizing nature of elections in Africa would intensify the negative effect of mobile internet coverage. In Table 2 and Figure 5, we put these ideas to the test in the DiD framework. We estimate the same models from Table 1, but with an interaction term between the mobile internet coverage variable and the number of months between the date of the survey interview and the nearest presidential election in the respondent's country.

Table 2 reports findings from these analyses. In line with our expectations, the effect of mobile internet service expansion is strongly moderated by the temporal distance to elections. Across different specifications reported in columns (1)~(6), the interaction term remains positive and consistent and is statistically distinguishable from zero at $p<0.01$. Substantively speaking, the magnitude of the coefficient means that an additional month closer to the election will decrease (since the months to election variable decreases as the election approaches) the proportion of individuals

Table 2: Heterogeneity of the effect of mobile internet coverage by election proximity

	Dependent variable:					
	Identify More Nationally Than Ethnically (Binary)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet	−0.127	−0.130	−0.128	−0.128	−0.142	−0.145
	(0.016)***	(0.016)***	(0.015)***	(0.015)***	(0.029)***	(0.029)***
	[0.036]***	[0.036]***	[0.033]***	[0.033]***	[0.038]***	[0.037]***
Months from election	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003
	(0.0005)***	(0.0005)***	(0.0004)***	(0.0004)***	(0.001)***	(0.001)***
	[0.001]**	[0.001]**	[0.001]**	[0.001]***	[0.001]**	[0.001]**
Mobile internet ×	0.004	0.004	0.004	0.004	0.005	0.005
Months from election	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.002)**	(0.002)**
	[0.002]*	[0.002]*	[0.002]**	[0.002]*	[0.002]*	[0.002]*
Fixed effects	Country	Country	District	District	Grid cell	Grid cell
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	55,238	54,809	55,238	54,809	55,238	54,809

Notes: DiD estimates of the heterogeneous effects of access to mobile internet on national identity by proximity to elections are shown. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. To correct for spatial autocorrelation, Conley (1999) standard errors are shown in brackets. *p<0.05; **p<0.01; ***p<0.001.

identifying with the nation by around 0.4~0.5% points more in comparison to those without mobile internet coverage.[22]

The line graph in Figure 5 plots the effect of mobile internet coverage on national identification by time to the closest election. Results are shown for column (4) in Table 2. For respondents surveyed far from elections, we observe no relationship between mobile internet access and national identification. However, the effect of mobile internet strengthens with election proximity and becomes statistically significant. For respondents within 10 months of an election (31.8% of the sample), access to mobile internet decreased national identity by over 9% points. This finding aligns with our theoretical argument that access to the polarizing influences of the internet during electoral campaigns, facilitated by mobile internet coverage, drives the negative effect of mobile technology on national identity.

While we expect polarizing rhetoric accessed over mobile internet to be more prevalent near elections, it is possible that this rhetoric does not increase linearly with proximity to elections. To

[22]We report the analysis in Table 2 with the full set of controls included in Table 3 in SI Appendix Table A9. The inclusion of this extensive set of controls do not substantively alter the results.

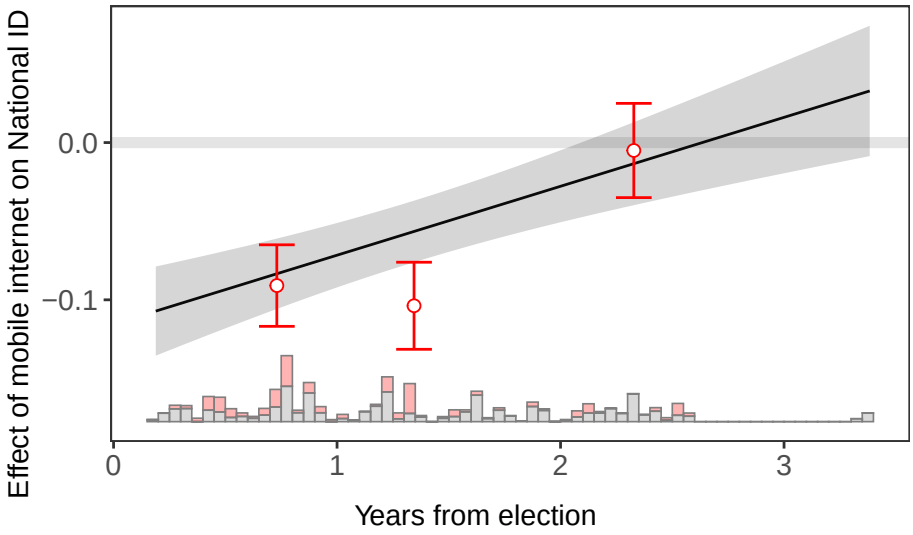


Figure 5: Heterogeneous effects of mobile internet on national identity by election proximity, with respondents in three bins: those surveyed less than 1 year from the election, between 1 and 2 years from the election, and 2 or more years from the election. 95 percent confidence intervals clustered by locality are shown.

address the possibility of non-linearity, we divide the time-to-elections variable into three categorical distance bins (as recommended by Hainmueller, Mummolo and Xu (2019)) that allow for a more flexible functional form. Figure 5 displays the results with time-to-election bins of up to one year, 1-2 years, and 2+ years. The effect of mobile internet 2+ years from an election is indistinguishable from zero. Closer to the election, mobile internet coverage substantially lowers national identification.

5.4 Alternative Explanations

We have argued that mobile internet decreases attachment to national identities through an electoral mechanism. However, we might be concerned that the mechanism underlying our effect operates through mechanisms other than the electoral one we propose in the preceding sections. We present a set of tests that probes this possibility more closely.

First, access to mobile internet may have increased individual respondents' wealth, which may be moderating the effects of mobile internet coverage on identity. Access to mobile networks could

increase individual or household income by lowering barriers to accessing information on prices and job or business opportunities. If wealth also induces changes in identity, the wealth effects of mobile internet access might explain our results. SI Appendix Table A8 includes a measure of individual wealth derived from asset ownership consisting of an additive index of indicators of whether a survey respondent's household owns a radio, a television, and a motor vehicle. The effect of mobile internet when controlling for household wealth is similar in magnitude to estimates from Table 1.[23] [24]

Second, there is the possibility that these results are driven by the selective expansion of mobile internet coverage into affluent areas. Mobile internet antennas have a shorter range than basic 2G mobile service, and profit-motivated mobile network providers are most likely to first provide mobile internet coverage in wealthy urban areas. Cell towers require electricity and road access for maintenance, so individuals far from roads or electrical transmission lines are less likely to have mobile internet coverage. We probe this possibility in Table 3, columns (1)~(6). In specifications (1)~(3), we first control for a time-varying subnational measure of population density. In columns (4)~(6), we also include covariates measuring the geographic distance between a respondent's home and both the road network and the electrical transmission grid. We constructed these measures by calculating the geodesic distance between every respondent and the closest points on the road network and electricity grids.[25] The inclusion of these covariates does not substantially change the point estimates or statistical significance of mobile internet coverage.

Third, mobile internet coverage may simply accompany a broader modernization process. A number of scholars of African politics have identified development as a source of increased ethnic competition and polarization (Bates, 1974; Posner, 2004). This could lead to a spurious finding, where ethnic polarization is the result of economic development, not mobile internet coverage. We test these alternative theoretical explanations in Table 3, columns (7)~(9). We add time-varying controls for nighttime light intensity, a broadly used measure of local economic activity. If eco-

[23] It is important to note that wealth is potentially affected by mobile internet coverage (i.e. post-treatment), and the results should be interpreted with caution.

[24] We also report models with controls for traditional news media consumption (TV, radio, newspapers) in Table A8.

[25] Details of how these variables were constructed can be found in the "Notes" section of Table 3.

Table 3: Effect of mobile internet coverage is not driven by modernization and local development

	Dependent variable:								
	Identify More Nationally Than Ethnically (Binary)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Mobile internet	−0.067	−0.058	−0.062	−0.067	−0.058	−0.062	−0.073	−0.060	−0.063
	(0.011)***	(0.010)***	(0.019)***	(0.011)***	(0.010)***	(0.019)***	(0.011)***	(0.010)***	(0.019)***
	[0.022]**	[0.016]***	[0.019]**	[0.022]**	[0.016]***	[0.019]**	[0.022]***	[0.016]***	[0.019]**
Fixed effects	Country	District	Grid cell	Country	District	Grid cell	Country	District	Grid cell
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Infrastructure controls	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Night lights controls	No	No	No	No	No	No	Yes	Yes	Yes
Observations	54,678	54,678	54,678	54,678	54,678	54,678	54,678	54,678	54,678

Notes: The specifications shown above include a series of covariates to demonstrate that the effect of access to mobile internet on national identity is not driven by modernization or local development. *Population controls* include subnational measures of population density from ORNL's annual LandScan datasets on population distribution which, in addition to census data, incorporate locations of known settlements and data on land cover derived from high-resolution imagery (Dobson et al., 2000). *Infrastructure controls* include distance to the electricity grid and distance to the nearest road. For *Night light controls*, we use harmonized annual composites of nighttime luminosity from the Defense Meteorological Satellite Program's Operational Linescan System and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership satellite (Li et al., 2020). Robust standard errors clustered at the locality or grid cell level are shown in parentheses. To correct for spatial autocorrelation, Conley (1999) standard errors are shown in brackets. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$.

nomic development is the reason for the effect of mobile internet on identity, we would expect the effect of mobile internet coverage to disappear—or at least be reduced—when controlling for nighttime lights. Instead, the estimated effect of mobile internet on national identity does not change substantively, suggesting that modernization *per se* does not fully account for our results.

Finally, it may also be possible that the effects we report here do not emerge through our posited electoral mechanism but because mobile internet increases access to information that shapes citizen evaluations (approval and trust) of the government, politicians, and institutions (Guriev, Melnikov and Zhuravskaya, 2020; Grossman et al., 2021). For example, when confronted with negative information regarding the performance of the incumbent president or local politicians, voters may not just reevaluate their approval or trust in these actors but also redefine their relationship with the state and national community. In order to rule out this alternative mechanism, we conduct two pieces of analyses; first, we include measures of presidential and MP approval as well as trust in the president and parliament (as an institution) from the Afrobarometer as control variables in models where national identification is the outcome. These results are reported in Appendix Table A11.[26] Second, we also estimate the effect of mobile internet on these approval and trust measures and report the results in Appendix Tables A12 and A13. These results collectively show that our identity effects of mobile internet are unlikely to be driven by changes in government approval or trust; the effect of mobile internet on national identity remains statistically significant and substantively similar when the presidential/mp approval and trust are adjusted for. Furthermore, there is little evidence that mobile internet has any direct effect on citizen approval or trust of the president or their parliamentarians.

6 Placebo Tests Using Basic Mobile Coverage

Our posited mechanisms for mobile internet do not extend to basic mobile phone service, which provides users with "talk and text" capabilities, and thus does not grant access to online social me-

[26]We acknowledge that these approval and trust measures are post-treatment variables and can result in post-treatment bias.

Table 4: Placebo test: effect of access to basic mobile phone service (2G) on national identification

	Dependent variable:					
	Identify More Nationally Than Ethnically (Binary)					
	(1)	(2)	(3)	(4)	(5)	(6)
Basic mobile coverage	0.010	0.004	0.013	0.009	0.014	0.014
	(0.014)	(0.014)	(0.013)	(0.013)	(0.025)	(0.025)
	[0.020]	[0.020]	[0.019]	[0.018]	[0.026]	[0.026]
Fixed effects	Country	Country	District	District	Grid cell	Grid cell
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	39,247	38,717	39,247	38,717	39,247	38,717

Notes: Results of a placebo test using access to basic mobile phone service (2G), which does not provide access to the internet-based platforms through which we argue election-driven polarization occurs. The sample is restricted to the country-waves prior to the intoduction of mobile internet in each country. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. To correct for spatial autocorrelation, Conley (1999) standard errors are shown in brackets. *p<0.05; **p<0.01; ***p<0.001.

dia platforms or internet-based messaging apps such as Whatsapp. We thus use the effect of basic mobile coverage as a placebo treatment test (Eggers, Tuñón and Dafoe, 2021). Though mobile internet and basic mobile coverage use different technologies and extend different distances, equipment to provide mobile internet coverage is often added to existing cell towers providing basic mobile service. This causes mobile internet coverage and basic mobile service to be spatially correlated. To avoid confounding from mobile internet we restrict the placebo to survey waves prior to the introduction of mobile internet in a country.

The results are shown in Table 4 and Table 5. Table 4 reports the same specifications as Table 1 but using *basic* mobile coverage, rather than mobile internet coverage, as treatment. As expected, point estimates are close to zero (albeit positive) and do not reach significance at conventional levels. Table 5 presents the same specifications as Table 2 but with the basic mobile treatment interacted with the months to elections variable. Given that basic mobile coverage does not expose individuals to social media or messaging applications, we expect that the relationship between basic mobile coverage and national identity will not be moderated by proximity to elections. In line with these expectations, we find limited evidence of such moderating effects, with the possible exception of columns (1) and (2), which employs a cruder country-fixed effects approach to estimation. Taken

Table 5: Placebo test: Heterogeneity of the effect of basic mobile phone service (2G) by election proximity

	Dependent variable:					
	Identify More Nationally Than Ethnically (Binary)					
	(1)	(2)	(3)	(4)	(5)	(6)
Basic mobile coverage	0.051	0.045	0.029	0.025	0.046	0.046
	(0.022)*	(0.023)*	(0.022)	(0.022)	(0.042)	(0.042)
	[0.039]	[0.039]	[0.034]	[0.034]	[0.049]	[0.049]
Months from election	−0.002	−0.002	−0.003	−0.003	−0.002	−0.002
	(0.001)*	(0.001)*	(0.001)***	(0.001)***	(0.002)	(0.002)
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Basic mobile coverage ×	−0.003	−0.003	−0.001	−0.001	−0.003	−0.003
Months from election	(0.001)**	(0.001)*	(0.001)	(0.001)	(0.002)	(0.002)
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]
Fixed effects	Country	Country	District	District	Grid cell	Grid cell
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	39,247	38,717	39,247	38,717	39,247	38,717

Notes: Results of a placebo test using access to basic mobile phone service (2G) interacted with proximity to elections. The sample is restricted to the country-waves prior to the intoduction of mobile internet in each country. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. To correct for spatial autocorrelation Conley (1999) standard errors are shown in brackets. *p<0.05; **p<0.01; ***p<0.001.

together, the findings from the placebo test bolster our confidence that the effects we reported and mechanisms posited for mobile internet coverage are indeed correct.

7 Conclusion and Implications

The expansion of mobile communications infrastructure has been heralded as one of the most transformative innovations of the past century. Whereas the reach of other landmark technological advances is believed to have been relatively limited in the Global South, academics and practitioners alike have shown that cell phone coverage is having a profound impact on these developing societies; on how day-to-day economic transactions are being handled (Suri and Jack, 2016; Aron, 2018) as well as how individuals engage in contentious collective action against the state (Pierskalla and Hollenbach, 2013).

In this paper, we have investigated what effect the expansion of the mobile internet has on an-

other salient and important dimension in sociopolitical life: the extent to which individuals share a sense of belonging or attachment to their national community. Leveraging over-time variation in mobile internet coverage in the context of a DiD design, we demonstrated that those with mobile coverage are significantly less likely to identify with their national in comparison to their ethno-communal groups. In addition, we tested the plausibility of the electoral mechanism we posited for the mobile internet effect by exploiting exogenous variation in the proximity of a survey respondent's interview date to the presidential election; our results showed that, as expected, the proximity to elections moderates the effect of mobile internet coverage.

Our findings provide some important avenues for extension. First, further analysis of the mechanisms underlying the negative relationship between cell phone coverage and national identification is warranted. Our approach in testing for the electoral mechanism is based on the assumption that the dissemination of such polarizing information is likely to increase as a function of proximity to the elections, which we were ultimately unable to test in the context of this paper. Future research should therefore attempt to validate this assumption by examining both the nature of the information and rhetoric disseminated through mobile cell phone networks and how it evolves as elections approach.

Second, further analysis of the generalizability of our findings is also necessary. Our results are restricted in the sense that we are only examining the effects of cell phone coverage over a relatively recent time period on a sample of citizens in sub-Saharan African countries, and there may be heterogeneous effects across different time periods and geographical contexts. For example, is the relationship between cell phone coverage and national identification similar across both the nascent stages of cell phone expansion (early 2000s) and later stages in which cell phones are much more ubiquitous? How do the effects of cell phone coverage vary across contexts in which politics are organized along different social cleavages (ethnicity versus class)? An attempt to examine this effect with more data spanning a longer time period and covering different regions of the world would provide more confidence as to the temporal and geographic external validity of these findings.

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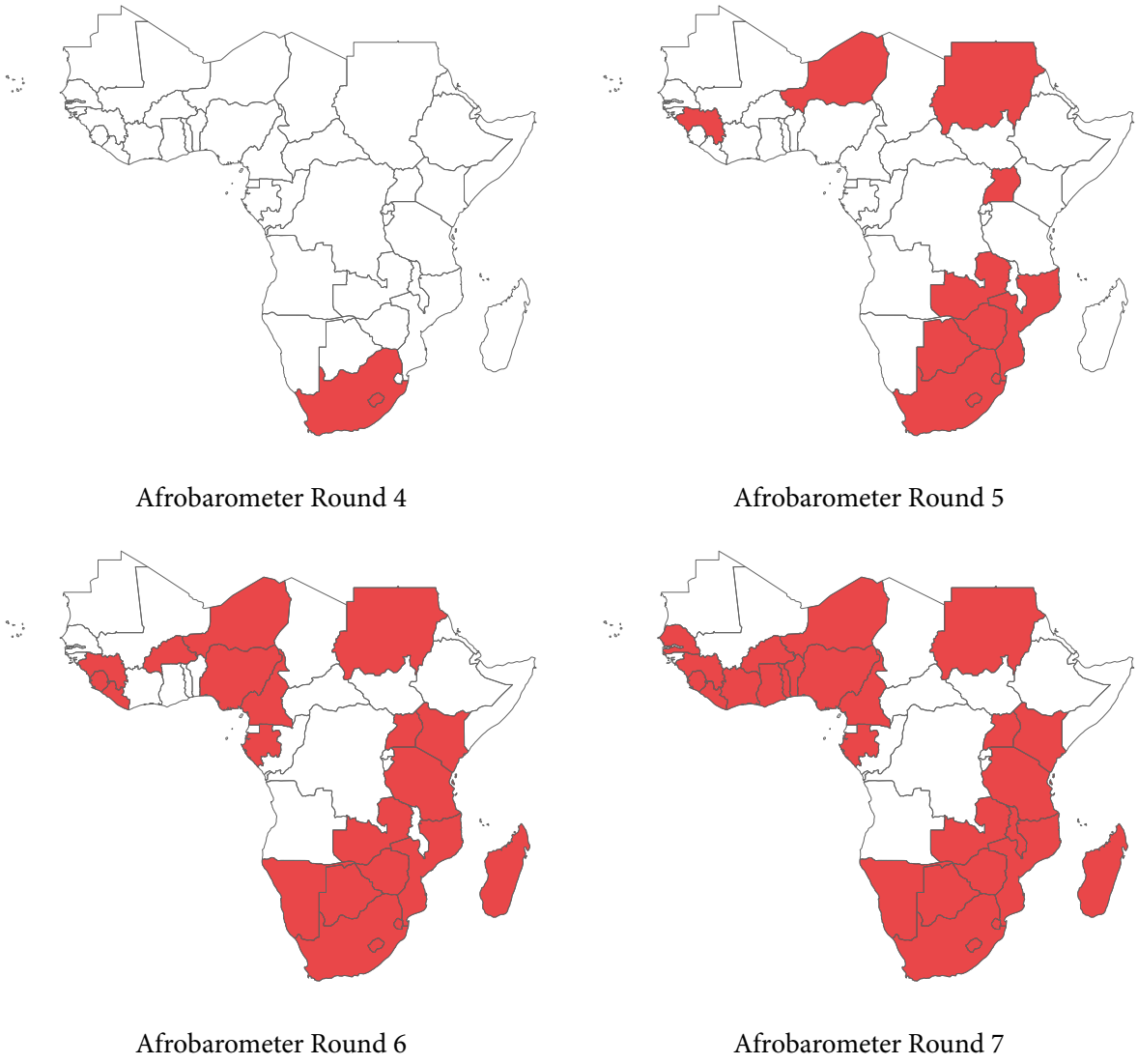
A *Supporting Information (SI Appendix) for* Mobile Communication Technology and National Identity in Sub-Saharan Africa

Contents

A.1 Geographic and temporal extent of data



Afrobarometer Round 4 | Afrobarometer Round 5

Afrobarometer Round 6 | Afrobarometer Round 7

Figure A1: Countries included in each Afrobarometer survey round for which mobile internet coverage data is available from the GSMA.

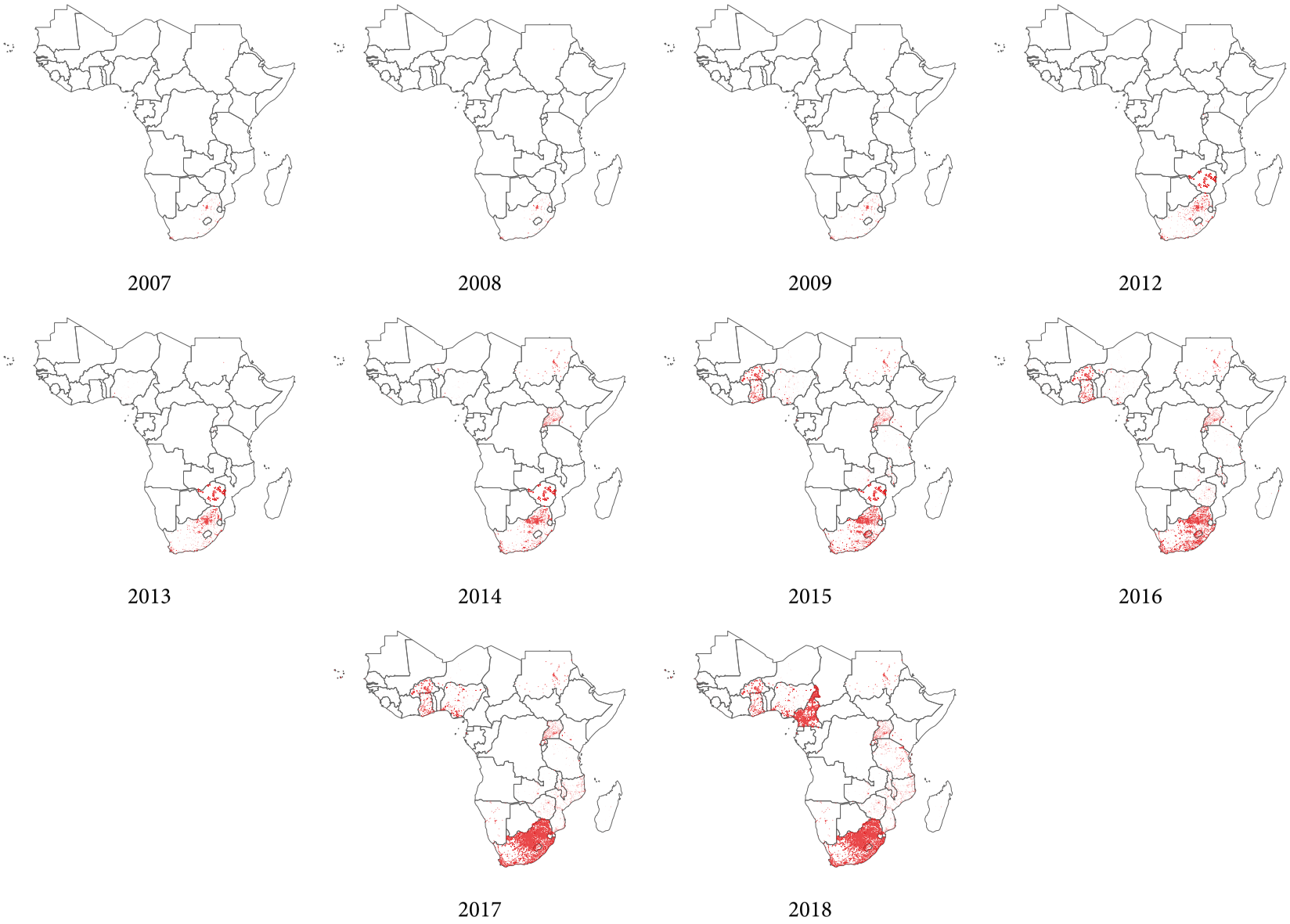


Figure A2: The expansion of mobile internet connectivity in sub-Saharan Africa between 2007 and 2018.

A.2 Afrobarometer Sampling

Afrobarometer Sampling

The empirical analysis in the paper relies on geocoded Afrobarometer surveys for the outcome. There are potentially two ways in which sampling and geocoding could undermine the validity of the results. The first is if the sampling technique and interview method for the Afrobarometer survey changed during the period of study as a function of the spread of mobile internet; i.e. that there is variable sampling in the pre-and post-periods that could drive the results, a key assumption of cross-sectional diff-in-diff design. In order to probe this possibility, we examine the sampling protocol for rounds 3–7 of the Afrobarometer. The Afrobarometer has implemented a consistent sampling method throughout this period, a national probability sample that begins by 1) randomly sampling the primary sampling units, 2) randomly sampling the start points for the Afrobarometer random-walk protocol, 3) interviewers randomly selecting households, and 4) within the households, the interviewer randomly selects an individual, ensuring gender balance in the surveys by alternating between each household. The survey interviews were conducted consistently in-person, face-to-face, and never adopted computer-assisted interview technology that would likely privilege mobile-internet covered areas. This should assuage concerns that outcome measurement was correlated with treatment. For more details on the sampling protocol, visit https://www.afrobarometer.org/surveys-and-methods/sampling/.

A.3 Results with alternatively-coded dependent variables

In the main body of the paper we show results in which our main outcome of interest is a respondent answering that they feel a stronger national than ethnic identity. As described in the main body of the paper, this variable was constructed from a question asking "Let us suppose that you had to choose between being a [respondent's national ID] and being a [respondent's ethnic group]. Which of the following best expresses your feelings?" Responses range from 1 ("I feel only [ethnic ID]") to 5 ("I feel only [national ID]"). Our preferred outcome variable is an indicator for whether the respondent identifies more nationally than ethnically: a response of 4 or 5. The strength of national (versus ethnic) identity could be measured other ways. Tables A2, A4 and A6 show estimates of the same specifications using the raw 5-point scale as the dependent variable.

Table A1: Effect of Access to Mobile Internet on National Identification (Only National Identification)

	Dependent variable:				
	Identify only nationally (binary)				
	(1)	(2)	(3)	(4)	(5)
Mobile internet coverage	−0.072***	−0.076***	−0.069***	−0.075***	−0.068***
	(0.012)	(0.012)	(0.010)	(0.012)	(0.010)
Fixed effects	Country	Country	District	Country	District
Demographic controls	No	Yes	Yes	Yes	Yes
Media controls	No	No	No	Yes	Yes
Observations	55,238	54,809	54,809	54,484	54,484

Notes: Difference in differences estimates of the effect of access to mobile internet on individuals' propensity to identify nationally and not ethnically are shown. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is an indicator for individuals who identify only nationally, not ethnically. All models include fixed effects for survey wave and either country or district. Models (2)-(5) also include covarates for gender, age, urban/rural status, and an indicator for whether the individual has completed secondary school. Models (4) and (5) also control for consumption of news from newspapers, radio, and television. Standard errors clustered by locality are shown are in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table A2: Effect of mobile internet coverage on national identity (5-point scale)

	Dependent variable:					
	National versus ethnic identity (5-point scale)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet	−0.148***	−0.166***	−0.140***	−0.147***	−0.162***	−0.165***
	(0.026)	(0.026)	(0.024)	(0.024)	(0.044)	(0.044)
Fixed effects	Country	Country	District	District	Grid cell	Grid cell
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	55,238	54,809	55,238	54,809	55,238	54,809

Notes: Difference in differences results show the effect of mobile internet on a respondent identifying more nationally than ethnically. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is a five point scale ranging from 1, for individuals who identify fully ethnically, to 5, for individuals who identify fully nationally. All specifications include fixed effects for survey wave and either country, district, or grid cell. Columns 5 and 6 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. *p<0.05; **p<0.01; ***p<0.001.

Table A3: Heterogeneity of the Effects of Access to Mobile Internet by Election Proximity (Only National Identification)

	Dependent variable:				
	Identify only nationally (binary)				
	(1)	(2)	(3)	(4)	(5)
Mobile internet	−0.140***	−0.142***	−0.145***	−0.141***	−0.143***
	(0.017)	(0.017)	(0.016)	(0.017)	(0.016)
Months from election	−0.003***	−0.003***	−0.003***	−0.003***	−0.003***
	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0004)
Mobile internet	0.004***	0.004***	0.005***	0.004***	0.005***
× Months from election	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fixed effects	Country	Country	District	Country	District
Demographic controls	No	Yes	Yes	Yes	Yes
Media controls	No	No	No	Yes	Yes
Observations	55,238	54,809	54,809	54,484	54,484

Notes: Difference in differences estimates of the heterogeneous effects of access to mobile internet on individuals' propensity to identify nationally and not ethnically are shown. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is an indicator for individuals who identify only nationally, not ethnically. Standard errors clustered by locality are shown are in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table A4: Heterogeneity of the effect of mobile internet coverage by election proximity (5-point scale)

	Dependent variable:					
	National versus ethnic identity (5-point scale)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile Internet	−0.321***	−0.331***	−0.340***	−0.344***	−0.401***	−0.411***
	(0.039)	(0.039)	(0.037)	(0.037)	(0.068)	(0.068)
Months from election	−0.006***	−0.006***	−0.007***	−0.007***	−0.007***	−0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Mobile Internet ×	0.011***	0.010***	0.013***	0.012***	0.016***	0.016***
Months from election	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)
Fixed effects	Country	Country	District	District	Grid cell	Grid cell
Demographic controls	No	Yes	No	Yes	No	Yes
Observations	55,238	54,809	55,238	54,809	55,238	54,809

Notes: Difference in differences estimates of the heterogeneous effects of access to mobile internet on individuals' propensity to identify more nationally than ethnically by proximity to elections are shown. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is a five point scale ranging from 1, for individuals who identify fully ethnically, to 5, for individuals who identify fully nationally. The positive interaction between mobile internet and months from the election indicates that the effect of mobile internet on national identification gets weaker closer to elections. All specifications include fixed effects for survey wave and either country, district, or grid cell. Columns 5 and 6 aggregate the treatment to the 0.5×0.5 degree grid cell to enable two way fixed effects. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. *p<0.05; **p<0.01; ***p<0.001.

Table A5: Effect of access to mobile internet is not driven by modernization and local development (National identity only)

	Dependent variable:							
	Identify only nationally (binary)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mobile internet coverage	−0.076***	−0.070***	−0.076***	−0.070***	−0.076***	−0.070***	−0.082***	−0.071***
	(0.012)	(0.010)	(0.012)	(0.010)	(0.012)	(0.010)	(0.012)	(0.010)
Fixed effects	Country	District	Country	District	Country	District	Country	District
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Infrastructure controls	No	No	No	No	Yes	Yes	Yes	Yes
Night lights controls	No	No	No	No	No	No	Yes	Yes
Observations	54,303	54,303	54,172	54,172	54,172	54,172	54,172	54,172

Notes: These results use an alternate measure of national identity as the dependent variable: an indicator for individuals who identify only nationally, not ethnically. The specifications shown above include a battery of covariates to demonstrate that the effect of access to mobile internet on national identity is not driven by modernization or local development. *Wealth controls* include an index of asset ownership as reported in the Afrobarometer surveys. Survey items probed whether a respondent owned a radio, TV, or motor vehicle. We include an index created from the dichotomous measure of each asset ownership. *Population controls* include subnational measures of population density ORNL's annual LandScan datasets on population distribution which, in addition to census data, incorporate locations of known settlements and data on land cover derived from high resolution imagery (Dobson et al., 2000). *Infrastructure controls* include distance to the electricity grid and distance to the nearest road. For *nightlight controls*, we use harmonized annual composites of nighttime luminosity from the the Defense Meteorological Satellite Program's Operational Linescan System and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership satellite (Li et al., 2020). Robust standard errors clustered at the locality level are shown in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table A6: Effect of mobile internet coverage is not driven by modernization and local development (5-point scale)

	Dependent variable:								
	National versus ethnic identity (5-point scale)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Mobile internet	−0.167***	−0.148***	−0.164***	−0.169***	−0.149***	−0.164***	−0.187***	−0.157***	−0.166***
	(0.026)	(0.024)	(0.044)	(0.026)	(0.024)	(0.044)	(0.026)	(0.024)	(0.044)
Fixed effects	Country	District	Grid cell	Country	District	Grid cell	Country	District	Grid cell
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Infrastructure controls	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Night lights controls	No	No	No	No	No	No	Yes	Yes	Yes
Observations	54,678	54,678	54,678	54,678	54,678	54,678	54,678	54,678	54,678

Notes: The specifications shown above include a battery of covariates to demonstrate that the effect of access to mobile internet on national identity is not driven by modernization or local development. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is a five point scale ranging from 1, for individuals who identify fully ethnically, to 5, for individuals who identify fully nationally. Columns 3, 6, and 9 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. *Population controls* include subnational measures of population density from ORNL's annual LandScan datasets on population distribution which, in addition to census data, incorporate locations of known settlements and data on land cover derived from high resolution imagery (Dobson et al., 2000). *Infrastructure controls* include distance to the electricity grid and distance to the nearest road. For *nightlight controls*, we use harmonized annual composites of nighttime luminosity from the the Defense Meteorological Satellite Program's Operational Linescan System and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership satellite (Li et al., 2020). Robust standard errors clustered at the locality or grid cell level are shown in parentheses. *p<0.05; **p<0.01; ***p<0.001.

A.4 Additional validation: Boundary design

In addition to robustness and placebo tests presented in the preceding paragraphs, we also leverage an alternate research design that uses the boundary of mobile internet coverage, comparing individuals with and without access to mobile internet residing within different bandwidths around the boundary of mobile phone coverage. The boundary of mobile internet coverage is a function of the location of cell towers and terrain. Importantly, the mobile internet coverage boundary does not correspond to the borders of administrative units, where other policies and political histories may change discontinuously. However, a geographic regression discontinuity design as in Keele and Titiunik (2015) is not appropriate because the coverage boundary does not represent a sharp discontinuity in mobile phone ownership and usage. Individuals living in areas without coverage that are nonetheless *near* the coverage boundary do have some access to mobile networks as they travel in and out of coverage boundaries as they go about their daily lives, but they have *less* access to mobile networks than individuals living in covered areas.

We estimate the effect of mobile phone coverage on national identity using the following specification, comparing the national identity of respondents on either side of the mobile internet coverage boundary:

$$y_{ijt} = \alpha + \beta \text{Covered}_i + \delta_{jt} + \xi W_i + \theta X_{ij} + \varepsilon_{ijt} \tag{2}$$

where y_{ijt} is an outcome for individual i in geographic area j in time period t and Covered_i is an indicator variable for whether the individual has mobile internet coverage. The border design is cross-sectional, so we include country-wave fixed effects, designated δ_{jt}. A flexibly estimated expansion of latitude and longitude, W_i is also included. Again we cluster standard errors at the locality level. For the cross-boundary comparison to be possible, there must be sufficient numbers of respondents in a country-wave on either side of the boundary—with and without coverage. Therefore, we restrict the boundary analysis to country-waves in which at least 10 respondents have mobile internet coverage and at least 10 respondents do not have coverage.

Figure A3 graphically reports results from these analyses, showing the difference in national identity for respondents with and without coverage residing near the coverage boundary for a range of bandwidths between 5km~100km.[1] Although there is a significant reduction in sample size, we are able to recover a negative treatment effect of mobile internet coverage on levels of national identification. The magnitude of the point estimates decreases for smaller bandwidths, consistent with the coverage boundaries not representing sharp discontinuities in actual mobile internet usage. However, point estimates remain negative and statistically significant over a broad spectrum of bandwidths.

[1] Because population, and thus country-wide survey sampling, is often sparse along the coverage boundary, we show a wide range of bandwidths.

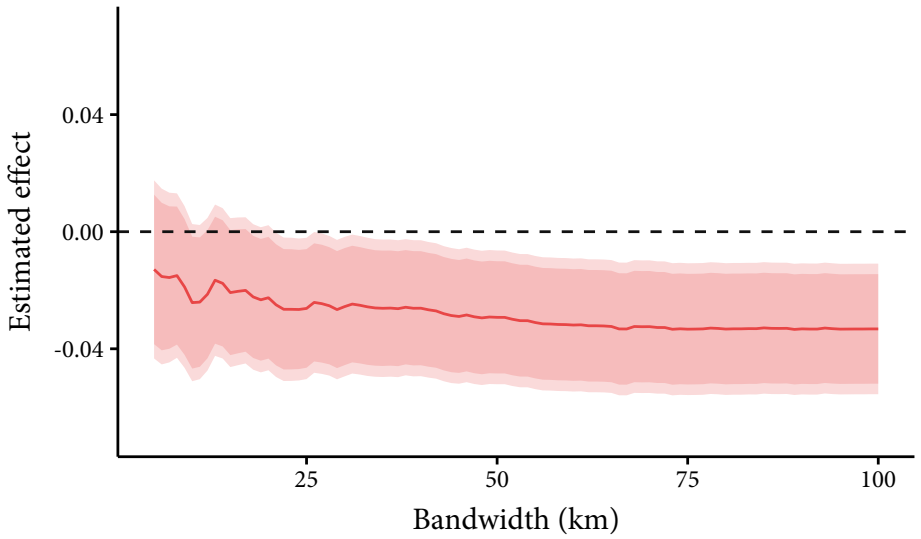


Figure A3: Results of the boundary analysis, showing how the propensity to identify more nationally than ethnically varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

A.5 Effect on mobile phone ownership and use

A necessary condition of the mechanism we propose is that mobile internet coverage must cause an increase in the use of mobile internet. Although we are unable to test this idea directly, we instead evaluate the effect of mobile internet coverage on self-reports of mobile phone ownership, mobile phone use, and where a respondent has a mobile internet subscription. Of these, mobile phone ownership is most weakly linked to our mechanism. This is because basic mobile phones can be used by respondents to talk and text who do not use mobile internet. Using a mobile phone daily is potentially more closely linked to our proposed mechanism, because the ability to use a phone for things other than talk or text may lead to more use. Table A7 shows difference-in-differences estimates of the effect of mobile internet on mobile phone ownership and use. Specifications with and without a one-period lead are shown. Results indicate that mobile internet coverage causes an increase in increase in daily use of mobile phones, but the effect on mobile phone ownership is more ambiguous. Future mobile coverage does not appear to affect mobile phone ownership or use.

Several measures of mobile internet use are only available in Afrobarometer round 7 and, therefore, cannot be used in the context of a DiD design. We instead show boundary analysis results for these outcomes, following the methodology described in SI Appendix Section A.4. SI Appendix Figures A4, A5, A6, A7, and A8 show boundary analysis results within a variety of bandwidths from the mobile internet coverage boundary, estimating the effect of mobile internet coverage on having a mobile internet subscription, getting news from social media such as Facebook or Twitter, getting news from the internet, using a mobile phone daily, and owning a mobile phone. Results indicate that mobile internet coverage causes a significant increase in all five outcomes.

Table A7: Effect of mobile internet on mobile phone ownership and use

	Dependent variable:			
	Owns mobile phone		Uses mobile daily	
	(1)	(2)	(3)	(4)
Mobile internet coverage	0.017	0.037**	0.041***	0.091***
	(0.011)	(0.017)	(0.014)	(0.023)
Mobile internet coverage (t+1)		−0.037		−0.021
		(0.024)		(0.027)
Fixed effects	Country	Country	Country	Country
Observations	57,018	18,746	40,291	11,886

Notes: Difference-in-differences estimates of the effect of mobile internet coverage on mobile phone ownership and use. Robust standard errors clustered at the locality level are shown in parentheses. *p<0.05; **p<0.01; ***p<0.001.

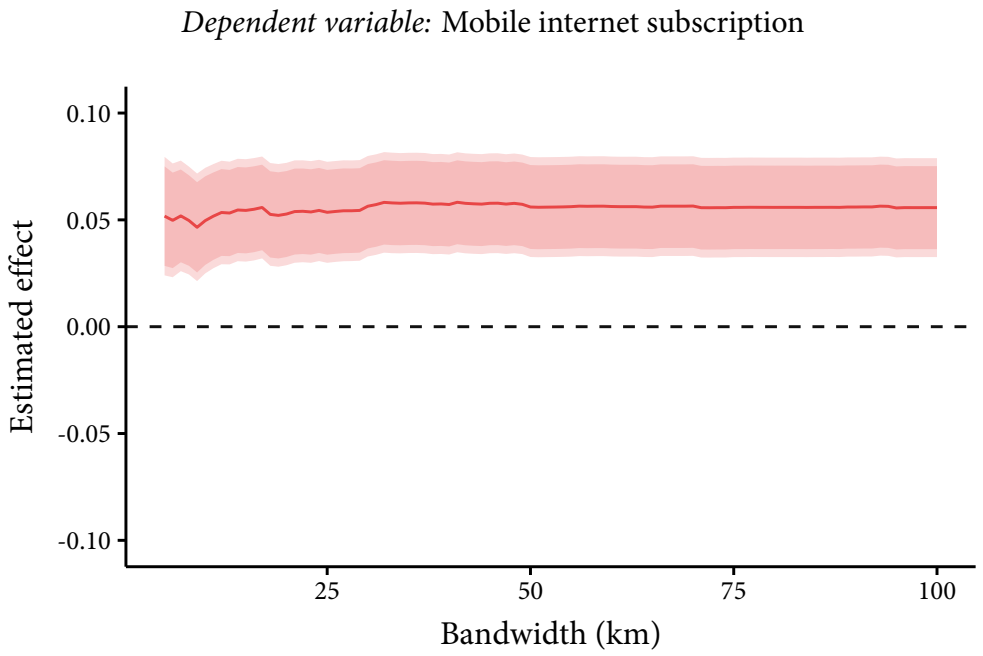


Figure A4: Results of the boundary analysis, showing how the propensity of a respondent to have a mobile internet subscription varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

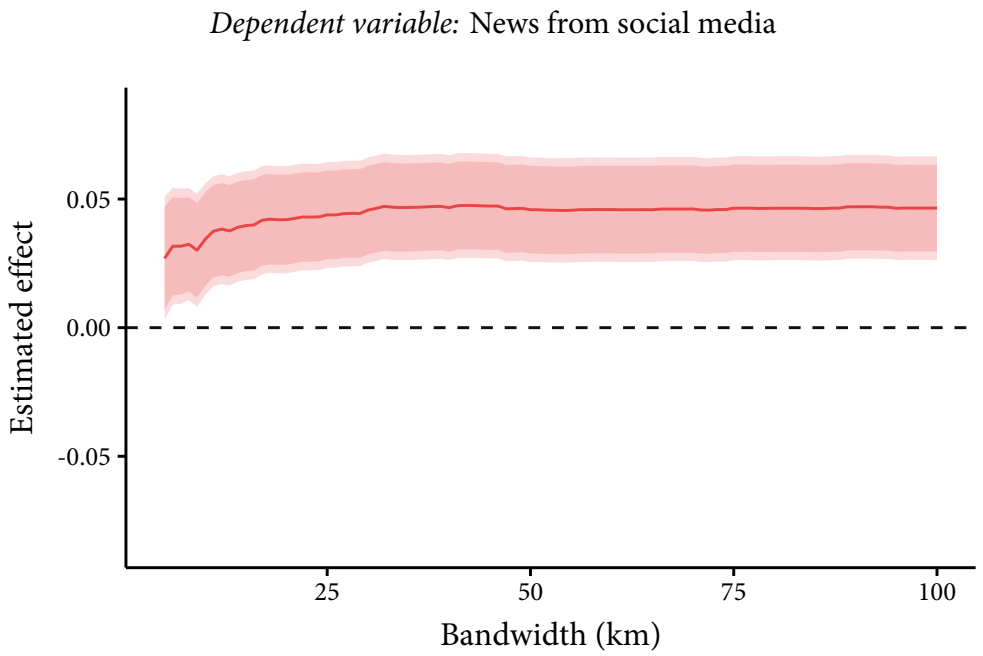


Figure A5: Results of the boundary analysis, showing how the propensity of a respondent to get news from social media varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

Dependent variable: News from internet

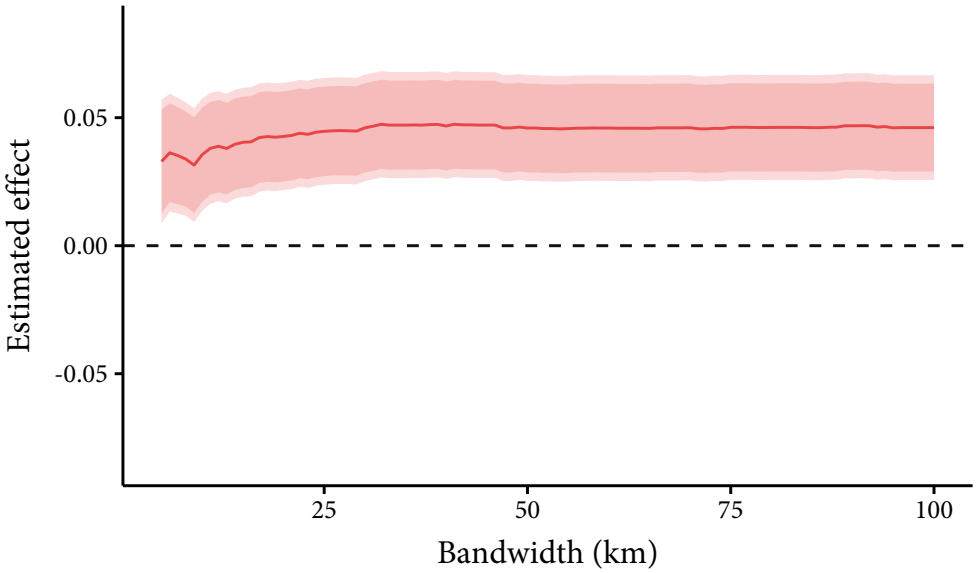


Figure A6: Results of the boundary analysis, showing how the propensity of a respondent to get news from the internet varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

Dependent variable: Use mobile phone daily

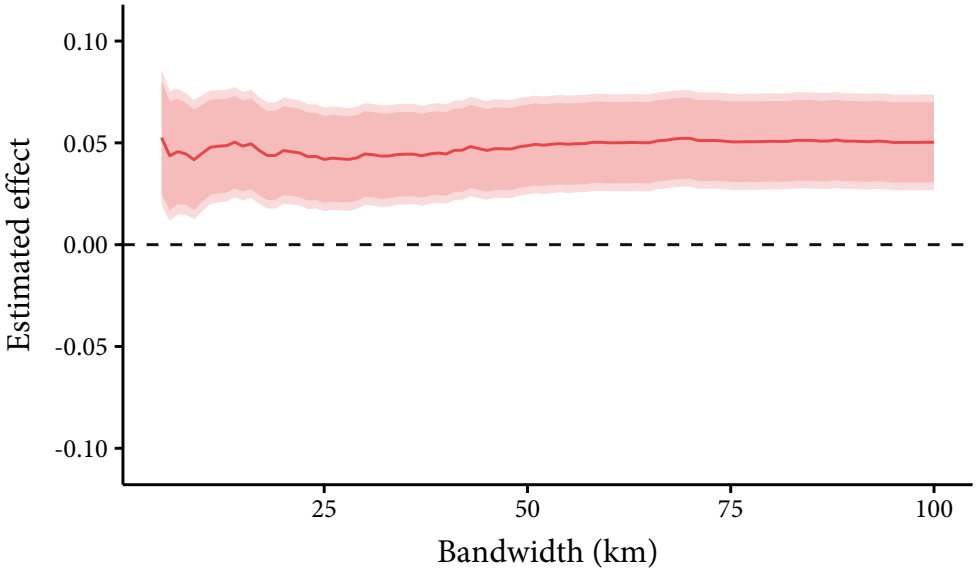


Figure A7: Results of the boundary analysis, showing how the propensity of a respondent to use a mobile phone daily varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

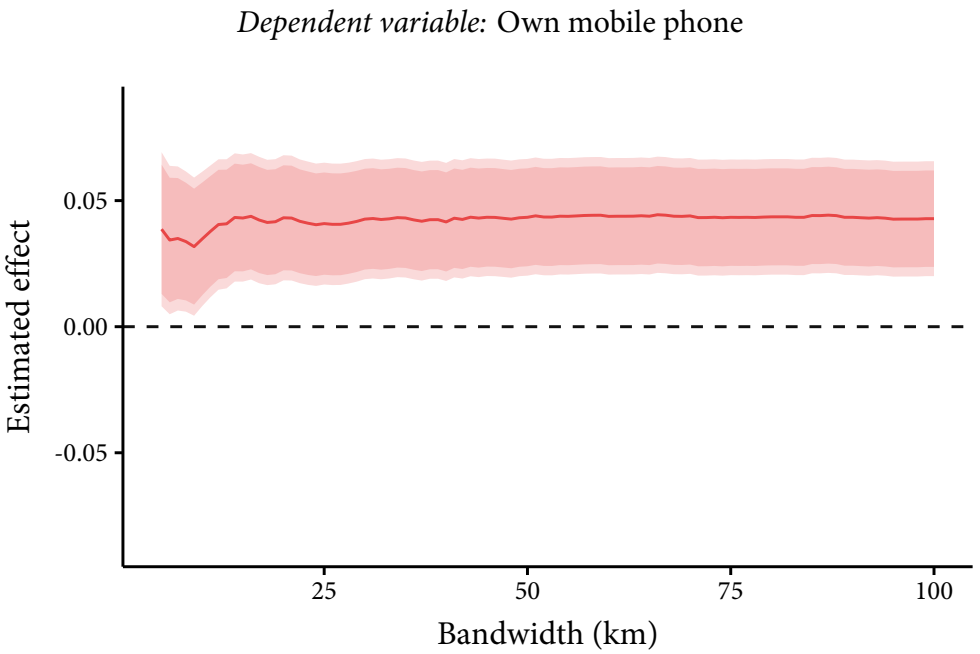


Figure A8: Results of the boundary analysis, showing how the propensity of a respondent to own a mobile phone varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

A.6 Additional robustness checks

Table A8 estimates the effect of mobile internet on identity and includes controls for measures of individual wealth and media consumption. Table A9 shows results for the interaction between mobile internet and election proximity and includes controls for multiple measures of modernization and local development.

Table A8: Effect of mobile internet coverage on national identity

	Dependent variable:					
	Identify More Nationally Than Ethnically (Binary)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet	−0.067***	−0.058***	−0.063***	−0.066***	−0.057***	−0.062***
	(0.011)	(0.010)	(0.019)	(0.011)	(0.010)	(0.019)
Fixed effects	Country	District	Grid cell	Country	District	Grid cell
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Wealth controls	Yes	Yes	Yes	No	No	No
Media controls	No	No	No	Yes	Yes	Yes
Observations	54,303	54,303	54,303	54,484	54,484	54,484

Notes: Difference in differences results show the effect of mobile internet on a respondent identifying more nationally than ethnically. All specifications include fixed effects for survey wave and either country, district, or grid cell. Columns 3 and 6 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. *Wealth controls* include an index of asset ownership as reported in the Afrobarometer surveys. Survey items probed whether a respondent owned a radio, TV, or motor vehicle. We include an index created from the dichotomous measure of each asset ownership. *Media controls* includes individual-level measures of news consumption from newspapers, radio, and television as reported in the Afrobarometer surveys. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$.

Table A10 shows difference-in-differences estimates of the effect of mobile internet on national identity for each sequential pair of Afrobarometer survey rounds. We do this to verify that no single round is driving our results. In earlier rounds, the sample size is smaller and the estimates noisier because fewer countries are in the GSM Association mobile internet coverage data. Although the point estimates are variable in magnitude, they are all negative and statistically significant. This demonstrates that our results are not driven by a particular time period or survey wave.

Table A9: Heterogeneity of the effect of mobile internet coverage by election proximity (Robustness)

	Dependent variable:								
	Identify More Nationally Than Ethnically (Binary)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Mobile internet	−0.131***	−0.128***	−0.144***	−0.131***	−0.128***	−0.143***	−0.134***	−0.129***	−0.144***
	(0.016)	(0.015)	(0.029)	(0.016)	(0.015)	(0.029)	(0.016)	(0.015)	(0.028)
Months from election	−0.003***	−0.003***	−0.003***	−0.003***	−0.003***	−0.003***	−0.003***	−0.003***	−0.003***
	(0.0005)	(0.0004)	(0.001)	(0.0005)	(0.0004)	(0.001)	(0.0005)	(0.0004)	(0.001)
Mobile internet×	0.004***	0.004***	0.005**	0.004***	0.004***	0.005**	0.004***	0.004***	0.005**
Months from election	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Fixed effects	Country	District	Grid cell	Country	District	Grid cell	Country	District	Grid cell
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Infrastructure controls	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Night lights controls	No	No	No	No	No	No	Yes	Yes	Yes
Observations	54,678	54,678	54,678	54,678	54,678	54,678	54,678	54,678	54,678

Notes: Difference in differences estimates of the heterogeneous effects of access to mobile internet on individuals' propensity to identify more nationally than ethnically by proximity to elections are shown. The positive interaction between mobile internet and months from the election indicates that the effect of mobile internet on national identification gets weaker closer to elections. All specifications include fixed effects for survey wave and either country, district, or grid cell. The specifications shown include a battery of covariates to demonstrate that the effect of access to mobile internet on national identity is not driven by modernization or local development. Columns 3, 6, and 9 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. *Population controls* include subnational measures of population density from ORNL's annual LandScan datasets on population distribution which, in addition to census data, incorporate locations of known settlements and data on land cover derived from high resolution imagery (Dobson et al., 2000). *Infrastructure controls* include distance to the electricity grid and distance to the nearest road. For *Night lights controls*, we use harmonized annual composites of nighttime luminosity from the the Defense Meteorological Satellite Program's Operational Linescan System and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership satellite (Li et al., 2020). Robust standard errors clustered at the locality or grid cell level are shown in parentheses. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$.

Table A10: Effect of access to mobile internet on national identification by round

	Dependent variable:					
	Identify More Nationally Than Ethnically (Binary)					
	Rounds 4 and 5		Rounds 5 and 6		Rounds 6 and 7	
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet coverage	−0.106**	−0.120***	−0.098***	−0.095***	−0.064***	−0.051***
	(0.046)	(0.045)	(0.022)	(0.022)	(0.015)	(0.013)
Fixed effects	Country	District	Country	District	Country	District
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,727	4,727	16,320	16,320	44,732	44,732

Notes: Difference in differences estimates of the effect of access to mobile internet on individuals' national identity are shown for each sequential pair of Afrobarometer survey rounds. All models include fixed effects for survey wave and either country or district as well as covarates for gender, age, urban/rural status, and an indicator for whether the individual has completed secondary school. Robust standard errors clustered by locality are shown are in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table A11: Effect of access to mobile coverage is not driven by approval of and trust in government

	Dependent variable:					
	Identify More Nationally Than Ethnically (Binary)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet	−0.039***	−0.031**	−0.020	−0.065***	−0.058***	−0.059**
	(0.012)	(0.011)	(0.021)	(0.011)	(0.010)	(0.019)
Fixed effects	Country	District	Grid cell	Country	District	Grid cell
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Gov. approval controls	Yes	Yes	Yes	No	No	No
Gov. trust controls	No	No	No	Yes	Yes	Yes
Observations	45,073	45,073	45,073	51,331	51,331	51,331

Notes: Difference in differences results show the effect of mobile internet on a respondent identifying more nationally than ethnically. These models include controls for approval of and trust in government officials and institutions. Columns 3 and 6 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. All specifications include fixed effects for survey wave and either country or district. *Government approval controls* are individual-level measures of approval of the president and the respondent's MP, each on a 4-point scale. *Government trust controls* are individual-level measures of trust in the president and parliament, also each on a 4-point scale. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$.

Table A11 adds controls for approval of and trust in government officials to table 1 in order to examine whether results for the effect of mobile internet on national identification could be driven by changes in approval of and trust in government officials and institutions that may accompany access to mobile internet. Columns 1 and 2 include controls for respondents' approval of the president and their MP, each measured on a 4-point scale. Columns 3 and 4 include controls for respondents' trust in the president and the parliament, which are both also measured on a 4-point scale. The effect of mobile internet remains negative and statistically significant with these controls. These variables are post-treatment, so caution is warranted in interpreting these estimates. However, these results provide evidence that changes in approval and trust in government are unlikely to be driving the effect of mobile internet on national identity.

Table A12: Effect of access to mobile internet coverage on presidential approval or trust in the presidency

	Dependent variable:					
	Presidential Approval			Trust in the President		
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet	−0.053*	−0.019	0.003	−0.024	−0.013	0.006
	(0.025)	(0.023)	(0.042)	(0.026)	(0.024)	(0.042)
Fixed effects	Country	District	Grid cell	Country	District	Grid cell
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52,313	52,313	52,313	56,461	56,461	56,461

Notes: Difference in differences results show the effect of mobile internet on approval of and trust in the president. Columns 3 and 6 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. All specifications include fixed effects for survey wave and either country or district. *Presidential approval* is an individual-level measure of approval of the president on a 4-point scale. *Trust in the president* is an individual-level measure of trust in the president, also each on a 4-point scale. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. *p<0.05; **p<0.01; ***p<0.001.

Table A13: Effect of access to mobile coverage is not driven by approval of and trust in government

	Dependent variable:					
	MP Approval			Trust in Parliament		
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet	−0.017	0.008	0.029	−0.038	−0.028	−0.053
	(0.022)	(0.021)	(0.037)	(0.022)	(0.021)	(0.033)
Fixed effects	Country	District	Grid cell	Country	District	Grid cell
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50,558	50,558	50,558	56,198	56,198	56,198

Notes: Difference in differences results show the effect of mobile internet on approval of and trust in the president. Columns 3 and 6 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. All specifications include fixed effects for survey wave and either country or district. *MP approval* is an individual-level measure of approval of the member of parliament on a 4-point scale. *Trust in parliament* is an individual-level measure of trust in the parliament, also each on a 4-point scale. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. *p<0.05; **p<0.01; ***p<0.001.

A.7 Parallel trends

The difference-in-differences estimator relies on the assumption of parallel trends—that national identification in treated and untreated areas would have followed similar patterns absent treatment. Though this assumption is untestable, its plausibility is often assessed using pre-treatment trends. Differential trends between treatment and control groups prior to actual changes in coverage would suggest that differential trends during the treatment period could be driven by other factors. For instance, one alternative explanation for our finding of decreased national identification is that mobile internet providers expand coverage into wealthy areas and that this economic development itself, rather than mobile coverage, causes decreases in national identification. We test whether differences in national identity precede changes in coverage by estimating equation 1 with the addition of one and two period leads to the treatment variable. That is, we include the respondent's treatment status for the survey waves that occur *after* after the actual interview. Results are shown in Table A14. In all specifications the effect of mobile internet coverage on a respondent identifying more nationally than ethnically remains negative and statistically significant at conventional levels. Coefficients for the *leads* of mobile internet coverage, representing the effect of *future mobile internet coverage* on *current* national identity, have point estimates near zero and are not significant at conventional levels. These results suggest that national identification does not anticipate mobile coverage, which we interpret to mean that our findings are not the result of mobile coverage expanding into more affluent areas.

Table A14: Future mobile internet does not cause a reduction in national identity

	Dependent variable:					
	Identify More Nationally Than Ethnically (Binary)					
	(1)	(2)	(3)	(4)	(5)	(6)
Mobile internet	−0.101*	−0.105*	−0.117**	−0.118**	−0.042	−0.044
	(0.045)	(0.046)	(0.044)	(0.045)	(0.049)	(0.049)
Mobile internet (t+1)	−0.024	−0.025	−0.031	−0.031	−0.056	−0.054
	(0.029)	(0.029)	(0.029)	(0.029)	(0.047)	(0.048)
Mobile internet (t+2)	0.031	0.030	0.038	0.041	0.066	0.060
	(0.032)	(0.032)	(0.035)	(0.035)	(0.043)	(0.042)
Fixed effects	Country	Country	District	District	Grid cell	Grid cell
Demographic cntrls	No	Yes	No	Yes	No	Yes
Observations	4,791	4,727	4,791	4,727	4,791	4,727

Notes: Difference-in-differences results show the effect of future access to mobile internet on a respondent identifying more nationally than ethnically. All specifications include fixed effects for survey wave and either country, district, or grid cell. Columns 5 and 6 aggregate the treatment to 0.5×0.5 degree grid cells to enable two way fixed effects. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. Robust standard errors clustered at the locality or grid cell level are shown in parentheses. *p<0.05; **p<0.01; ***p<0.001.

A.8 Balance on election proximity

Table A15: Balance on "months from nearest election" variable

	Dependent variable:				
	Months from Nearest Election				
	(1)	(2)	(3)	(4)	(5)
Female	−0.034				
	(0.020)				
Age		−0.003			
		(0.004)			
Education			0.166		
			(0.145)		
Urban				0.510*	
				(0.250)	
Wealth					0.393**
					(0.070)
Constant	15.545***	15.642***	15.460***	15.309***	14.931***
	(0.124)	(0.202)	(0.118)	(0.139)	(0.142)
Observations	59,874	59,602	59,573	59,881	59,169

Notes: Result of a balance test on election proximity variable, assessed by running a bivariate regression on "months from nearest election" variable using the following predictors: Female (binary), Age (binary), Education (binary, secondary school or above), Urban (binary), Wealth (index). Robust standard errors clustered at the locality level are shown in parentheses. *p<0.05; **p<0.01; ***p<0.001.

A.9 Alternate outcome: "My ethnic group is treated unfairly"

Table A16: Effect of Cell Phone Coverage on Belief Ethnic Group is Treated Unfairly (binary)

	Dependent variable:			
	R's ethnic group treated unfairly by gov't (binary)			
	(1)	(2)	(3)	(4)
Mobile internet coverage	0.026***	0.019***	0.028***	0.020***
	(0.008)	(0.007)	(0.008)	(0.007)
Fixed effects	Country	District	Country	District
Demographic controls	No	No	Yes	Yes
Observations	51,340	51,340	50,940	50,940

Notes: Result of the DiD analysis on alternate outcome; perceptions of ethnic discrimination. Robust standard errors clustered at the locality level are shown in parentheses. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$.

The Afrobarometer also asks whether the respondent's ethnic group is treated unfairly by the government. We find that respondents with mobile internet coverage are approximately two percentage points more likely to believe that their ethnic group is treated unfairly.

A.10 Robustness to omitting countries in analysis

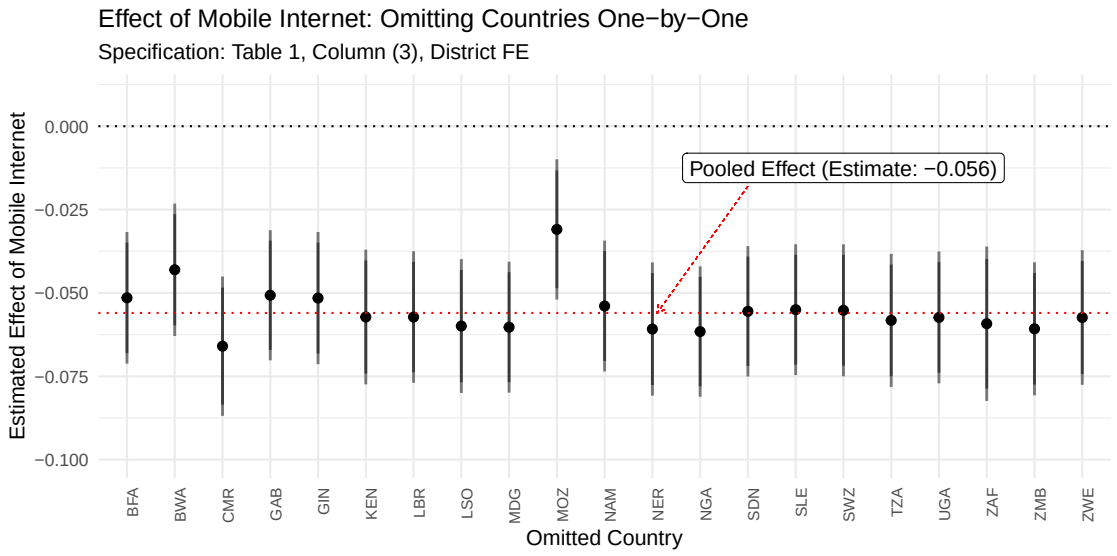


Figure A9: Estimated effects of mobile internet when omitting countries sequentially one-by-one in the estimation. Specification used is from Table (1), Column (3). X-axis labels denote the ISO3 code of the country omitted from the sample used in the estimation. Points denote the estimate and the dark and light lines denote the 90% and 95% confidence intervals for the estimate. Red dotted line plots the pooled effect.

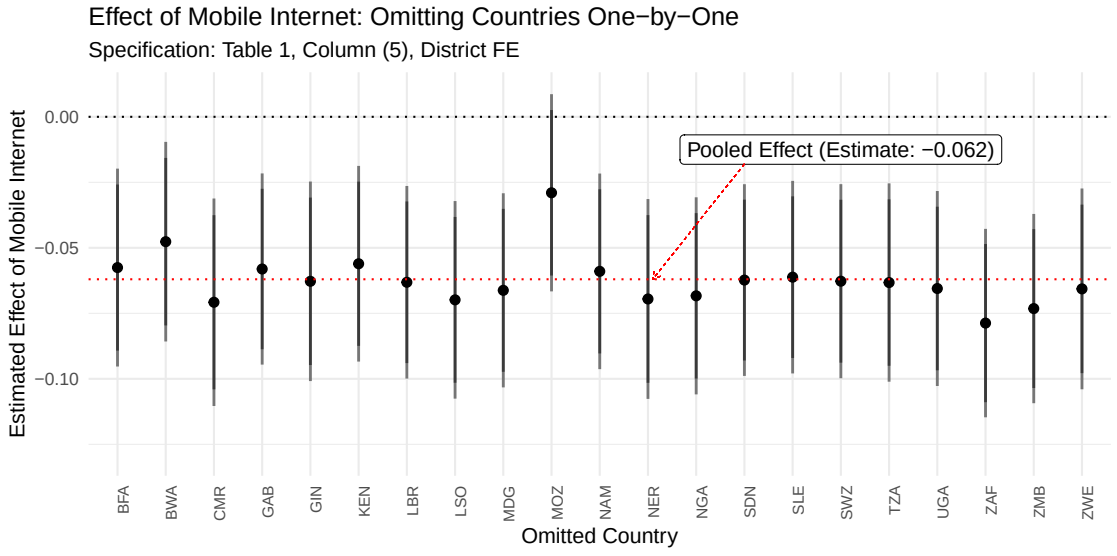


Figure A10: Estimated effects of mobile internet when omitting countries sequentially one-by-one in the estimation. Specification used is from Table (1), Column (5). X-axis labels denote the ISO3 code of the country omitted from the sample used in the estimation. Points denote the estimate and the dark and light lines denote the 90% and 95% confidence intervals for the estimate. Red dotted line plots the pooled effect.