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ABSTRACT

Fast Internet, Women Identity, and Female Genital Mutilation*

Female Genital Mutilation (FGM) is deeply ingrained in the identity of women in many societies, where it symbolizes feminine traits valued within these communities, such as purity or conformity to the community. This paper examines the impact of the expansion of fast internet, arguably a powerful catalyst for identity transformation. Using Nigeria as a case study, our findings indicate that exposure to fast internet reduces the prevalence of FGM and diminishes support for the practice, particularly among women. The results suggest that the effect is not driven by exposure to online explicit anti-FGM content. Instead, we find evidence of a broader identity transformation among women, with less stigma around promiscuous behaviors and premarital sex—stigmas that are associated with FGM in Nigeria—thereby reducing the social relevance of FGM. Specifically, we show that the expansion of fast internet increased the number of reported sexual partners, decreased age at first sex but not age at marriage, and increased the number of extra-marital relations for women. Conversely, we rule out wealth and migration as major drivers of the effect of fast internet on FGM.

JEL Classification: O12, J16, O33
Keywords: female genital mutilation, cultural change, fast internet

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1 Introduction

More than 200 million women worldwide have been subjected to female genital mutilation (FGM) (WHO, 2018). This cultural norm, which implies the alteration or injuring the female genitalia for non-medical reasons, has negative consequences in terms of health and education (Jones et al., 1999; Wagner, 2015; García-Hombrados and Salgado, 2022). Well aware of the lasting negative consequences of this practice, the fight against FGM is at the top of the political agenda of many international organizations and countries where this practice is prevalent, mobilizing substantial resources. However, while the prevalence of the practice is decreasing in some countries, it remains largely unchanged in many others.

But why this practice persist in so many countries? A widespread hypothesis links FGM with the lack of women empowerment and education (De Cao and La Mattina, 2019; Harari, 2019). Others highlight the role of this practice facilitating marriage and convening a higher bride price (Khalifa, 2022; García-Hombrados and Salgado, 2022). While the hypotheses outlined above might contribute to the persistence of the practice in some settings, existing evidence testing the effect of education and empowerment interventions show limited effects on FGM, and DHS data reveal community acceptance as the most cited perceived benefit of FGM in almost every country, well above convening a better marriage. Consistently, various anthropological studies highlight that FGM is deeply rooted into the women's identity in many societies (Koso-Thomas, 1987; Ahmadu, 2001; Shell-Duncan and Hernlund, 2001). In particular, the studies argue that FGM is typically linked with purity and the stigma surrounding promiscuous behavior, maturity, and conformity to community norms, which are highly valued attributes of traditional female identity in many of these communities. In Nigeria, where this study is centered, FGM is believed to attenuate sexual desire and encourage pre-marital virginity and sexual loyalty to husband (Mandara, 2001). In this context, interventions or shocks to local cultural norms that alter women's identities or the social value of these attributes within these communities may also influence the prevalence of FGM. However, culture, values, and social norms tend to be difficult to change.

In this study, we assess the impact of one of the most significant shocks to culture experienced in sub-Saharan Africa in the last decades: access to fast internet, on the support and prevalence of FGM. But why might fast internet transform attitudes towards FGM, women's identity, and local culture more generally? First, access to fast internet may provide individuals with access to specific anti-FGM content, including information on health risks and exposing individuals to anti-FGM advocacy campaigns. While it is also possible to encounter pro-FGM content

online, the prevalence and popularity of anti-FGM content is substantially greater (Babbs et al., 2023a). Second, for a significant portion of the population, fast internet serves as a window to other cultures and values through films, music, or social networks, which may promote alternative forms of women's identity. If FGM is closely linked to a particular form of women's identity and traits that align with societal expectations for women in these communities (e.g., purity, repressed sexual behavior, etc.), then a potential effect of fast internet on the social value of these traits (e.g., destigmatization of promiscuous behavior and premarital sex) could have profound impacts on FGM, even if individuals do not directly access explicit anti-FGM content.

Using a difference-in-difference design and the staggered roll-out of 3G networks in Nigeria, the main technology for fast internet access in sub-Saharan Africa, we show that the availability of fast internet decreases the prevalence and the support for FGM. The effects are particularly large in rural areas. We also document patterns that indicate a broader change in traditional women identities associated with sexual behavior: the availability of 3G resulted in a reduction in the age at first sex but not in age at marriage, and in an increase in the reported number of sexual partners and extramarital relations. This is consistent with the hypothesis that the fast internet reduce the stygma around pre-marital and extra-marital sex, which are strongly linked to FGM in Nigeria, eventually eroding this harmful practice. We also find that exposure to 3G resulted in an increase in smoking, which used to be highly stigmatized among women, an in bargaining power for women. These results are consistent with fast internet decreasing more generally the value of conformity to community. We also explore the effect of a prominent on-line anti-FGM campaign and find limited effects, reassuring the hypothesis that the results are not simply driven by fast internet increasing exposure to explicit anti-FGM campaigns and content. Finally, and while in principle fast internet could potentially affect FGM even without a cultural change or change in values, we find that the effects are not simply driven by an increase in wealth or by migration.

Nigeria is a relevant an optimal setting to examine the effect of fast internet on FGM and support for FGM for various reasons. First, Nigeria is the largest mobile broadband market in Africa, with around 170 million mobile connections in 2019, which accounts for approximately one in six mobile subscriptions in Africa that year (Bahia et al., 2024). Second, while the prevalence of FGM in Nigeria is not as high as in other countries such as Somalia, Mali or Guinea, Nigeria has the third largest number of cut women after Egypt and Ethiopia. Third, several Nigerian DHS rounds collect information on both attitudes towards FGM and on the prevalence of FGM

at the individual level, before and after the arrival of 3G network in Nigeria, which enables a rigorous analysis of the effect of fast internet on FGM. Finally, unlike in many other countries, the vast majority of cuts in Nigeria occur during childhood. This is specially important to define the risk of being cut over the children's first years of life, which is an essential part of the identification strategy. For all these reasons, Nigeria is an ideal setting to study the effect of 3G on the prevalence of the practice.

Our study contributes to different streams of research. First, it contributes to the body of evidence investigating what works to reduce the prevalence of female genital mutilation (FGM). A review of the effectiveness of different types of these interventions is provided in Novak and Bussbergt (2023). The authors searched the sociology, anthropology, and economics literature and found that public policy interventions have rarely been evaluated and those have been were found to have limited observable impacts.[1] Fostering substantial changes in cultural norms is challenging as usually require interventions that target the cultural roots of FGM. The evidence on the effectiveness of anti-FGM interventions that targeted broader transformations of local culture is however scarce. Corno and La Ferrara (2019) shows that the adoption of alternative rites of passage into adulthood can decrease the prevalence of FGM, and Diabate and Mesplé-Somps (2019) documents that migrants that returned to Mali after working in Ivory Coast (where FGM is not prevalent) decreased the prevalence of FGM. Finally, Congdon Fors et al. (2024) find that Christian missions reduce the prevalence of FGM. We contribute to this literature through examining the effect of fast internet, arguably one of the strongest catalyst for cultural change that experienced sub-Saharan African countries in the 21st century. Our results document that interventions that target the cultural and identity roots of FGM can be effective strategies to reduce FGM.

Second, our research is also related with the broad literature on social norms and, more specifically, with those studies that explore the nature and persistence of FGM and other traditional harmful norms. Specifically, we provide empirical evidence supporting the anthropological hypothesis that links FGM to women identity (Shell-Duncan and Hernlund, 2001; Ahmadu, 2001; Koso-Thomas, 1987).

Finally, we contribute to the growing body of evidence that examines the effects of new communication technologies. Manacorda and Tesei (2020) reveals the mobilization and protest-facilitating role of mobile phone coverage (2G) in Africa. Additionally, Hjort and Poulsen (2019a) demonstrates the positive employment effects resulting from the gradual introduction of submarine Internet cables on the

[1]The evidence is summarized in detailed in Section 2.

continent, and Bahia et al. (2024) shows that mobile broadband increased household wealth and labor force participation in Nigeria. The study by Zhuravskaya et al. (2020) delves into the influence of 3G networks on voting patterns. Contrarily, Frezza (2023) uncovers adverse effects on women's welfare and justification of IPV violence in West Africa stemming from the arrival of both terrestrial and submarine cables. In this paper, we show that fast internet can trigger a broad cultural change, contributing towards the eradication of FGM, a harmful social norm deeply rooted in the culture of many societies.

The rest of this paper is structured as follows. Section 2 characterizes the practice of FGM, presenting stylized facts, and summarizing the evidence on the effectiveness of anti-FGM policies. Section 3 describes the expansion of fast internet in the analysis and why it might have changed FGM. Sections 4 and 5 introduce the data and the empirical strategy used to estimate the effect of 3G on the prevalence of female genital mutilation. Section 6 presents the results of the expansion of 3G on the prevalence of FGM. Section 7 explores the impact of 3G on the support for FGM and on broader indicators of cultural change, and discusses alternative hypotheses to explain the main results. Section 8 concludes.

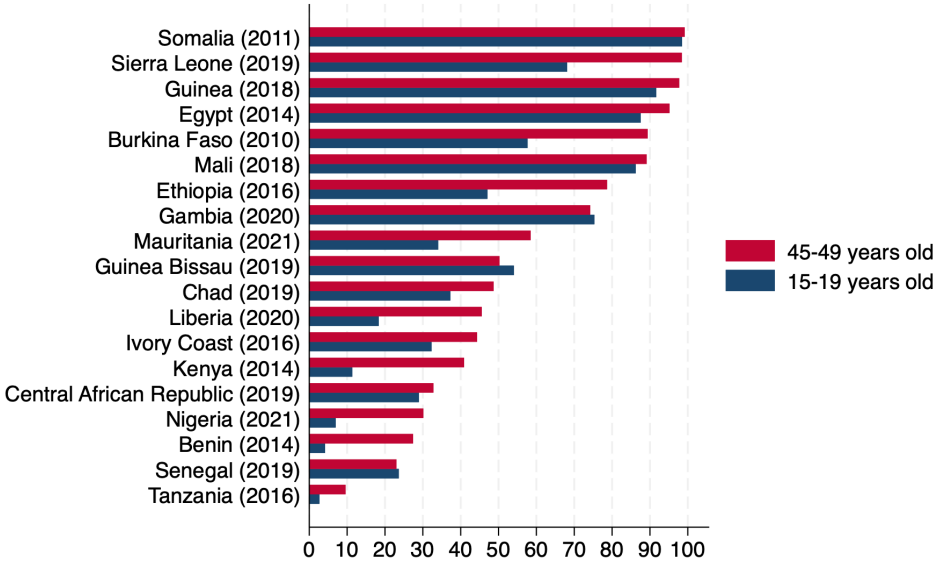
2 Female genital mutilation: How prevalent it is? why is it practiced? and what works to fight this harmful norm?

Figure 1 shows the prevalence throughout various countries where this practice is prevalent for women aged 15-49, ranging between 3% and 99%. The Figure also displays how the prevalence varies across generations, suggesting that while the practice is decreasing in some countries such as Burkina Faso or Kenya, it is hardly changing in other countries such as Somalia or Guinea, with the UN estimating that 4 million girls are still at risk of FGM every year (UNICEF, 2022).

A common belief among policy makers, the general public, and some scholars, links female genital mutilation with lack of empowerment. Every 6th of February, for the commemoration of the day of zero tolerance against female genital mutilation, the newspapers and international organizations issue statements that emphasize the importance of education as a crucial factor to foster the abandonment of FGM. While there is a well-established association between better education and the prevalence of FGM (see, for example, Novak and Bussbergt 2023 or De Cao and La Mattina 2019), the link between education and, more broadly, women's empowerment and

FGM is arguably non-causal. Figure 2 shows that the support for this practice is similar, or even slightly larger, among women than among men in many countries.[2] Thus, increasing bargaining power within the household might lead to an increase in the prevalence of FGM. Moreover, mothers are already the primary decision makers responsible for the cutting decisions in most communities (Novak and Bussbergt, 2023). Gruenbaum (2001) shows that the main backlash against anti-FGM campaigns are led by women, who claim FGM to be part of their women identity. In line with this argument, De Cao and La Mattina (2019) shows that the policy that expanded education in Nigeria did not lead to a lower support or prevalence of FGM.

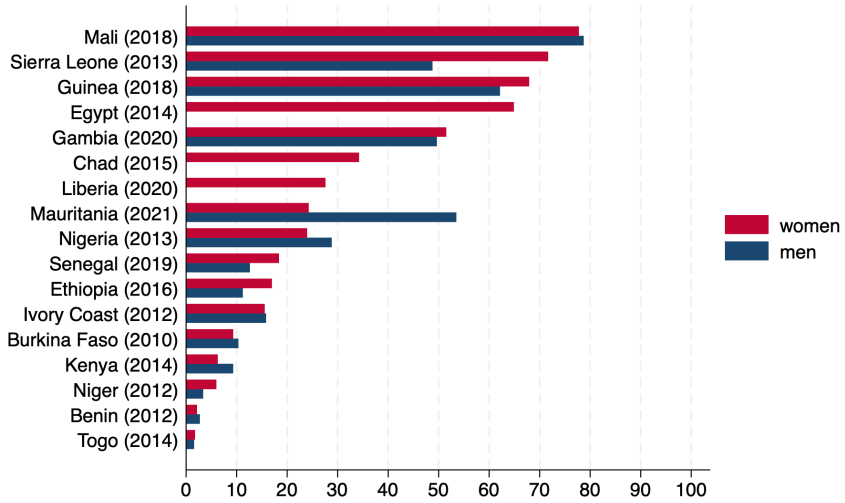
Figure 1: Prevalence of FGM by country and age group



Note: The figure shows the average prevalence of FGM across two groups of women: Women aged 15-19, and women aged 45-49. Because the vast majority of FGM occurs by the age of 15, the differences in the prevalence of FGM across generations captures the variation in the practice over time. To build the figure, we use data from the last round of DHS and MICS surveys with information on FGM in every African country.

[2] An exception is Mauritania, where the support is much higher among men than among women.

Figure 2: Support for FGM by country and sex



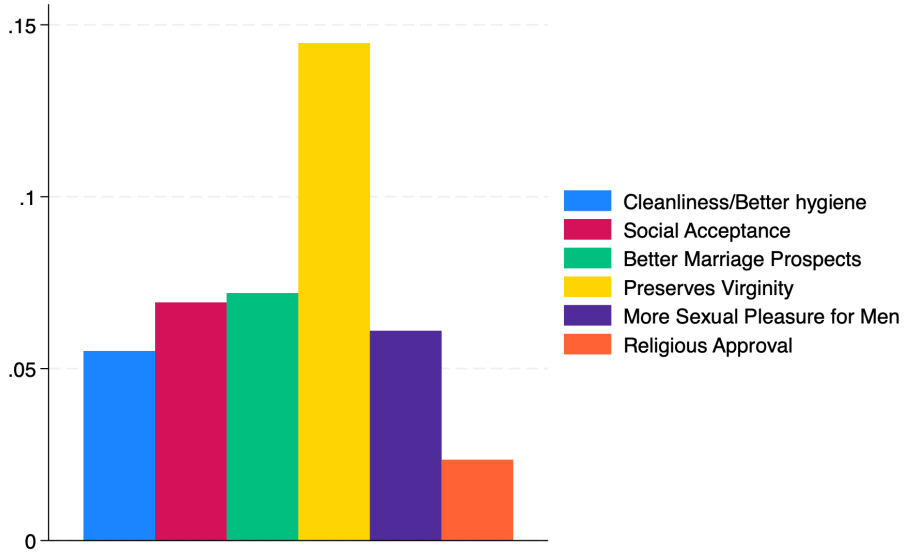
Note: The figure shows the average support for FGM among men and women among different countries. FGM support is defined as the percentage of people who think that the practice should continue. Information is obtained using the last DHS available in every country with information on support for FGM by gender.

But if FGM is not an empowerment issue, what is it about? Different anthropological studies argue that FGM is a deeply entrenched cultural practice in various societies, often perceived as an essential aspect of womanhood and female identity. Different scholars examine its multifaceted meanings in different societies. In Nigeria, Mandara (2001) and Orubuloye et al. (2001) highlight that FGM signals cultural identity and conformity with the society. In a context where pre-marital and extra-marital sex among women are traditionally stigmatized, FGM is believed to attenuate sexual desire and discourage pre-marital and extra-marital sex (Mandara, 2001). In line with this argument, DHS data on perceived benefits of FGM included in Nigerian DHS round 2008 highlights preservation of virginity as the most cited benefit (see Figure 3). While linked to marriage markets, these attributes in Nigeria are more broadly linked to social acceptance and status within the community.

The practice of FGM in other settings shares common grounds with what is described for Nigeria in the previous paragraph, although it might be less explicitly linked to the repression of promiscuity and the preservation of virginity in other settings. Gruenbaum (2001) and Koso-Thomas (1987) further explore the cultural perceptions surrounding FGM in Sudan and Sierra Leone, highlighting how it signals adherence to societal norms, rites of passage, and the preservation of tradition. Interestingly, Ahmadu (2001) argues that within the Kono community in Sierra Leone, FGM can be seen as a marker of female empowerment and identity. Overall,

the anthropological literature documents that within the contexts where FGM is practiced, it is often rooted in women's identity in these communities (Shell-Duncan and Hernlund, 2001), reflecting certain characteristics that are social valued and esteemed, including femininity, purity, sexual loyalty to husband, maturity, and stability.

Figure 3: Perceived benefits of FGM in Nigeria



Note: The figure shows the proportion of individuals in Nigeria that perceives FGM has each of the following benefits. Data used is the 2008 Nigerian DHS, which is the last survey including information on the perceived benefits of FGM.

Female genital mutilation is a human rights violation with lasting negative consequences in terms of health and education (Berg et al., 2014; García-Hombrados and Salgado, 2022; Wagner, 2015). Well aware of the pernicious consequences of the practice, the fight against FGM is at the top of the policy agenda of many policy makers from national governments and international organizations, mobilizing every year 19 million USD.[3] Despite the broad interest in this practice, there is very little rigorous evidence on what works to reduce female genital mutilation (Novak and Bussbergt, 2023).

A review of the evidence is provided in Novak and Bussbergt (2023). Overall, the larger effects are found for interventions and shocks that target the cultural roots

[3]Annual spending on FGM reduction between 2018 and 2021, corresponding to the UNFPA-UNICEF Joint Programme on FGM. According to Katz et al. (2021), expanding prevention, care and treatment, and protection programs would cost 300 million USD per year. Such intervention would avert up to 24 million cases.

of FGM, including the adoption of alternative rites of passage (Corno and La Ferrara, 2019), or the spillover effects of returned migrants (Diabate and Mesplé-Somps, 2019). Consistently, Congdon Fors et al. (2024) shows that Christian missions in sub-Saharan Africa decrease the current prevalence of FGM, and that this effect is not driven by better education or economic development. Less clear is the evidence that explore the effects of FGM bans, with studies suggesting some beneficial effects in Senegal and Burkina Faso (García-Hombrados and Salgado, 2022; Crisman et al., 2016), and others showing no effects or even unintended negative consequences in terms of age at cutting (Camilotti, 2015; Cetorelli et al., 2020). Similarly, studies assessing the effectiveness of interventions aiming to increase women empowerment have mixed results: While De Cao and La Mattina (2019) shows no effect of educational interventions on FGM or support for FGM, Harari (2019) suggests that expanding women inheritance rights reduce the prevalence of FGM. Finally, interventions providing information about campaigns or advocacy can decrease the prevalence of FGM (Khalifa, 2022; Corno and La Ferrara, 2019; Vogt et al., 2016; Efferson et al., 2015), although they can also backlash (Gruenbaum, 2001).

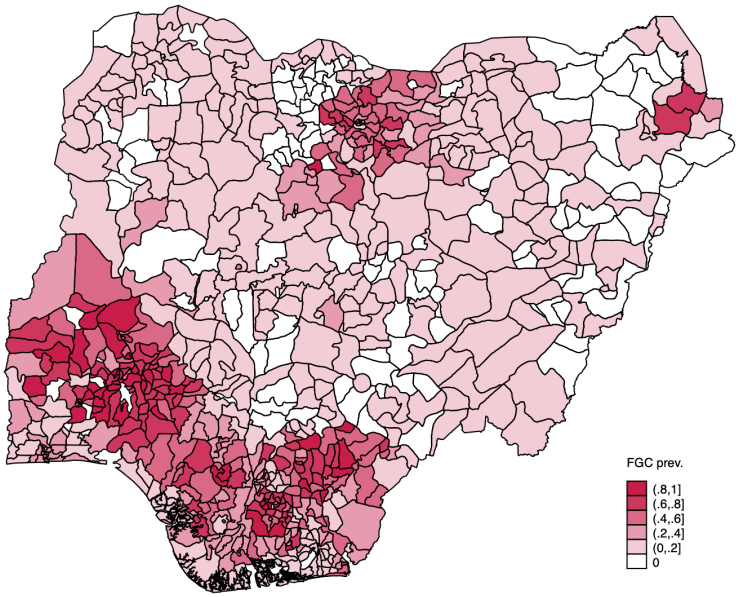
2.1 FGM in Nigeria

The last round of the Nigerian DHS, conducted in 2018, indicates that 20% of women aged 15-49 in the country undergo female genital mutilation (FGM). Figure A1 in Appendix shows the prevalence of this practice by year of birth, providing information on the evolution of FGM in Nigeria. Despite a significant decrease over the last decades, the prevalence of FGM has remained relatively stable for those born after year 2000. The survey also reveals that most cuts are type I (partial or total removal of the clitoral glans), and are performed by traditional circumcisers. Unlike in other settings, more than 80% and 95% of cuts occur within the first and second year of life, respectively. FGM is deeply rooted in the tradition of the most populous Nigerian ethnic groups including the Yoruba, Igbo or the Hausa. Figure 4 shows that FGM is prevalent throughout the country with higher rates concentrated in Southern and Southeastern counties, with certain focal points in Northern Nigeria.

3 The expansion of fast internet in Nigeria and its potential impact on FGM

To explore the effect of fast internet on FGM in Nigeria, we focus on the expansion of the third and fourth generation of mobile telecommunications, known as 3G and

Figure 4: Prevalence of FGM in Nigeria by LGA (women age 15-49)



Note: The figure depicts proportion of women undergoing FGM in Nigeria by county (LGA). The figure is constructed using the 2018 Nigerian DHS round.

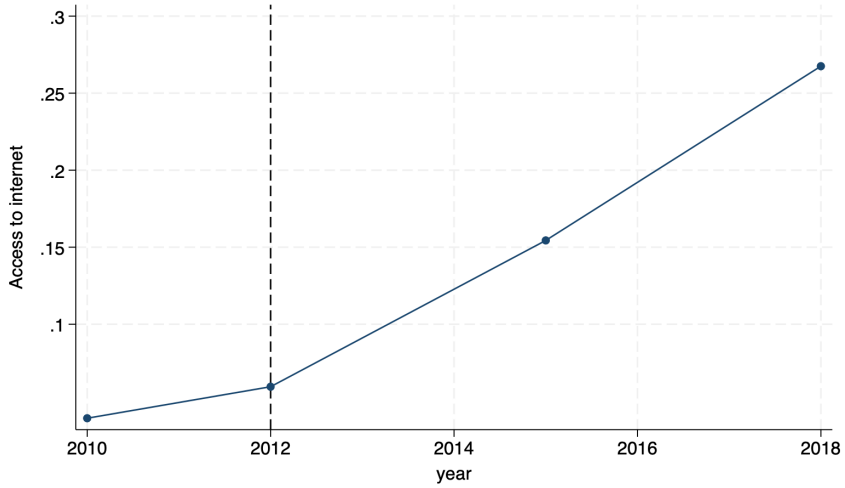
4G networks. 3G and 4G technology provides enhanced mobile communication capabilities, including fast data transmission and expanded multimedia capabilities, allowing for fast internet access from mobile phones. While we consider both 3G and 4G for our analysis, 4G was first introduced in Nigeria at the very end of our study period and typically in areas that previously already had 3G. For simplicity, we use the term 3G throughout the rest of the paper.

3G technology operates through cell towers or base stations that communicate with user terminals in their vicinity using electromagnetic signals to connect these terminals to the core network and provide fast internet. While the reach of cell towers crucially depends on topography, buildings, transmission power, and weather conditions, they can reach up to 15 km in rural areas. Introduced first in the main Nigerian cities, 3G networks gradually extended nationwide during the 2010's. By the end of 2019, Nigeria has 170 million mobile connections (60% of which used 3G or 4G mobile broadband technologies), which makes Nigeria the largest mobile broadband in Africa (Bahia et al., 2024). In Sub-Saharan Africa, where cable connections/Digital Subscriber Line (DSL)/fiber optic infrastructures are limited and costly (less than 0.5 subscriptions per 100 inhabitants (World Bank, 2024)), 3G mobile networks, accessed via smartphones, serve as the predominant means of internet access, as described in Figure A2 in Appendix. Using data from the Nigerian General Household Survey (NGHS), Figure 5 depicts how internet acces-

sibility increased after 2012, being mobile phones the main source of access to the Internet, specially after 2012 (see Figure A2 in Appendix). Figure A3 in Appendix provides information on how Nigerian households use the internet, highlighting its use for communication and for accessing cultural content such as videos, music, social media, and films.

We hypothesize that fast internet can foster a cultural change leading to a reduction in FGM. First, the internet exposes individuals to more progressive women identities than what is typically seen in most Nigerian communities. Considering that FGM is a practice indicating adherence to traditional values like preservation of virginity, sexual activity only within marriage, and conformity to the group, the need for such practice may decrease if the prevailing ideas about women's sexual behaviors change due to exposure to more progressive ideals and role models on the internet (e.g. music, Youtube videos, movies, social media, etc). Second, the internet facilitates the dissemination of explicit anti-FGM content, granting individuals the opportunity to access such materials. Nigeria stands out globally for its substantial efforts in countering FGM through online platforms and social media channels. A detailed discussion of these on-line campaigns and efforts is provided in Section 7.2. However, exposure to different cultures and anti-FGM content may also trigger cultural backlash (Blumenstock et al., 2022; Gruenbaum, 2001), raising questions about the direction of the effect, which remains an open empirical question.

Figure 5: Access to Internet in Nigeria



Note: The figure shows the evolution of the proportion of the population that report having access to internet in Nigeria. The proportions are calculated using the Nigerian General Household Survey rounds 2010, 2012, 2014, 2016, 2018.

Furthermore, it is possible that fast internet decreases FGM even in absence

of a cultural change or a change in the support for the practice. Previous studies showed that fast internet can increase labor force participation, firm productivity, and income (Hjort and Poulsen, 2019a; Bahia et al., 2024), which has been connected to FGM in some setting (McGavock and Novak, 2023). The latter paper shows that, in communities where FGM typically occur close to marriage, negative economic shocks increase the prevalence of FGM, which allow the parents to receive a higher bride price (McGavock and Novak, 2023; García-Hombrados and Salgado, 2022; Khalifa, 2022). If 3G networks increase household income and since FGM may increase a daughter's value in marriage (leading to a higher bride price), parents might decide to stop the practice because the extra money from 3G compensates for the loss of income associated with not having their daughter subjected to FGM.

4 Data

The analysis combine geolocated household data from Demographic and Health Surveys, the Nigerian General Household Survey, and the Afrobaromater, with grid level data on 3G network availability and population density.

Nigerian Demographic and Health Surveys (DHS): We use information from four rounds of the Nigerian DHS conducted in 2003, 2008, 2013, and 2018. DHS data includes individual-level information from a nationally representative sample of women aged 15-49 in Nigeria. The questionnaire provides information on demographic, socioeconomic and health characteristics, including self-reported information on their FGM status and on the FGM status of each of their daughters, support for FGM, beliefs about FGM, and sexual behavioral outcomes. The survey also includes a male module that collect information on a nationally representative sample of men aged 15-59. Information on the perceived benefits of FGM is only included in the 2003 and 2008 surveys. The men sample is smaller since only one third of the interviewed households were selected for the male module. Moreover, the male module only includes information on support for FGM in the 2003, 2008 and 2013 rounds. All the DHS rounds considered include information on the latitude and longitude of the survey cluster (village for rural areas and wards for urban areas). While the geolocation of the survey clusters is randomly displaced 2km in urban areas and 5 km in rural areas, the error caused by this random displacement in terms of the reception of 3G network is believed to be small and, in any case, would bias our results downwards due to clasical measurement error, which would not invalidate the main conclusions of the study.

During the survey, enumerators are instructed to ensure privacy, though achiev-

ing complete seclusion from other family members may not always be feasible. The words and methods employed by enumerators are specifically designed and trained to avoid undereporting due to social desirability bias and other causes (US AID, 2011). The FGM module involves a structured approach: Enumerators initially inquire whether the individuals are aware of the concept of FGM through two distinct questions, with the first introducing the concept and the second providing details.[4] If respondents are not aware regarding FGM, no additional questions are posed to them on this subject.[5] Subsequently, women are asked about their personal experiences with FGM, including if they are cut, the type of cut, and the age at circumcision. Following this, the enumerator repeats these questions for each living daughter of the interviewed women, using birth history. Individuals are further questioned about their attitudes toward the practice and their perceived benefits. Moreover, the survey gathers additional individual-level information on fundamental demographics, health, and socioeconomic characteristics.

Table 1: Summary statistics: Sample used in the analysis of the effect of 3G on FGM

	N	Mean	SD	Min	Max
PANEL A: Full sample					
FGM (0/1)	29503	0.16	0.37	0	1
3G at time of birth	29503	0.09	0.28	0	1
Age	29503	3.16	2.81	0	11
Year of birth	29503	2011	3.28	2007	2018
PANEL B: Girls aged 3 or older					
FGM (0/1)	15863	0.16	0.37	0	1
3G at time of birth	15863	0.05	0.21	0	1
Age	15863	5.05	2.53	3	11
Year of birth	15863	2010	2.82	2007	2015

Note: Panel A provides descriptive statistics for the main analytical sample used in the analysis of the effect of 3G on FGM. Panel B provides descriptive statistics for the sample used in the analysis of the effect of 3G on FGM restricted to girls aged 3 or older.

We establish two distinct analytical samples to study the effect of fast internet on the prevalence of FGM. Firstly, based on FGM information provided by women about their daughters, we examine all girls born between 2007 and 2018, considering

[4]Using the local term for female circumcision

[5]In our analytical sample, we categorize women as uncut if they declare lack of awareness regarding FGM in response to both related questions.

cohorts of women born up to five years before the start of the deployment of 3G networks in Nigeria. Panel A in Table 1 shows the summary statistics for this sample of 29,503 daughters. The prevalence of FGM among them is 16%. Their ages range from 0 to 11, with an average age of 3 years old. Secondly, we construct a second dataset restricting the sample to girls born between 2007 and 2018 who are aged 3 or older at the time of the survey. Because the 95% of the cut girls in Nigeria are cut by the age of 2, this restrained sample arguably includes information on the final FGM status of the girls for the very vast majority of girls. While the use of this restricted analytical sample limits the statistical power of the analysis, it helps to rule out the hypothesis that part of the effect is driven by 3G networks delaying the age at cutting.

Table 2: Summary statistics: Sample used in the analysis of the effect of 3G on support for FGM, sexual behavior, and other outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	N	Mean	SD	Min	Max	Mean women	Mean men
Age	169,172	29.46	10.19	15	59	28.85	30.98
Female	169,172	0.72	0.45	0	1		
Support FGM	83,039	1.54	0.85	1	3	1.53	1.56
Beliefs FGM linked to Religion	86,366	0.17	0.38	0	1	0.16	0.21
Labor force partic.	168,568	0.67	0.47	0	1	0.62	0.81
HH wealth index	169,172	0.00	1.00	-2.82	3.11	-0.02	0.04
Age at 1st marriage	117,790	19.63	5.94	2	56	17.94	25.29
Age at 1st intercourse	131,672	17.74	4.07	4	47	16.82	20.32
N lifetime sexual partners	156,610	1.96	4.68	0	95	1.48	3.17
Sexual partners excluding husband (last 12 m.)	168,531	0.15	0.52	0	52	0.10	0.26
Used condom last relation (0/1)	124,646	0.09	0.29	0	1	0.06	0.18
Smoke	155,779	0.03	0.16	0	1	0.01	0.10
Final say on...							
Own health	84,930	1.50	0.66	1	3	1.50	
Large household purchases	111,422	1.70	0.78	1	3	1.45	2.51
Visits to family relatives	84,912	1.65	0.68	1	3	1.65	

Note: Descriptive statistics for the analysis of cultural change and support for FGM. DHS rounds 2003, 2008, 2013 and 2018. Differences in the number of observations across variables are explained by missing variables and by the fact that information on every outcome is not available in every DHS round.

Aiming at understanding the effect of fast internet on the support for FGM and other cultural change outcomes, we use information from the household, male and female records of the 2003, 2008, 2013, and 2018 Nigerian DHS. Specifically, we use information on support for FGM,[6] the belief that FGM is a religious requirement,

[6]The variable takes the value of 1 if the respondent does not want FGM to continue, 2 if the respondent answer "depends", and 3 if the respondent wants FGM to continue.

women's bargaining power,[7] age at first marriage, age at first intercourse, number of lifetime sexual partners, number of extramarital sexual partners in the last 12 months, and condom use in the last sexual relationship. Descriptive statistics for this sample are reported in Table 2 and comprises approximately 154,000 individuals, 122,000 women aged 15-49 and 32,000 men aged 15-59. The table also provides information for the following variables, which are studied in the Appendix for further robustness checks: whether individual smokes regularly, household wealth,[8] and labor force participation.

3G data: We leverage yearly data on the availability of 3G and 4G mobile networks between 2007 and 2018 obtained from the Global System for Mobile Communications Association (GSMA). These datasets include coverage data provided by mobile network operators globally to the GSM Association.[9] We use yearly information on 3G or 4G availability provided at the 1x1-kilometer grid level for all Nigeria. The available information allows therefore to determine whether the individuals interviewed in the different geolocated surveys have 3G or 4G network available, which provides fast internet. While we consider both 3G and 4G, 4G was first introduced in Nigeria at the very end of our study period and typically in areas that previously already had 3G. Most of the variation used in the study in exposure to fast internet arises therefore with the deployment of 3G. As discussed in the previous section, while we consider both 3G and 4G, we use the term 3G throughout the rest of the paper for simplicity.

While we provide evidence that 3G increases internet usage using the Nigerian General Household Survey, our main analysis focuses on 3G (fast internet) availability rather than usage for two reasons. First, the DHS dataset, which is the primary dataset including information on FGM outcomes, does not include information on internet usage.[10] Second, the identity change brought about by fast internet may also affect community members who do not have direct access to the internet. This can occur if, for example, internet users share information and content with non-users, or through the assimilation of behaviors exhibited by internet users.

[7] We construct a variable of bargaining power of the respondent for each of the following decisions: final say on health expenditures, final say on large household expenditures, family visits, and manage women money. The variables take the value of 0 if the decision is not taken by the respondent, 1 if the respondent participate in the decision, and 2 if the decision is taken by the respondent alone. The women module includes information for the 4 decisions, while the male module includes information only for the final say on large household purchases.

[8] Household wealth is constructed in the DHS as an standardized index using information on dwelling quality and other assets.

[9] The GSM Association serves as the representative body for the collective interests of mobile network operators worldwide.

[10] Only the 2018 round includes this information, which is provided only at the time of the survey and does not allow for use in the retrospective analysis conducted in the main analysis.

Other datasets: Following Zhuravskaya et al. (2020), we use the NASA map of population density at the 1x1 km level[11] and the GSMA dataset to calculate the proportion of population in each Nigerian county every year with 3G network available.[12] The onset of 3G mobile networks is readily discernible looking at Figure A4. In 2011, the absence of 3G availability contrasted sharply with the scenario in 2018, where 55% of the Nigerian population live in a village or city with 3G network available. This variable is used in the analyses presented in Section 7.

Since only DHS round 2018 includes information on access to internet, the analysis of the effect of 3G availability on internet access is conducted with information from rounds 2010, 2012, 2015, and 2018 of the Nigerian General Household Survey (NGHS), which collects information on this dimension for a nationally representative sample of households.

We also use yearly rainfall data collected by the University of Delaware at the grid level for the period 1900-2018. The latter dataset is used to assess the effect of rainfall shocks on FGM, which helps to rule out the hypothesis that the effect of 3G network is simply driven by an increase in wealth.

Finally, we use information from the 2003, 2008, 2014, and 2017 rounds of the Afrobarometer survey in Nigeria. These rounds include geocoded information for nationally representative samples of both men and women on political opinions including trust in tradional leaders, which is used in a complementary exercise to better understand how 3G erodes traditional values and institutions.

5 Empirical strategy

To assess the impact of fast internet on FGM, we leverage information obtained from the daughters of women participating in the Nigerian DHS. The information is collected from the female module which includes information on FGM status for every daughter of women aged 15-49. Our empirical approach relies on variation in the availability of 3G network at the time of birth in the place of residence. Because FGM in Nigeria occur mainly within the first year of life, those girls born after the introduction of this technology in the village/ward of residence are considered exposed to 3G while those born before 3G network is available in the location or in locations with no 3G network available during the study period are considered unexposed. Formally, we estimate the following difference-in-differences model:

[11] https://neo.gsfc.nasa.gov

[12] Nigerian counties refer to Local Government Areas or LGAs.

$$FGM_{ibv} = \delta_0 + \delta_1 3G\ network_{bv} + \theta_b + \gamma_v + \delta_2 Age_{ibv} + u_{ibv} \quad (1)$$

where FGM_{ibv} is equal to 1 if girl i, born in year b and living in village v is cut and 0 otherwise. $3G\ network_{bv}$ indicates whether village/ward v in year b is covered by 3G network. δ_1 is the parameter of main interest and it measures the effect of 3G network availability at birth on the prevalence of FGM. θ_b and γ_v are year-of-birth and village fixed effects to control for time-invariant village-level characteristics and birth-year specific events. Age_{ibv} is a control variable for the age of the girl. Because different survey rounds are used in the analysis, there is no multicollinearity between the vector of year of birth fixed effects and the age at survey variable. We include the latter as a control variable because the probability of FGM arguably increases with age within the first two years of live. Standard errors are clustered at the village/ward level (DHS cluster).

Because the introduction of 3G throughout Nigeria is staggered, the standard OLS model may lead to the negative weights problem identified by Goodman-Bacon (2021). To overcome this challenge, we use the estimator developed in Sun and Abraham (2021). We also test the robustness of our results to the use of the canonical two-way fixed effect estimator (TWFE), and the difference-in-differences methods for staggered treatment adoption developed in Callaway and Sant'Anna (2021), and in Chaisemartin and D'Haultfœuille (2020). The main identification condition in this analysis is the parallel trends: In absence of 3G network, the evolution of the prevalence of FGM would be similar across cohorts exposed and unexposed to 3G. While this condition cannot be formally tested, we can assess whether the evolution of the prevalence of 3G across cohorts exposed and unexposed to 3G follows a similar trend before the deployment of the 3G network. If so, it is reasonable to expect that, in the absence of the treatment, both groups would have followed the same trend across cohorts. To test the feasibility of this condition, we use the event study design proposed in Sun and Abraham (2021).

One potential concern with the results is the misreporting of daughters' FGM status. If misreporting is random, the latter would cause larger confidence intervals. More worryingly, if the misreporting is correlated with the availability of 3G network at the time of birth, our estimates of the effect of 3G on FGM would be overestimated. We believe this is not a major concern in our analysis. In our setting, FGM status is defined using information provided by mothers many years after the procedure. The variation used in the analysis comes from FGM status reported in the same survey round many years after the cut for daughters born before and after the arrival of the 3G network. While underreporting of FGM status is possible in

our data, it is unlikely to be correlated with the availability of 3G many years prior to the survey, once we control for the availability of the 3G network at the time of the survey (captured by our fixed effects). In Section 6.1, we examine the robustness of the results to the introduction of anti-FGM laws, which may also affect the reporting of FGM, and find reassuring results.

We also assess the effect of 3G network availability on the support for FGM, the belief that FGM is a religious requirement, sexual behavioral outcomes, and bargaining power within the household. Information on these variables at the time of the survey is included for women aged 15-49, and for men aged 15-59.[13] Unlike in the analysis of the FGM prevalence, exposure to 3G is not defined based on the availability of 3G network in the place of residence at the time of birth, but rather at the time of the survey. Additionally, the DHS data are repeated cross-sections and the survey clusters are different in every round. We circumvent this limitation by converting our treatment variable of interest, 3G exposure, into a variable representing the proportion of the population covered by 3G networks in each county (LGA). Defining the treatment at the county level enables us to incorporate fixed effects and cluster observations by county because, unlike survey clusters, these are always the same no matter the survey round. Given that now the main treatment variable is continuous (the proportion of individuals in the LGA with 3G network available at the time of the survey), the equation is estimated using the staggered difference-in-differences method presented in Chaisemartin and D'Haultfœuille (2020). The latter approach is the only new difference-in-difference estimators that allows for the use of continuous treatment variables. As a robustness check, we also estimate the following regression using TWFE:

$$Support\ FGM_{itl} = \delta_0 + \delta_1 Sh\ population\ with\ 3G\ network\ available_{tl} + \mu_t + \nu_l + X_{itl} + u_{itl} \quad (2)$$

where $SupportFGM_{itl}$ indicates the outcome of interest for individual i, living in county l interviewed at time t, $Sh\ population\ 3G_{tl}$ is the share of the population in county l at time t that has 3G available. μ_b and ν_v are year-of-interview (survey) and county (LGA) fixed effects. u is the error term. Standard errors are clustered by county. To test the feasibility of the parallel trends condition in this specification, we also estimate the event study design proposed in Chaisemartin and D'Haultfœuille (2020).

The same approach is also used to estimate the effects of 3G network availability

[13] Not all the variables are however available in every survey round.

on access to internet using the Nigerian General Household Survey (NGHS), the probability of smoking, labor force participation, and wealth using DHS data, and the trust in traditional leaders using the Afrobarometer.

As a robustness check, we use the individual level of exposure to 3G network availability to estimate the association between 3G network availability and these survey outcomes in Appendix C, showing consistent estimates.

6 Results

Using data from rounds 2010, 2012, 2015, and 2018 of the NGHS, we start by examining the effect of 3G availability on access to Internet. The results of this analysis are depicted in Figure A5 in Appendix and show that the availability of 3G mobile technology increases the probability of internet use by 30 percentage points. The effect on internet access is immediate and particularly large for young women. These results are not surprising, since 3G is the primary technology for internet access in Nigeria (see Figure A2 in Appendix), and use of internet in 3G covered areas in Nigeria is large, particularly among young people.[14] Infrastructure for cable connections, DSL, and optic fiber are expensive and deficient out of the big cities in sub-Saharan Africa (World Bank, 2024).

The primary focus of the study centers on examining the impact of 3G network availability on the prevalence of female genital mutilation (FGM). The findings from the analysis are reported in Table 3. The results indicate that the availability of 3G network has a strong effect on the prevalence of FGM. Specifically, the effect of 3G availability on the prevalence of FGM ranged from 4 to 6.6 percentage points, depending on the estimation method. The effect remains significant for the sample of girls aged 3 years and older, ruling out the hypothesis that 3G are delaying FGM rather than reducing its prevalence. The results of the event study reported in Figure 6 reveal that the effects are not driven by the pre-existing differential trends, and the effect is immediate from the first year. Table A1 in Appendix reports the estimates excluding from the analysis those girls who were aged 1 or 2 at the time of the 3G deployment in their location. Because a small fraction of cut girls were cut after the age of 1, some girls aged 1 or 2 when the 3G network was deployed in their location might be considered treated.[15] Once these women and girls, considered as

[14] Round 2018 of the NGHS shows that nearly 55% (66%) of women (men) aged 18-30 living in 3G covered areas declared having access to internet. The % of individuals among the full population that access internet is smaller: 39% for women, and 54% for men.

[15] While some girls were cut even after the age of 2, 80% of cut girls were cut within the first year of life and 95% of the cut girls were cut before reaching the age of 3 years old.

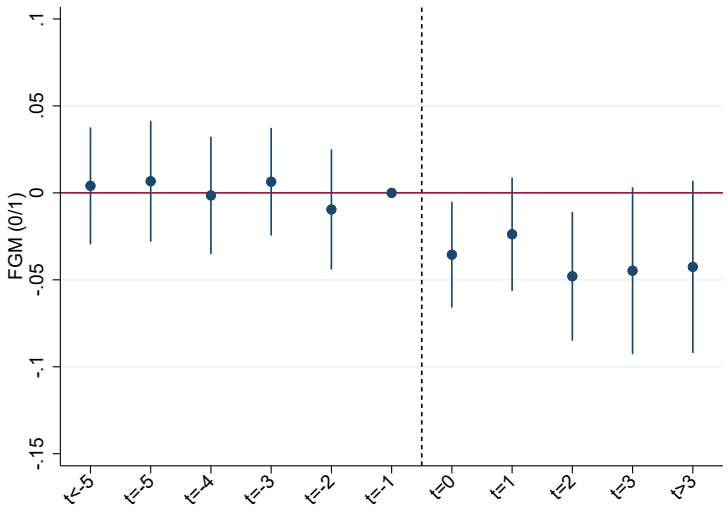
control in the main estimates, are excluded from the analysis, the estimates have the expected larger magnitude.

Table 3: Effect of 3G network availability on the probability of FGM

Dep var: FGM (0/1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3G network available	-0.047**	-0.050**	-0.066***	-0.056	-0.034*	-0.068*	-0.044***	-0.040***
	(0.019)	(0.025)	(0.025)	(0.054)	(0.018)	(0.036)	(0.010)	(0.015)
N	29,503	15,751	29,542	15,463	11,204	11,204	29,503	15,751
Mean dep var.	0.159	0.163	0.159	0.164	0.000	0.000	0.159	0.163
Estimation method	Sun & Abraham	Sun & Abraham	Callaway & Sant'Anna	Callaway & Sant'Anna	Chaisem. & D'Haultf.	Chaisem. & D'Haultf.	TWFE	TWFE
Analytical sample	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2

Note: Columns 1-8 report the estimates of the impact of 3G availability at the time of birth on the probability of being cut. Because the introduction of 3G across survey clusters was staggered, we use various difference-in-differences estimation methods. Columns 1 and 2 report the results of the method described in Sun and Abraham (2021). Columns 3 and 4 report the results of the method described in Callaway and Sant'Anna (2021). Columns 5 and 6 report the results of the method described in Chaisemartin and D'Haultfœuille (2020). Columns 7 and 8 report the results of a two-way fixed effects. Each estimation method is run using two different samples. Columns 1, 3, 5 and 7 use the whole sample of women born within the period studied: 2007 and 2018. Columns 2, 4, 6 and 8 use the sample of women born within the period studied (2007 and 2018) that were at least 3 years old at the time of the survey. More than 95% of the women cut are cut within the first 2 years of life.***p<0.01;**p<0.05,*p<0.1.

Figure 6: Event study: Effect of 3G network availability on the probability of FGM



Note: The figure depicts the dynamic effects of 3G availability on the prevalence of FGM. The event study is estimated following the procedure presented in Sun and Abraham (2021).

We then investigate the heterogeneous effects of 3G network availability over three key dimensions: rural and urban areas, areas with more and less than 50%

FGM prevalence, and muslim vs non-muslim population. The results are reported in columns 1 and 2 of Table A2. The estimates show large effects of 3G network on the prevalence of FGM in rural areas while small and statistically insignificant effects in urban areas. These results are consistent with the hypothesis that the effect of exposure to fast internet is larger in communities with lower levels of exposure to other cultures before the deployment of 3G network. The results reported in columns 3 and 4 of Table A2 show mixed evidence of the heterogeneous effects of 3G availability on FGM by the pre-existing prevalence of FGM in the cluster. While the magnitude of the effect is twice as large in areas where the prevalence of FGM is more than 50%, this effect is not statistically significant at conventional confidence levels. This result needs to be interpreted with caution because only about 20% of the clusters have an FGM prevalence over 50%, which reduce substantially the analytical sample and the statistical power of the analysis. On the other hand, although the magnitude of the effect of 3G in areas where the prevalence of FGM is less than 50% is smaller, the effect is statistically significant at conventional confidence levels. Therefore, while the magnitude of the effect is substantially larger in areas with a higher prevalence of FGM, the results do not allow us to conclusively determine whether the effect of fast internet is stronger in areas where the majority of the population practiced FGM. Finally, the results reported in columns 5 and 6 suggest that the impacts are larger for Muslims, who are the majority in the North of the country and have a higher prevalence of FGM, compared to non-Muslims. However, the effects of 3G on FGM are statistically indistinguishable from zero at conventional confidence levels for both muslims and non-muslims.

6.1 Robustness

This section explores whether the main estimates of the effect of 3G availability on FGM might be confounded by other policies or phenomena that simultaneously affect this practice. Since the mid-2000s, various states in Nigeria have enacted laws criminalizing FGM. We conduct two tests to explore their potential influence on our estimates. Firstly, we re-estimate equation 1 including a control variable indicating whether the girl resides in a region where FGM was prohibited at the time of birth. The results of this analysis are reported in Table A3 and reveal nearly identical estimates for the effect of 3G availability on the prevalence of FGM. Secondly, we conduct the analysis restricting the sample to regions without FGM bans. The results of this analysis are reported in Table A4, showing consistent estimates of the effects of 3G availability on FGM for this subsample. Taken together, these analyses rule out the hypothesis that the main estimates are confounded by the introduction

of bans on FGM during the study period.

The introduction of 3G network not only provides fast internet but also facilitates communication among individuals through calls and short messages (SMS). To rule out the hypothesis that these other functionalities of the 3G technology are confounding the effects of fast internet, we assess the impact of the expansion of 2G mobile networks on FGM in Nigeria in the early 2000s. While 2G facilitated the transmission of text-based data through short messages (SMS), it only provided limited internet browsing and applications, not fast internet. The results reported in Table A5 and Figure A6 show null results and a fairly flat trend in terms of FGM prevalence before and after the introduction of 2G networks.

Finally, it is also possible that fast internet affect migration (Adema et al., 2022). If 3G network fosters migration of more progressive households into areas with fast internet, this would confound the estimates of interest. To examine this hypothesis, we assess the effect of fast internet on FGM restricting the analytical sample to daughters from parents that did not migrate in the last 10 years, well before the start of 3G network initial deployment in Nigeria. The results of this analysis are reported in Table A6 and show similar effects to those in the main analysis.

7 Fast internet, support for FGM and cultural change

This section examines whether fast internet caused a change in the support for FGM and then explore various hypothesis about the potential mechanisms. We start by assessing how 3G networks affect attitudes and beliefs about FGM, specifically, (1) support for FGM, and (2) the misconception that FGM is a religious requirement. Support for FGM is defined as a continuous variable equal to 1 if the individual does not want the practice to continue, 2 if it depends, and 3 if the respondent wants the practice to continue. The variable *Beliefs FGM is linked to religion* is a binary variable taking the value 1 if the individual believes FGM is a religious requirement and 0 otherwise.

The results of the analysis are presented in Table 4.[16] Our findings reveal that 3G network availability decreases the support for the practice of FGM. Our preferred estimator, reported in column (1), shows that an increase in 10 percentage points in the proportion of people covered by 3G networks decrease by 0.067 points the support for FGM, which is measured in a scale from 1 to 3. Moreover, the estimate reported in column (3) shows that an increase in 10 percentage points

[16]The results of the event study are reported in Figures A7 and A8 in Appendix.

in the proportion of people covered by 3G networks decreases by 0.033 percentage points the proportion of individuals believing that FGM is a religious requirement. 3G network availability not only diminishes support for FGM but also mitigates underlying beliefs that endorse the practice.

Table 4: Effect of 3G network availability on the support for FGM and the belief that FGM is a religious requirement

	(1) Support FGM	(2) Support FGM	(3) Belief FGM linked to religion	(4) Belief FGM linked to religion
Panel A: All indiv.				
Share pop with 3G network available	-0.671***	-0.247***	-0.323***	-0.117***
	(0.183)	(0.049)	(0.067)	(0.023)
N	39,866	83,039	40,952	86,366
Mean dep var.	1.542	1.542	0.172	0.172
Estimation method	Chaisemartin & D'Haultfoeuille	TWFE	Chaisemartin & D'Haultfoeuille	TWFE
Panel B: Women				
Share pop with 3G network available	-0.707***	-0.164***	-0.328***	-0.095***
	(0.185)	(0.046)	(0.074)	(0.024)
N	31,286	61,038	32,040	63,468
Mean dep var.	1.534	1.534	0.159	0.159
Estimation method	Chaisemartin & D'Haultfoeuille	TWFE	Chaisemartin & D'Haultfoeuille	TWFE
Panel C: Men				
Share pop with 3g network available	0.319	0.190	-0.129	0.019
	(0.299)	(0.174)	(0.186)	(0.101)
N	8,408	21,996	8,721	22,893
Mean dep var.	1.564	1.564	0.207	0.207
Estimation method	Chaisemartin & D'Haultfoeuille	TWFE	Chaisemartin & D'Haultfoeuille	TWFE

Note: Columns 1-4 estimate the impact of 3G availability at the time of survey on support for FGM and on the belief that FGM is a religious requirement. Support for FGM is a continuous variable that takes the value of 1 if individual does not want FGM to continue, 2 if depends, and 3 if respondent wants the practice to continue. FGM linked to religion is a dichotomous variable equal to 1 if individual beliefs FGM is a religious requirement and 0 otherwise. Columns 1 and 3 report the results of the method described in Chaisemartin and D'Haultfœuille (2020). Columns 2 and 4 report the results of a two-way fixed effect model. Panel A reports the results for all individuals aged 15-49. Panel B reports the results only for women. Panel C report the results only for men.***p<0.01;**p<0.05,*p<0.1.

The results by gender in Panel B and C of Table 4 suggest that the observed effect of 3G on attitudes towards FGM is primarily driven by women. The results show limited effects for men although they need to be taken with caution due to smaller sample size.[17] The event-studies reported in Figures A7 and A8 using the

[17]Only men in one of three households is interviewed in DHS rounds 2003, 2008 and 2013. The male module in survey round 2018 does not include information on support for FGM.

Chaisemartin and D'Haultfœuille (2020) estimator show that the results are not driven by pre-treatment differential trends. Moreover, Appendix C examines the association between 3G network availability and these outcomes using the individual level of exposure to 3G network availability and find consistent estimates.

But what is driving the effect of fast internet on support for FGM and its prevalence? On the one hand, internet access might provide exposure to explicit anti-FGM content and campaigns. On the other hand, most of the online content consumed by Nigerians is unrelated to FGM. Figure A3 highlights that individuals in Nigeria use the internet to access cultural content such as videos, music, social media, and films. For many, access to the internet represents an unprecedented window to other cultures and women's identities. We hypothesize that, while not directly linked to FGM, this cultural content might reduce the stigma around promiscuity and virginity, which are crucially linked to FGM in these societies, eventually eroding support for this harmful practice. We test these two hypotheses in the following subsections.

7.1 Broader cultural change

We showed in Figure 3 that the main perceived benefit of FGM in Nigeria is the preservation of virginity. Consistently, the anthropological and medical literature shows that in Nigeria and other settings, cut women are perceived as more loyal to their husbands and less sexually promiscuous, traits that are highly valued in traditional communities in Nigeria (Mandara, 2001; Orubuloye et al., 2001; Gruenbaum, 2001; Mpofu et al., 2017). We hypothesize that fast internet exposes these communities to cultural content and identities where pre-marital sex and promiscuity are less stigmatized. This exposure may diminish the social significance of these treats within the communities, ultimately reducing support for FGM. However, while exposure to alternative values and identities might transform one's own values to resemble more closely those of the exposed identities (La Ferrara et al., 2012; Balbo and Barban, 2014; Miho et al., 2023), it may also lead to a resurgence and strengthening of one's own culture (Gruenbaum, 2001; Blumenstock et al., 2022).

To test this hypothesis, we use information reported in the DHS on the age at first sex, age at marriage, number of lifetime sexual partners, the number of extramarital relations, and the use of condom in the last sexual relation.[18] If 3G network availability transform sexual behaviour towards more progressive identities, that would be consistent with this broader cultural change hypothesis.

[18]These were the outcomes identified in the DHS that were reported in more than a survey round that were associated with the values of purity and sexual activity only within marriage.

Table 5: Effect of 3G network availability on sexual behavior outcomes for women

	(1)	(2)	(3)	(4)	(5)
	Age at 1st marriage	Age at 1st intercourse	N lifetime sexual partners	N sexual partners (last 12m excluding husband)	Used condom last relation (0/1)
Panel A: Chaisemartin & D'Haultfoeuille					
Share pop with 3G network available	0.509	-0.868***	1.028***	0.045*	0.010
	(0.324)	(0.295)	(0.112)	(0.027)	(0.017)
N	47,292	51,110	62,254	63,401	47,995
Panel B: TWFE					
Share pop with 3G network available	0.564***	-0.105	0.577**	0.015	-0.015
	(0.156)	(0.138)	(0.262)	(0.012)	(0.009)
N	90,609	97,002	112,213	120,587	91,717
Mean dep var.	17.938	16.822	1.480	0.104	0.064

Note: The table reports the estimates of the impact of 3G availability at the time of the survey on sexual behavior outcomes for women. Panel A reports the estimations of the difference-in-differences method described in Chaisemartin and D'Haultfœuille (2020). Panel B reports the results of a two-way fixed effects model.***p<0.01;**p<0.05,*p<0.1.

Table 5 presents the results of the effect of 3G networks on these behavioral outcomes for women.[19] The results show that while exposure to 3G has no effects on age at marriage for women, it has a strong negative effect on the age at first sex, suggesting an increase in the probability of pre-marital sex, which is heavily stigmatized in Nigeria and to which FGM is linked. Similarly, we also find that exposure to 3G network increases the reported number of lifetime sexual partners and extra-marital partners, which are also stigmatized in the traditional culture of most Nigerian communities and are also closely linked to FGM. On the other hand, we do not observe any effect on the probability of using condom during the last sexual relation. Taken together, these results suggest that fast internet is transforming women's sexual behavior in traditional communities towards a more progressive stance, aligning with the broader cultural change hypothesis.

In many Nigerian communities, sexual behaviors such as extramarital sex, pre-marital sex, or a high number of sexual partners are traditionally considered taboo, particularly for women. Thus, many women might misreport this information, which means that we could be observing an increase in the reporting of these sexual behaviors rather than an actual change in the behaviors themselves. While we cannot disentangle an effect on behavior from an effect on reporting, we believe that the

[19]The results of the event study are reported in Figure A9 in Appendix.

latter could equally be an indication of cultural change linked to FGM, reflecting the de-stigmatization of these sexual behaviors.

Table 6: Effect of 3G network availability on sexual behavior outcomes for men

	(1)	(2)	(3)	(4)	(5)
	Age at 1st marriage	Age at 1st intercourse	N lifetime sexual partners	N sexual partners (last 12m excluding husband)	Used condom last relation (0/1)
Panel A: Chaisemartin & D'Haultfoeuille					
Share pop with 3G network available	1.241	-0.018**	0.053	-0.127	-0.054
	(0.911)	(0.896)	(0.492)	(0.080)	(0.048)
N	13,373	16,869	23,296	24,056	16,293
Panel B: TWFE					
Share pop with 3G network available	0.140	-0.164	-0.273	-0.077***	-0.081***
	(0.273)	(0.304)	(0.301)	(0.026)	(0.020)
N	27,181	34,670	44,397	47,943	32,929
Mean dep var.	25.286	20.323	3.174	0.256	0.177

Note: The table reports the estimates of the impact of 3G availability at the time of the survey on sexual behavior outcomes for men. Panel A reports the estimations of the difference-in-differences method described in Chaisemartin and D'Haultfœuille (2020). Panel B reports the results of a two-way fixed effects model.***p<0.01;**p<0.05,*p<0.1.

Table 6 reports the estimated effects of the 3G network availability of the sexual outcomes for men.[20] While some of the coefficients are sizeable, the estimates of the effects are statistically insignificant at conventional confidence levels and the sign of the coefficients vary in each outcome. While the smaller sample of men surveyed require to interpret with caution these estimates, the results suggest that 3G does not make men less traditional in terms of sexual behavior. A potential explanation for weaker cultural effects is that, as suggested by the descriptive statistics, the traditional values of purity and sexual activity only within marriage in most Nigerian communities were more prominent for women than for men, and therefore the expected shock of exposure to other identities might be smaller for Nigerian men.

We then examine the effect of fast internet on other women identity and cultural outcomes. First, we explore the women's bargaining power within the household over different dimensions. These variables take the value of 1 if the decision is taken by another person, 2 if they participate in the decision, and 3 if the women takes the decision alone. While the statistical significance of the coefficients reported in Table 7 varies by estimation method and specific outcome, they are all sizeable and

[20]The results of the event study are reported in Figure A10 in Appendix.

consistently positive for women, indicating that exposure to 3G increases women bargaining power within their household. On the other hand, the results reported in column 5 show that the effect on bargaining power within the household for men is negative.[21] The results reported in Table A7 in the Appendix suggest however that this increase in bargaining power is not accompanied by higher levels of labor force participation for women.[22]

Table 7: Effect of 3G network availability on bargaining power of women within the household

	(1)	(2)	(3)	(4)	(5)
Respondent	Women	Women	Women	Women	Men
Final say on	Health care	Large HH purchases	Visits family relatives	Manage women money	Large HH purchases
Panel A: Chaisemartin & D'Haultfoeuille					
Share pop with 3G network available	0.161**	0.128*	0.038	0.079	-0.225
	(0.071)	(0.077)	(0.088)	(0.066)	(0.154)
N	43,976	43,954	43,979	43,375	12,988
Panel B: TWFE					
Share pop with 3G network available	0.153***	0.117***	0.089**	-0.023	-0.284***
	(0.038)	(0.034)	(0.039)	(0.037)	(0.063)
N	84,930	84,860	84,912	78,326	26,652
Mean dep var.	1.502	1.446	1.648	1.344	2.507

Note: The table reports the estimates of the impact of 3G availability at the time of the survey on bargaining power within the household for men and women. The variables indicate the final say of the respondent on different household decisions for married individuals. The variable takes the value 3 if individual takes the decision alone, 2 if individuals participate in the decision, and 1 if the decision is taken by another person. Columns (1) to (4) report the results for women and column (5) reports the results for men. Panel A reports the estimations of the difference-in-differences method described in Chaisemartin and D'Haultfœuille (2020). Panel B reports the results of a two-way fixed effects model.***p<0.01;**p<0.05,*p<0.1.

Second, we show in Table A8 in the appendix that the effects of 3G network availability on the probability of smoking, which is heavily stigmatized for women in Nigeria, and also for trust in traditional leaders. The results show that 3G has a positive effect on the probability of smoking for women. Less clear is the effect of 3G on trust in traditional leaders. While the estimates vary across specifications, the results suggest that 3G decrease the trust in traditional leaders for men.

[21] The results of the event study are reported in Figure A11 in Appendix.
[22] The results of the event study are reported in Figures A12 and A13 in Appendix.

All in all, we find evidence supporting the hypothesis that fast internet fostered social change, promoting the adoption of behaviors and beliefs associated with more progressive stances, and diminishing the value of treats linked to FGM such as women's virginity and sexual loyalty to husband.

7.2 Direct exposure to anti-FGM content

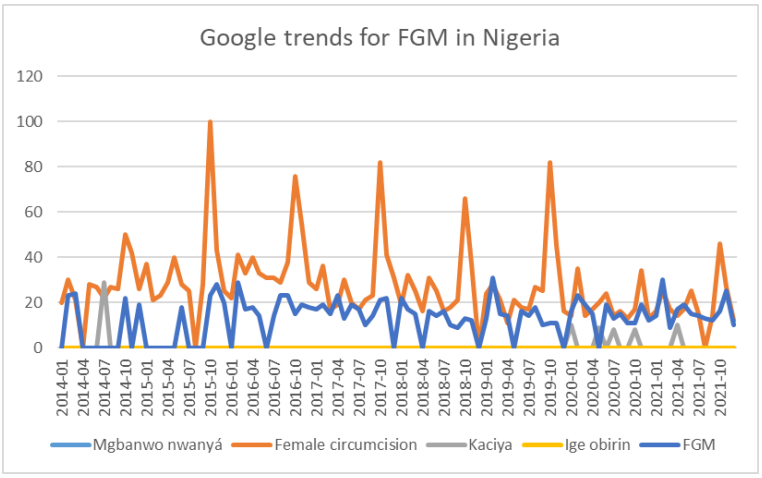
In principle, the effects of fast internet on the support for FGM and on the prevalence of FGM might also be driven by exposure to explicit anti-FGM online content, without necessarily involving a broader cultural change in women's identity. The internet facilitates the dissemination of explicit content related to FGM, granting individuals the opportunity to access such materials. Nigeria stands out globally for its substantial efforts in countering FGM through online platforms and social media channels. Notably, the "Sarah's Cross" series, available on YouTube, successfully reached an audience exceeding 200,000 individuals within Nigeria. The impactful #endcuttinggirls Twitter campaign, spanning various social media platforms, effectively engaged nearly 8 million people across the country. Additionally, an anti-FGM documentary titled "Female Genital Mutilation in Nigeria" garnered 600,000 views (UNFPA-UNICEF, 2018). In the year 2020, Nigeria demonstrated heightened online activism against FGM, emerging as the second country, following Kenya, to generate a significant volume of tweets discussing the issue. Approximately 14% of the total FGM-related tweets originated from Nigerian users (Babbs et al., 2023a). While not all the Internet content on FGM is explicitly critical with the practice, this is the case for the vast majority of the content (Babbs et al., 2023a). The large reach of FGM-related content, however, represents only a small fraction of the Nigerian population, a country with nearly 220 million people. Moreover, most of the internet content accessed in Nigeria (e.g., music, films, newspapers, sports) is unlikely to be explicitly related to FGM. Thus, it is unclear what effect explicit anti-FGM online content and campaigns could have in Nigeria.

To better understand the effect of anti-FGM online content, we assess the short-term effects on support for FGM of the anti-FGM online campaign for the International Day of the Girl Child, celebrated on October 11, 2018.[23] This campaign is launched on the same date every year by UNICEF in collaboration with the Nigerian Ministries of Health and Women Affairs and Social Development. Key hashtags like #endcuttinggirls or #EndFGM trend on Twitter and Instagram, amplified the campaign's reach. Through these collective efforts, the campaign strives to engage

[23]Examples of anti-FGM tweets issued the October 11, 2018 are provided in Figure A14 in Appendix.

a broad audience. Figure A15 in Appendix shows that October 11th is the day of the year with a higher number of anti-FGM tweets and Figure 7 also shows that Google searches about FGM peak every year on October 11th.

Figure 7: Google searches for FGM



Note: The figure depicts Google searches for the main words used to refer to FGM in Nigeria in English, Yoruba, Igbo, and Hausa, the main languages spoken in Nigeria. The searches are normalized to the moment and term of more Google searches as Google does not provide the raw number of searches for each term.

We focus in the 2018 edition of the campaign because it was launched in the middle of the 2018 round of the Nigerian DHS survey fieldwork, which lasted from August to December 2018.[24] To estimate the short term effects of the campaign, we use a regression discontinuity design (RDD) in time, which compares the support for FGM among those women interviewed just before and after October 11th 2018. Because the male module of the 2018 survey round does not include questions on support for FGM, the analysis is conducted only for women. Specifically, we will estimate the following regression:

$$Supports\ FGM_i = \alpha_0 + \alpha_1 Post_i + \alpha_2 F(Days\ to\ October\ 11th_i) + \alpha_3 Age_i + \mu_i \quad (3)$$

where *Supports FGM* is the main outcome and indicates the degree of FGM support (1-3) of individual i, where 1 indicates that the respondent does not want the practice to continue, 2 indicates "it depends", and 3 indicates that the respondent wants the practice to continue. The variable *Post* is a dummy variable equal to 1 if woman i is interviewed on the 11th of October 2018 or later and 0 if is interviewed

[24]The previous survey was launched in 2013, before the start of the anti-FGM online campaigns in Nigeria.

before the mentioned date. The main parameter of interest is α_1, which measures the effect of being interview just after the anti-FGM online campaign on October 11th. $F(Days\ to\ October\ 11th)$ is a function of the number of days between the survey interview and October 11th, *Age* indicates the age of the girl in years and μ is the error term. We estimate equation 3 using both non-parametric methods and parametric methods with first and second order polynomials for the running variable. The non-parametric estimation is calculated using the local polynomial regression-discontinuity estimation method with robust bias-corrected confidence intervals presented in Calonico et al. (2019). The parametric regressions include survey cluster fixed effects. As a robustness checks, we also estimate these regressions excluding from the analysis those women that were interviewed during the week before the start of the campaign. We exclude these observations to examine the robustness of the results to potential anticipation effects during pre-campaign.

Table 8: Anti-FGM online campaign and the support for FGM

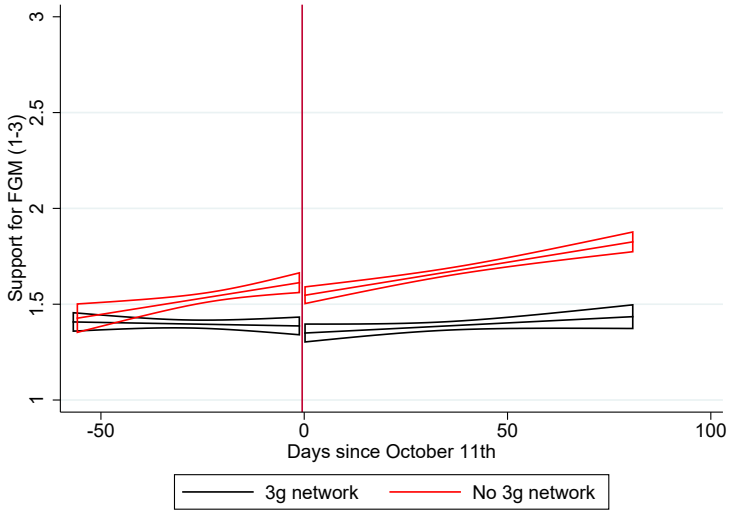
	(1) Support FGM (1-3)	(2) Support FGM (1-3)	(3) Support FGM (1-3)	(4) Support FGM (1-3)	(5) Support FGM (1-3)	(6) Support FGM (1-3)
Post	-0.0639	-0.0338	0.0179	0.166	0.0578	0.129
	(0.0886)	(0.0244)	(0.0670)	(0.172)	(0.0403)	(0.0845)
Estimation method	Non parametric	Parametric Linear fit	Parametric Quadratic fit	Non parametric	Parametric Linear fit	Parametric Quadratic fit
Cluster FE	No	Yes	Yes	No	Yes	Yes
Donut (1 week before)	No	No	No	Yes	Yes	Yes
Observations	6,484	6,482	6,482	6,106	6,102	6,102
Mean	1.392	1.392	1.392	1.384	1.384	1.384

Note: Columns 1-3 report the RDD estimates of the effect of the anti-FGM online campaign for the International Day of the Girl Child hold on October 11th 2018. The effects are estimated for the subsample of individuals living in locations with 3G network available at the time of the campaign using the 2018 DHS data. We compute parametric estimations with polynomials of order 1 and 2 for the running variable and the non-parametric method following the procedure presented in Calonico et al. (2019). The parametric regressions include survey cluster fixed effects. Columns 4-6 reestimate the same regressions excluding respondents interviewed during the week before October 11th, which might be affected by the pre-campaign announcements.***p<0.01;**p<0.05,*p<0.1.

The results of this analysis are presented in Table 8. They show null effects of the campaign on the support for FGM for individuals living in areas with 3G network available. The estimates are consistently small and statistically insignificant at conventional confidence levels across estimations methods and samples. Figure 8 shows graphically the short-terms effect of the October 11th campaign for both individuals with and without 3G network available in their location, showing small statistically insignificant results for both groups. While the RDD approach used only measures the short-term effects of the anti-FGM campaign, it is likely that if

a one-day campaign has no impact in the short term, the long-term effects would also be limited. Taken together, the results on the effects of the anti-FGM online campaign are consistent with the hypothesis that the effects of 3G operate via a broader cultural change that transform the value of the treats linked to FGM (e.g. purity, virginity, conformity to the community) rather than through exposure to explicit anti-FGM content.

Figure 8: The October 11th anti-FGM campaign and the support for FGM



Note: The figure depicts the estimates of the short-term effects of the anti-FGM online campaign hold on the 11th October 2018 for the International Day of the Girl Child on the support for FGM for both individuals with 3G network available and without 3G network available. The estimates are calculated using a linear polynomial function regression discontinuity approach and the 2018 Nigerian DHS round.

7.3 Alternative hypotheses

Fast internet may lead to a reduction in the prevalence of FGM even if 3G availability does not reduce the support for FGM. Using NGHS, Bahia et al. (2024) documents that fast internet increased household wealth in Nigeria.[25] If poverty plays a pivotal role in FGM and parents subject their daughters to FGM to extract a larger bride price (Khalifa, 2022; García-Hombrados and Salgado, 2022), a positive effect of fast internet on income may lead to parents at the margin deciding not to cut their daughters even if their support for FGM does not change.

[25]We report in the Appendix our estimates of the effect of fast internet on household wealth using DHS data. The results are reported in Table A7. Unlike in Bahia et al. (2024), we find no effect of fast internet on the DHS wealth index. Similarly, we find no effects of 3G on labor force participation for men or women.

Table 9: Effect of rainfall shocks on the probability of FGM in Nigeria

Dep var: FGM (0/1)	(1)	(2)
Rainfall shock year of birth	-0.0133	-0.0081
	(0.0097)	(0.0148)
N	29,503	15,751
Mean dep. var	0.16	0.16

Note: Columns 1-2 estimate the impact of rainfall shocks during year of birth on the probability of being cut. Columns 1 uses all the sample of daughters born within the period studied: 2007 and 2018. Columns 2 uses the sample of daughters born within the period studied (2007 and 2018) that were at least 3 years old at the time of the survey. More than 95% of the women cut in Nigeria are cut within the first 2 years of life.***p<0.01;**p<0.05,*p<0.1.

To test this mechanism, we examine the effect of pure income shocks on the prevalence of FGM. To do so, we replicate for Nigeria and our sample the analysis conducted in McGavock and Novak (2023) which examines the effect of adverse rainfall shocks during the age with higher risk of cutting. The results are reported in Table 9 and show no effects of income shocks on the prevalence of FGM in Nigeria. This result is in line with McGavock and Novak (2023), which shows no effect of rainfall shocks on FGM for ethnic groups where the practice is typically conducted early in life, as in the case of Nigeria. A detailed description of this analysis is reported in Appendix B. As a whole, the results of this analysis suggest changes in income or wealth alone are unlikely to drive the effect of 3G on FGM.

8 Conclusion

FGM affects nearly 4 million girls every year. Despite the large amount of resources dedicated in the fight against FGM, the practice remains widespread in many countries. In line with previous anthropological studies, we present descriptive statistics suggesting that this harmful practice is deeply rooted into the women identity of many ethnic groups, where this practice is believed to prevent pre-marital and extra-marital sex, and is linked to maturity and conformity to community. These results open the question on whether interventions aiming to expose these women to other forms of women identity where promiscuous behaviors and pre-marital sex are not heavily stigmatized can be effective in the fight against FGM.

We then examine the effect of one of the most prominent cultural shocks in the last decades in sub-Saharan Africa: the expansion of fast internet, which exposed many traditional communities to previously unknown cultural content and women identities. Specifically, we focus on the expansion of 3G networks in Nigeria, the country with the third highest number of cut women. Our results show that exposure to 3G networks serves as a potent catalyst for identity transformation, leading to a significant reduction in the prevalence of FGM and diminished support for the practice, particularly among women. Furthermore, we observe a concurrent shift in outcomes associated with more progressive sexual behavior, including a lower age at first sex, a higher number of lifetime sexual partners, and a higher number of extramarital partners. We rule out the hypotheses that the effects are driven by migration, wealth, or simply exposure to explicit anti-FGM online content.

In essence, our findings suggest that fast internet contributes to a cultural shift away from FGM and traditional women identities. The study underscores the potential of interventions that target changes in women's identity to transform social norms and highlights the crucial role of technological advancements in culture transmission and the shaping of harmful social norms. Although we illustrate the beneficial effects of this shift on a harmful traditional norm, increased cultural homogeneity could have drawbacks, which opens questions to address in future research.

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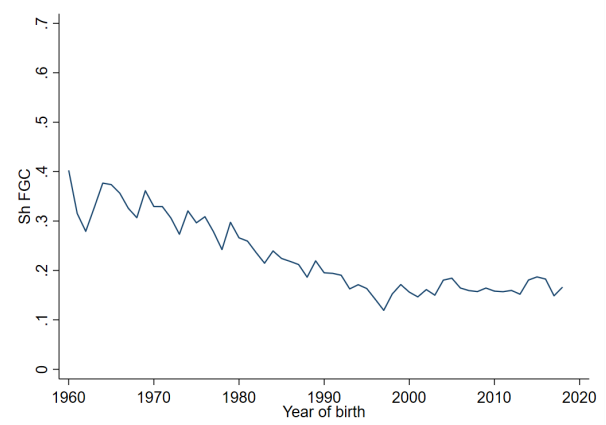
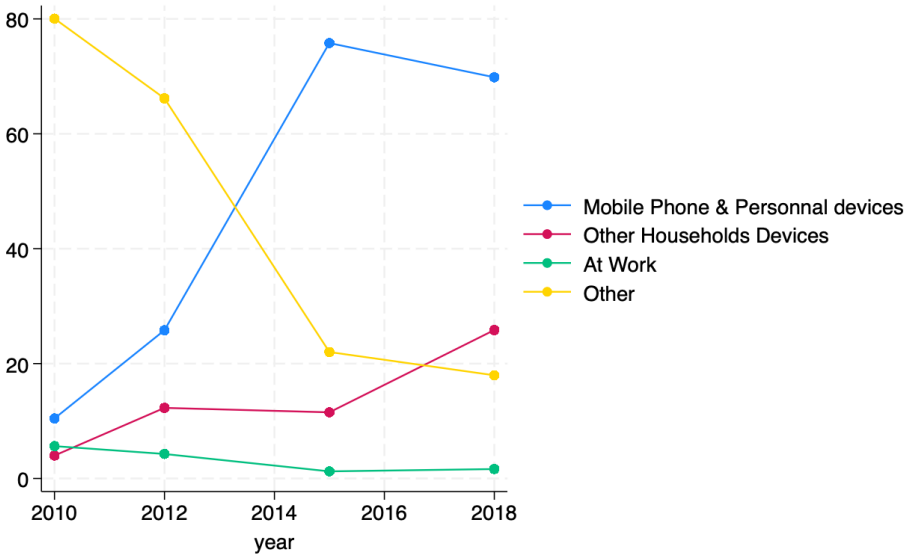
Appendix A Additional tables and figures

Figure A1: Proportion of women subjected to FGM in Nigeria by year of birth



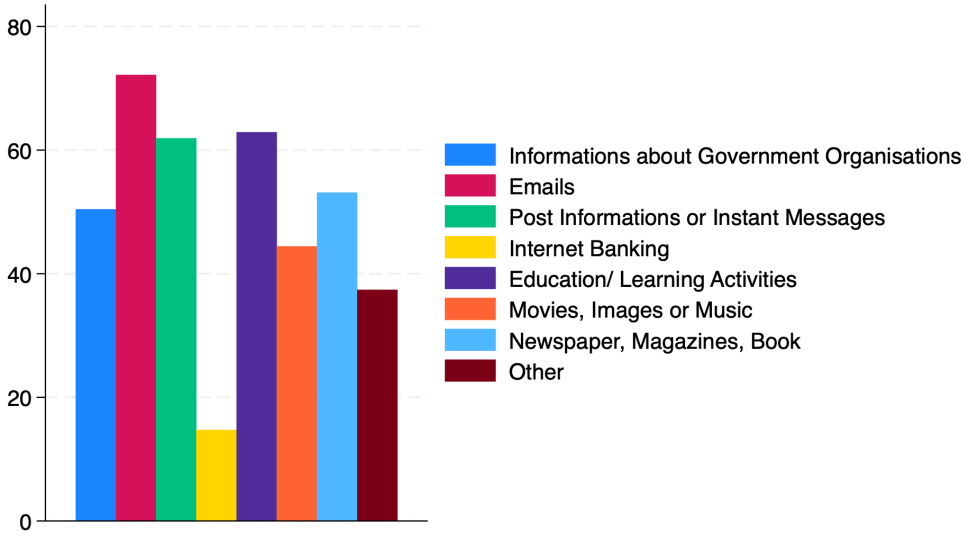
Note: The figure depicts the evolution of the proportion of women subjected to FGM in Nigeria by year of birth. The figure is constructed using data from the Nigerian Demographic and Health survey, rounds 2003, 2008, 2013, and 2018.

Figure A2: Main form of internet access in Nigeria



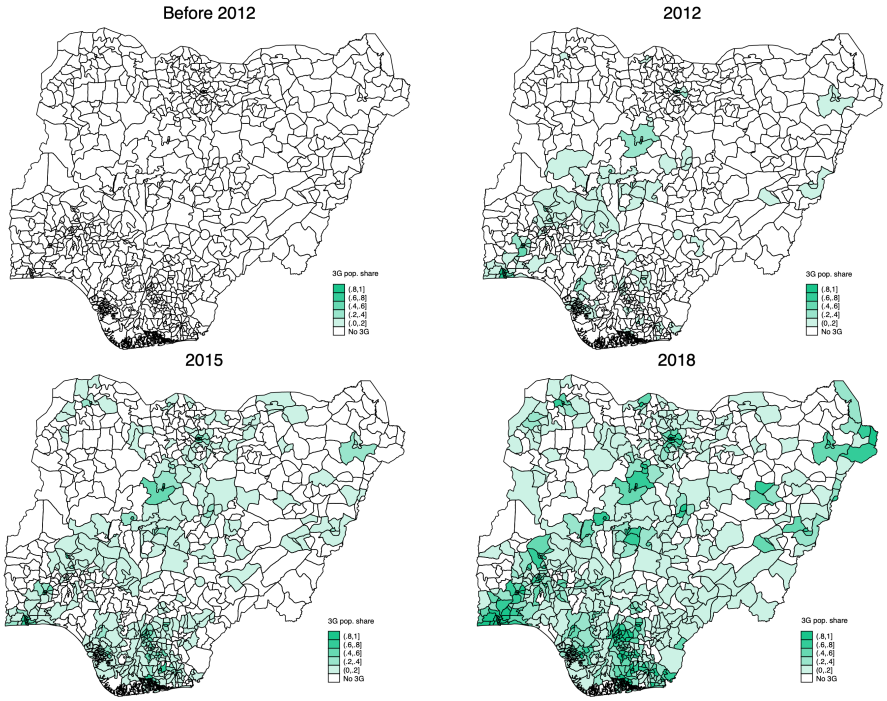
Note: The figure shows the evolution of the main source of internet access in Nigeria. The share for each source are calculated over the sample of individuals that access Internet. Data used are the 2010, 2012, 2014, 2016, and 2018 rounds of the Nigerian General Household Survey.

Figure A3: What is internet used for?



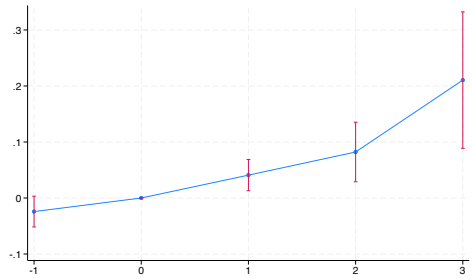
Note: The figure shows the share of individuals that use internet for different purposes among the total number of internet users. The figure is constructed using information from the 2012 Nigerian General Household Survey

Figure A4: Share of individuals with 3G network available by county and year

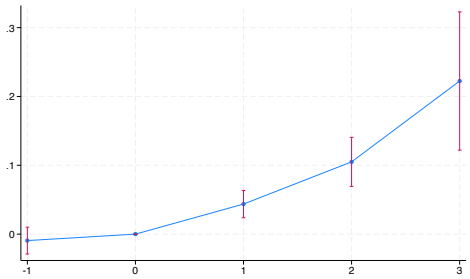


Note: The figure illustrates the expansion of the 3G network in Nigeria using GMSA data between 2012 and 2018 and the NASA population dataset to calculate the share of population with 3G network available every year at the county level.

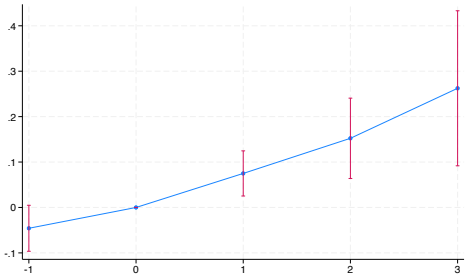
Figure A5: Effect of 3G network availability on internet access



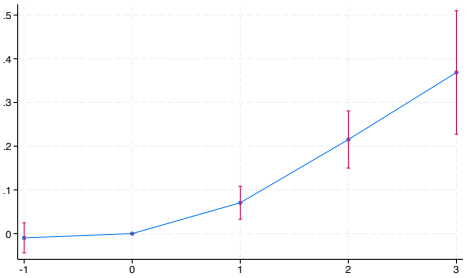
(a) Men



(b) Women



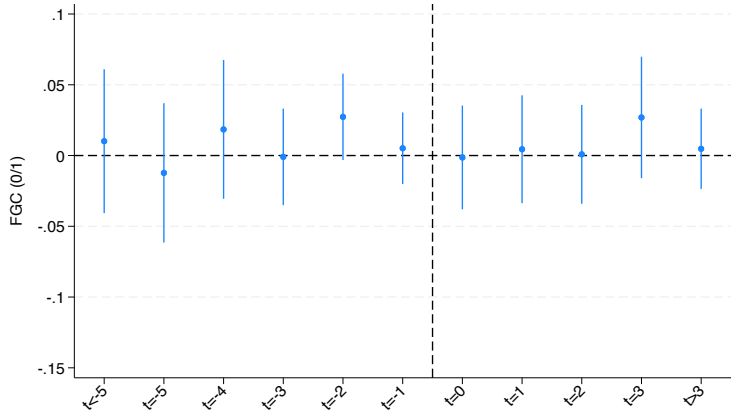
(c) Young Men



(d) Young Women

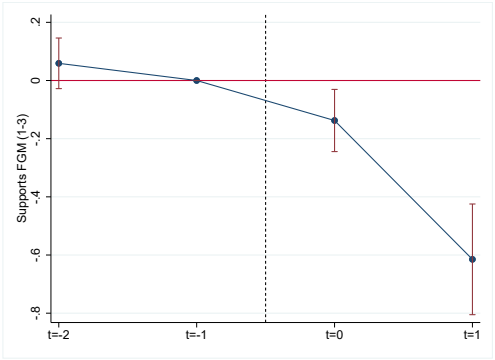
Note: The figure shows an event study of the effect of 3G network availability on internet access using the estimator developed by Chaisemartin and D'Haultfœuille (2020). 3G availability is defined as the share of the population in the county (LGA) that live in a location covered by 3g network. Top graphs refer to the entire sample while bottom graphs restrict the sample to people between 18 and 30 years old. The data used are the rounds 2010, 2012, 2015 and 2018 of the Nigerian General Household Survey.

Figure A6: Effect of 2G network availability on the probability of FGM

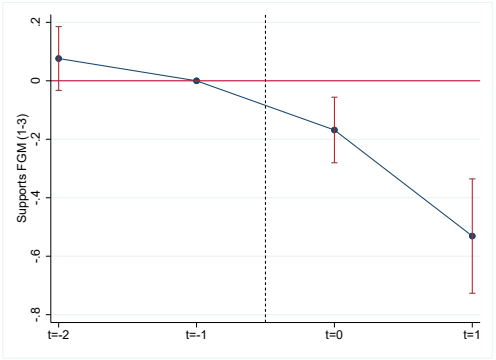


Note: The figure shows the dynamic effects of 2G network availability on the prevalence of FGM using the event study estimator presented in Sun and Abraham (2021).

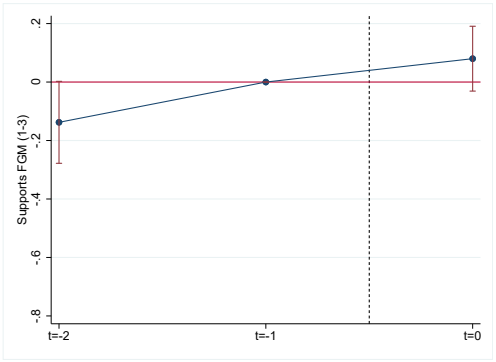
Figure A7: Effect of 3G network availability on the support for FGM



(a) All individuals



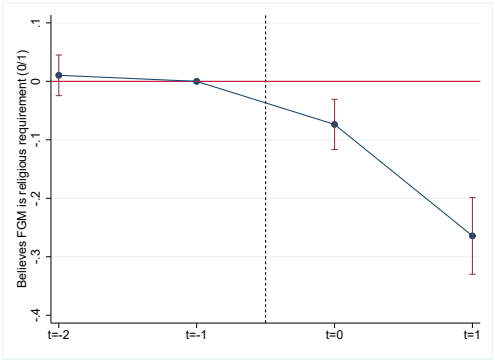
(b) Women



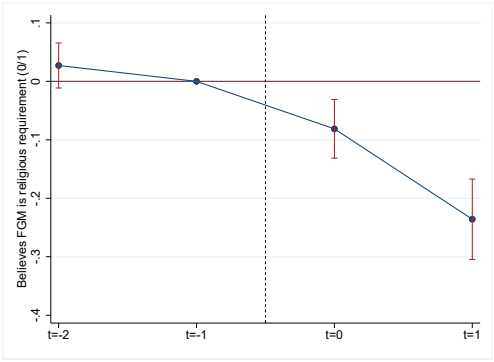
(c) Men

Note: The figure shows the dynamic effects 3G network availability on the support for FGM using the event study estimator developed in Chaisemartin and D'Haultfœuille (2020). 3G availability is defined as the share of the population in a LGA covered by 3G. Data used include rounds 2003, 2008, 2013, and 2018 of the Nigerian Demographic and Health Surveys.

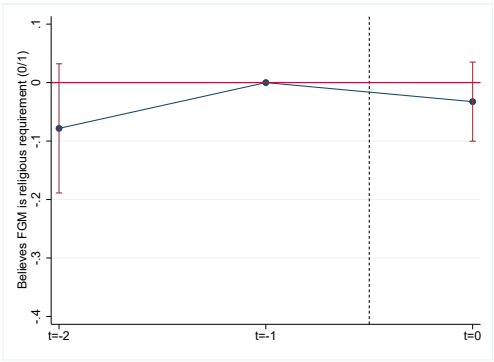
Figure A8: Effect of 3G network availability on the belief that FGM is a religious requirement



(a) All individuals



(b) Women



(c) Men

Note: The figure shows the dynamic effects 3G network availability on the believe that FGM is a religious requirement using the event study estimator developed in Chaisemartin and D'Haultfœuille (2020). 3G availability is defined as the share of the population in a LGA covered by 3G. Data used include rounds 2003, 2008, 2013, and 2018 of the Nigerian Demographic and Health Surveys.

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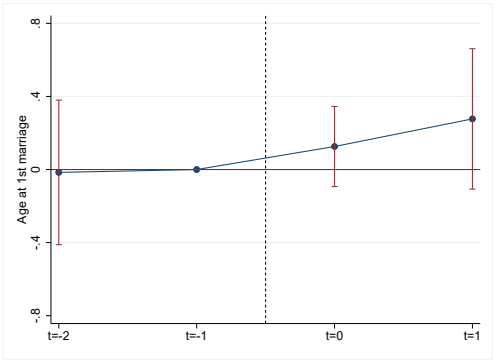
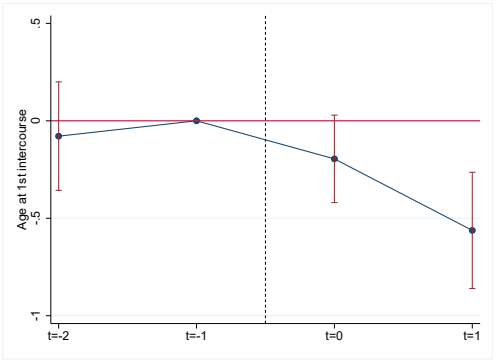
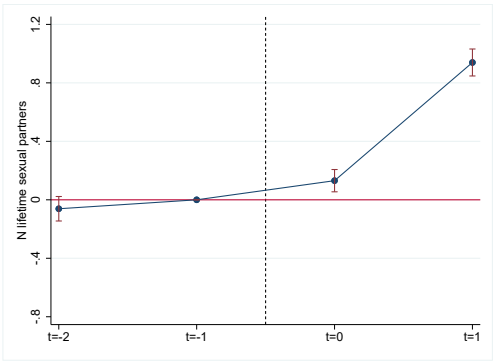
Figure A9: Effect of 3G network availability on sexual behavior outcomes for women



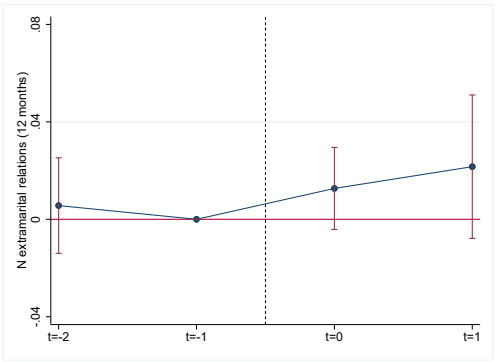
(a) Age at 1st marriage



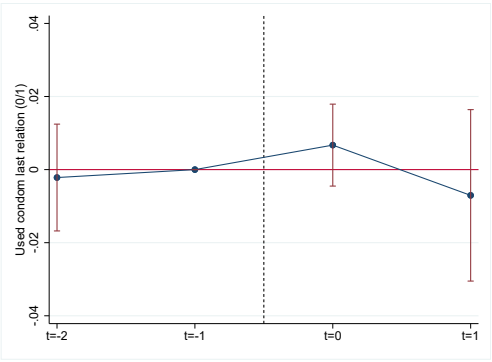
(b) Age at 1st intercourse



(c) N lifetime sexual partners



(d) N extramarital partners last 12 months



(e) Used condom in last relation

Note: The figure shows the dynamic effects of 3G network availability on sexual behavior outcomes for women using the estimator presented in Chaisemartin and D'Haultfœuille (2020). 3G availability is defined as the share of the population in a LGA covered by 3G. Data used include the Nigerian Demographic and Health Surveys, rounds 2003, 2008, 2013, and 2018.

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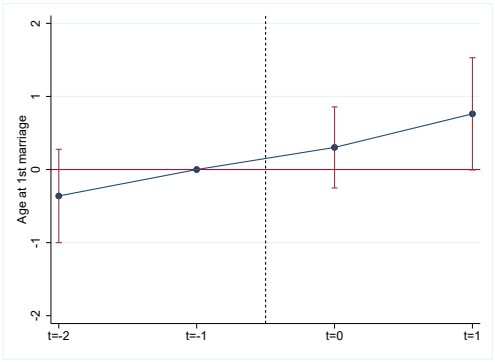
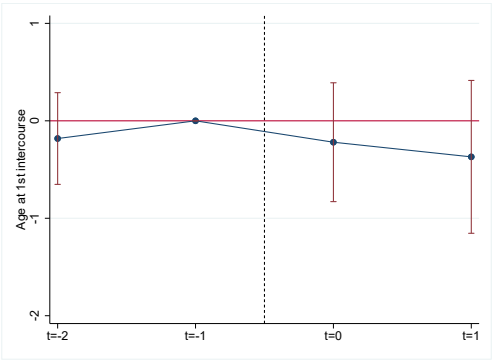
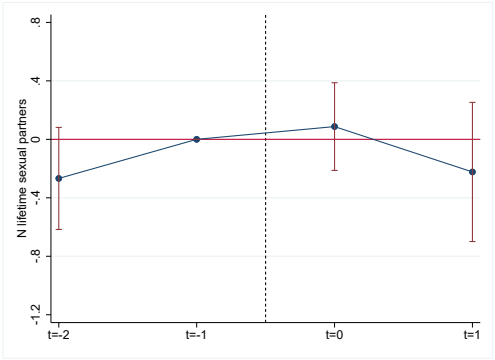
Figure A10: Effect of 3G network availability on sexual behavior outcomes for men



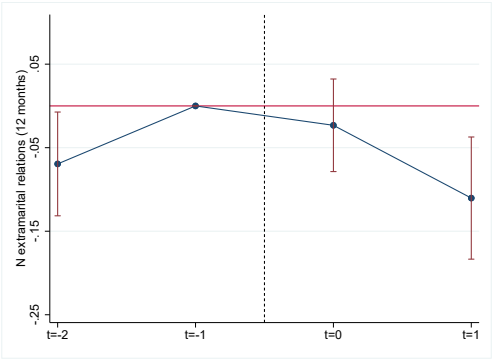
(a) Age at 1st marriage



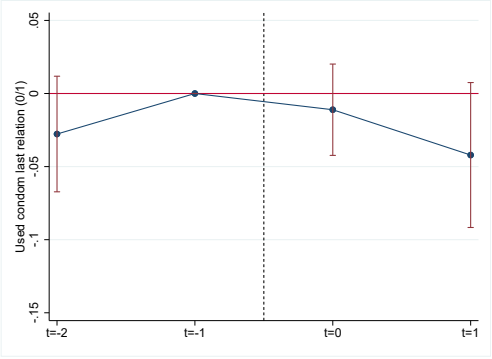
(b) Age at 1st intercourse



(c) N lifetime sexual partners



(d) N extramarital partners last 12 months



(e) Used condom in last relation

Note: The figure shows the dynamic effects of 3G network availability on sexual behavior outcomes for men using the estimator presented in Chaisemartin and D'Haultfœuille (2020). 3G availability is defined as the share of the population in a LGA covered by 3G. Data used include the Nigerian Demographic and Health Surveys, rounds 2003, 2008, 2013, and 2018.

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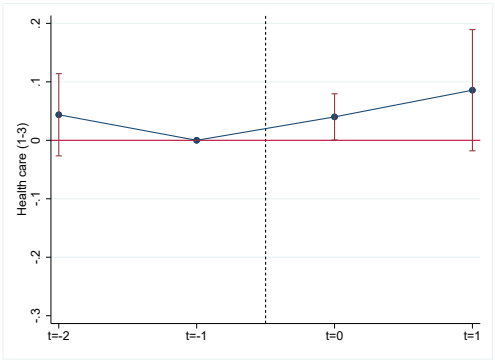
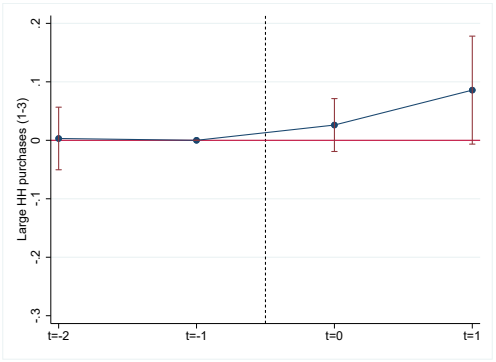
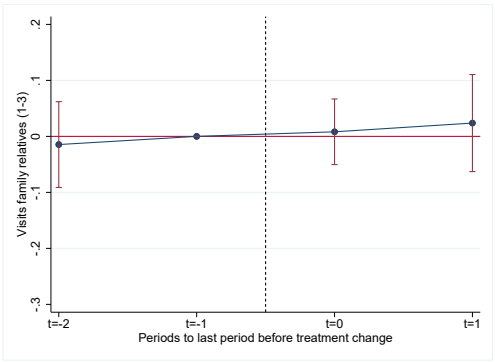
Figure A11: Effect of 3G network availability on final say on...



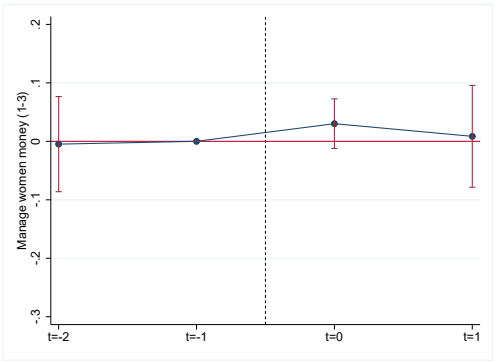
(a) Health care - Women



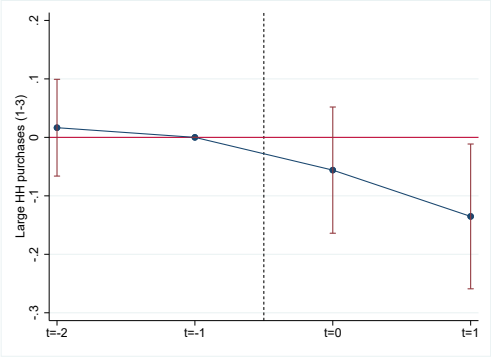
(b) Large HH purchases - Women



(c) Visits family relatives - Women



(d) Manage women money - Women



(e) Large HH purchases - Men

Note: The figure shows the dynamic effects of 3G network availability on bargaining power within the household for women and men using the estimator presented in Chaisemartin and D'Haultfœuille (2020). 3G availability is defined as the share of the population in a LGA covered by 3G. Data used include the Nigerian Demographic and Health Surveys, rounds 2003, 2008, 2013, and 2018.

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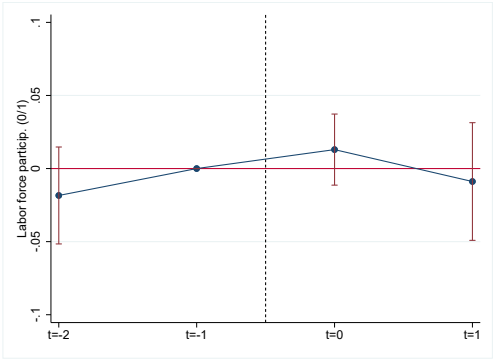
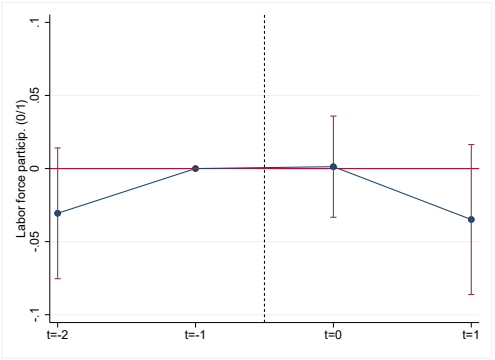
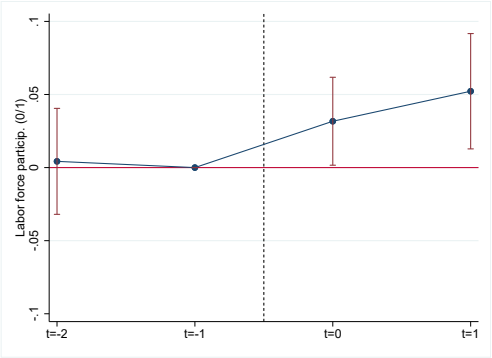
Figure A12: Effect of 3G network availability on labor force participation



(a) All



(b) Women



(c) Men

Note: The figure shows the dynamic effects of 3G network availability on labor fore participation using the estimator presented in Chaisemartin and D'Haultfœuille (2020). 3G availability is defined as the share of the population in a LGA covered by 3G. Data used include the Nigerian Demographic and Health Surveys, rounds 2003, 2008, 2013, and 2018.

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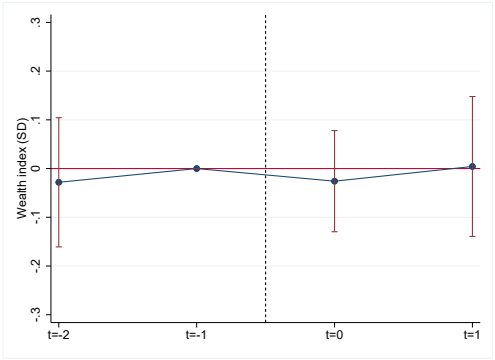
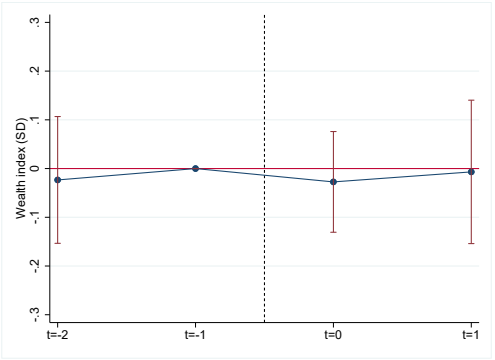
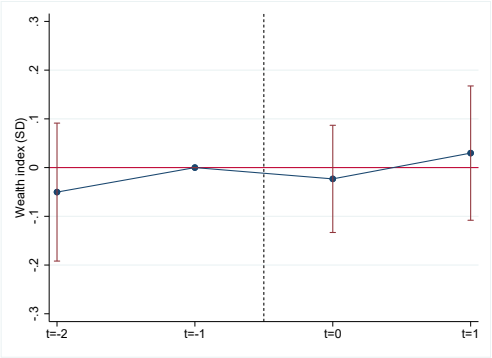
Figure A13: Effect of 3G network availability on household wealth



(a) All



(b) Women



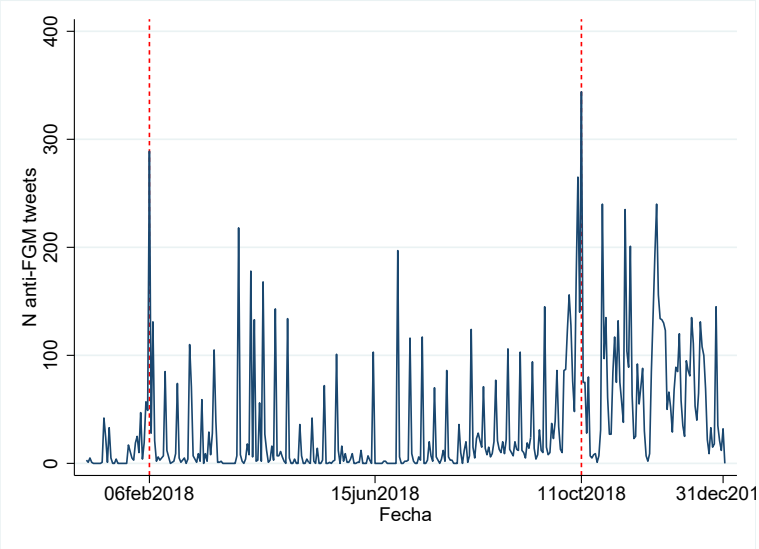
(c) Men

Note: The figure shows the dynamic effects of 3G network availability on household wealth using the estimator presented in Chaisemartin and D'Haultfœuille (2020). 3G availability is defined as the share of the population in a LGA covered by 3G. Data used include the Nigerian Demographic and Health Surveys, rounds 2003, 2008, 2013, and 2018.

Figure A14: Examples of anti-FGM tweets

Note: The figure displays various examples of anti-FGM tweets in Nigeria. The tweets were issued on October 11th, 2018, during the International Day of the Girl Child.

Figure A15: Daily Number of anti-FGM tweets in 2018



Note: The figure depicts the daily number of tweets in Nigeria that used one or more of the following anti-FGM hashtags: #endFGM, #endcuttinggirls, or #nofgm.

Table A1: Effect of 3G network availability on the probability of FGM (excluding girls aged 1 or 2 years old at the time of 3G deployment in the location)

Dep var: FGM (0/1)	(1)	(2)	(3)	(4)
3G network available	-0.050**	-0.082***	-0.071	-0.046***
	(0.023)	(0.030)	(0.061)	(0.012)
N	27,948	17,692	976	27,948
Mean dep var.	0.160	0.162		0.160
Estimation method	Sun & Abraham	Callaway & Sant'Anna	Chaisemartin & D'Haultfoeuille	TWFE

Note: Columns 1-4 report the estimates of the impact of 3G network availability at the time of birth on the probability of being cut, excluding from the sample those girls who were aged 1 or 2 at the time 3G was available in their location. The reason for this is that some cuttings are conducted around the age of 1-2 so these girls might be affected by the 3G availability even if it was not available at their time of birth. Because the introduction of 3G across survey clusters was staggered, we use various difference-in-differences estimation methods. Column 1 reports the results of the method described in Sun and Abraham (2021). Column 2 reports the results of the method described in Callaway and Sant'Anna (2021). Column 3 reports the results of the method described in Chaisemartin and D'Haultfœuille (2020). Column 4 reports the results of a two-way fixed effects.***p¡0.01;**p¡0.05,*p¡0.1.

Table A2: Heterogeneous effects of 3G network availability on the probability of FGM by prevalence of FGM in the location, rural vs urban, and muslim vs non-muslim

Dep var: FGM (0/1)	FGM prevalence >50% (1)	FGM prevalence <50% (2)	Urban (3)	Rural (4)	Muslim (5)	Non-muslim (6)
3G network available	-0.064	-0.038**	0.001	-0.090**	-0.048	-0.027
	(0.057)	(0.017)	(0.028)	(0.036)	(0.033)	(0.023)
N	4,964	24,539	9,887	19,616	17,428	11,832
Mean dep var.	0.408	0.109	0.148	0.165	0.211	0.084
Estimation method	Sun & Abraham	Sun & Abraham	Sun & Abraham	Sun & Abraham	Sun & Abraham	Sun & Abraham

Note: Columns 1-4 report the estimates of the impact of 3G network availability at the time of birth on being cut. Columns 1 reports the effect for women living in survey clusters where the prevalence of FGM among women aged 15-49 is at least 50%. Columns 2 reports the effect for women living in survey clusters where the prevalence of FGM among women aged 15-49 is less than 50%. Columns 3 and 4 report the effect for women living in urban and rural areas. Columns 5 and 6 report the effect for muslim and non-muslim women.***p<0.01;**p<0.05,*p<0.1.

Table A3: Effect of 3G network availability on the probability of FGM (controlling for anti-FGM laws)

Dep var: FGM (0/1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3G network available	-0.047**	-0.050**	-0.076***	-0.056	-0.034*	-0.068*	-0.044***	-0.040***
	0.019	0.025	0.025	0.054	0.018	0.036	0.010	0.015
N	29,503	15,751	29,542	15,463	11,204	2549	29,503	15,751
Mean dep var.	0.159	0.163	0.159	0.164	0.000	0.000	0.159	0.163
Estimation method	Sun & Abraham	Sun & Abraham	Callaway & Sant'Anna	Callaway & Sant'Anna	Chaisemartin & D'Haultfoeuille	Chaisemartin & D'Haultfoeuille	TWFE	TWFE
Analytical sample	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2
Control for FGM bans	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Columns 1-8 report the estimates of the impact of 3G availability at the time of birth on the probability of being cut. Because the introduction of 3G across survey clusters was staggered, we use various difference-in-differences estimation methods. Columns 1 and 2 report the results of the method described in Sun and Abraham (2021). Columns 3 and 4 report the results of the method described in Callaway and Sant'Anna (2021). Columns 5 and 6 report the results of the method described in Chaisemartin and D'Haultfœuille (2020). Columns 7 and 8 report the results of a two-way fixed effects. Each estimation method is run using two different samples. Columns 1, 3, 5 and 7 use the whole sample of women born within the period studied: 2007 and 2018. Columns 2, 4, 6 and 8 use the sample of women born within the period studied (2007 and 2018) that were at least 3 years old at the time of the survey. More than 95% of the women cut are cut within the first 2 years of life. All regressions include as a control variable a dummy indicator for whether a ban on FGM was in place in the region of residence of girl i at her time of birth.***p<0.01;**p<0.05,*p<0.1.

Table A4: Effect of 3G network availability on the probability of FGM (excluding regions with FGM bans)

Dep var: FGM (0/1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3G network available	-0.031	-0.016	-0.076***	-0.018	-0.028	-0.063	-0.042***	-0.030*
	0.022	0.028	0.029	0.060	0.021	0.045	0.011	0.018
N	19,598	10,430	19,625	10,235	7,140	7,140	19,598	10,430
Mean dep var.	0.142	0.148	0.142	0.150	0.000	0.000	0.142	0.148
Estimation method	Sun & Abraham	Sun & Abraham	Callaway & Sant'Anna	Callaway & Sant'Anna	Chaisemartin & D'Haultfoeuille	Chaisemartin & D'Haultfoeuille	TWFE	TWFE
Analytical sample	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2
Anti-FGM law regions	No	No	No	No	No	No	No	No

Note: Columns 1-8 report the estimates of the impact of 3G availability at the time of birth on the probability of being cut. Because the introduction of 3G across survey clusters was staggered, we use various difference-in-differences estimation methods. Columns 1 and 2 report the results of the method described in Sun and Abraham (2021). Columns 3 and 4 report the results of the method described in Callaway and Sant'Anna (2021). Columns 5 and 6 report the results of the method described in Chaisemartin and D'Haultfœuille (2020). Columns 7 and 8 report the results of a two-way fixed effects. Each estimation method is run using two different samples. Columns 1, 3, 5 and 7 use the whole sample of women born within the period studied: 2007 and 2018. Columns 2, 4, 6 and 8 use the sample of women born within the period studied (2007 and 2018) that were at least 3 years old at the time of the survey. More than 95% of the women cut are cut within the first 2 years of life. Individuals living in regions where FGM bans were introduced were removed from the analytical sample.***p<0.01;**p<0.05,*p<0.1.

Table A5: Effect of 2G network availability on the probability of FGM

Dep var: FGM (0/1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2G network available	0.001	-0.004	0.041*	0.009	-0.011	0.026	0.002	0.003
	(0.002)	(0.004)	(0.024)	(0.030)	(0.028)	(0.042)	(0.008)	(0.012)
N	40,042	21,392	34,043	17,897	17,670	6296	21,965	11,542
Mean dep var.	0.165	0.165	0.163	0.163	0.000	0.000	0.163	0.163
Estimation method	Sun & Abraham	Sun & Abraham	Callaway & Sant'Anna	Callaway & Sant'Anna	Chaisemartin & D'Haultfoeuille	Chaisemartin & D'Haultfoeuille	TWFE	TWFE
Analytical sample	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2

Note: Columns 1-8 report the estimates of the impact of 2G network availability at the time of birth on the probability of being cut. Because the introduction of 2G across survey clusters was staggered, we use various difference-in-differences estimation methods. Columns 1 and 2 report the results of the method described in Sun and Abraham (2021). Columns 3 and 4 report the results of the method described in Callaway and Sant'Anna (2021). Columns 5 and 6 report the results of the method described in Chaisemartin and D'Haultfœuille (2020). Columns 7 and 8 report the results of a two-way fixed effects. Each estimation method is run using two different samples. Columns 1, 3, 5 and 7 use the whole sample of women born within the period studied: 2007 and 2018. Columns 2, 4, 6 and 8 use the sample of women born within the period studied (2007 and 2018) that were at least 3 years old at the time of the survey. More than 95% of the women cut are cut within the first 2 years of life. To avoid potential confounding, observations are removed when 3G technology substitutes 2G technology in a location.***p<0.01;**p<0.05,*p<0.1.

Table A6: Effect of 3G network availability on the probability of FGM (non-migrated sample)

Dep var: FGM (0/1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3G network available	-0.047**	-0.050**	-0.085	0.099	-0.034*	-0.068*	-0.044***	-0.040***
	0.019	0.025	0.066	0.077	0.018	0.036	0.010	0.015
N	29,503	15,751	9,074	4,779	11,204	11,204	29,503	15,751
Mean dep var.	0.159	0.163	0.149	0.162	0.000	0.000	0.159	0.163
Estimation method	Sun & Abraham	Sun & Abraham	Callaway & Sant'Anna	Callaway & Sant'Anna	Chaisemartin & D'Haultfoeuille	Chaisemartin & D'Haultfoeuille	TWFE	TWFE
Analytical sample	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2

Note: Columns 1-8 report the estimates of the impact of 3G network availability at the time of birth on the probability of being cut. Because the introduction of 3G across survey clusters was staggered, we use various difference-in-differences estimation methods. Columns 1 and 2 report the results of the method described in Sun and Abraham (2021). Columns 3 and 4 report the results of the method described in Callaway and Sant'Anna (2021). Columns 5 and 6 report the results of the method described in Chaisemartin and D'Haultfœuille (2020). Columns 7 and 8 report the results of a two-way fixed effects. Each estimation method is run using two different samples. Columns 1, 3, 5 and 7 use the whole sample of women born within the period studied: 2007 and 2018. Columns 2, 4, 6 and 8 use the sample of women born within the period studied (2007 and 2018) that were at least 3 years old at the time of the survey. More than 95% of the women cut are cut within the first 2 years of life. The analytical sample is limited to those girls whose parents did not migrate in the previous 10 years.***p<0.01;**p<0.05,*p<0.1.

Table A7: Effect of 3G network availability on wealth and labor force participation

	(1) HH wealth index	(2) HH wealth index	(3) Labor force participation	(4) Labor force participation
Panel A: All indiv.				
Share pop with 3G network available	-0.056	0.000	0.023	0.006
	(0.151)	(0.049)	(0.041)	(0.016)
N	87,590	169,172	87,358	168,568
Mean dep var.	0.000	0.000	0.672	0.672
Estimation method	Chaisemartin & D'Haultfoeuille	TWFE	Chaisemartin & D'Haultfoeuille	TWFE
Panel B: Women				
Share pop with 3G network available	-0.066	-0.002	-0.024	-0.010
	(0.151)	(0.049)	(0.055)	(0.020)
N	63,470	120,998	63,304	120,516
Mean dep var.	-0.018	-0.018	0.616	0.616
Estimation method	Chaisemartin & D'Haultfoeuille	TWFE	Chaisemartin & D'Haultfoeuille	TWFE
Panel C: Men				
Share pop with 3G network available	-0.035	0.001	0.109**	0.038*
	(0.158)	(0.051)	(0.043)	(0.021)
N	24,120	48,173	24,054	48,051
Mean dep var.	0.044	0.044	0.811	0.811
Estimation method	Chaisemartin & D'Haultfoeuille	TWFE	Chaisemartin & D'Haultfoeuille	TWFE

Note: Columns 1-4 report the estimates of the impact of 3G network availability on household wealth index and on labor force participation. The wealth index varies between -284155 and 315067 but for estimation purposes the variable has been normalized.***p<0.01;**p<0.05,*p<0.1.

Table A8: Effect of 3G network availability on trust in local leaders and on smoking

Respondent	(1) Women	(2) Men	(3) Women	(4) Men
	Trust in local leaders (0-3)	Trust in local leaders (0-3)	Smoke (0/1)	Smoke (0/1)
Panel A: Chaisemartin & D'Haultfoeuille				
Share pop with 3G network available	-0.403	-0.077	0.010*	-0.033
	(0.324)	(0.333)	(0.050)	(0.052)
N	759	2,699	63,391	13,812
Panel B: TWFE				
Share pop with 3G network available	-0.128	-0.360***	0.007***	0.017
	(0.135)	(0.131)	(0.002)	(0.024)
N	4,279	4,214	120,845	34,934
Mean dep var.	1.377	1.334	0.006	0.102

Note: The table reports the estimates of the impact of 3G network availability at the time of the survey on trust in local leaders and on the probability of smoking for both men and women. Panel A reports the estimations of the difference-in-differences method described in Chaisemartin and D'Haultfœuille (2020). Panel B reports the results of a two-way fixed effects model. Information on smoking is obtained from the Nigerian DHS rounds 2003, 2008, 2013, and 2018 for women, and DHS rounds 2003, 2008, and 2013 for men. The male module of the Nigerian DHS round 2018 does not include information on smoking. Information on trust in local leaders is obtained from the Nigerian Afrobarometer rounds 2003, 2008, 2014, and 2017.***p<0.01;**p<0.05,*p<0.1.

Appendix B The effect of rainfall shocks on FGM in Nigeria

One potential mechanism driving the effect of 3G network availability on FGM is an increase in income. If 3G networks increase household income (Bahia et al., 2024) and FGM increases a daughter's value in marriage (i.e., leading to a higher bride price) (Khalifa, 2022; García-Hombrados and Salgado, 2022), parents at the margin of cutting their daughters might decide to stop the practice because the additional income from 3G compensates for the loss of income associated with not having their daughter subjected to FGM. The latter mechanism implies that 3G might decrease the prevalence of FGM even if it does not reduce the support for this practice.

To test this hypothesis, we examine in this appendix the effect of a pure income shock on FGM, specifically rainfall shocks. If a pure income shock does not affect the prevalence of FGM, it is unlikely that the effect of 3G on FGM is solely driven by a rise in income. To this end, we replicate the analysis conducted by McGavock and Novak (2023), focusing on Nigeria. The latter paper assesses the effect of rainfall shocks during the age of risk of FGM on the prevalence of this practice in sub-Saharan Africa. Following McGavock and Novak (2023), we estimate the following equation:

$$FGM_{ibv} = \delta_0 + \delta_1 Rainfall\ shock_{bv} + \theta_b + \gamma_v + \delta_2 Age_{ibv} + u_{ibv} \tag{4}$$

where *Rainfall shock* is equal to 1 if the annual precipitation in cluster v during the year of birth b was below the 15th percentile of the gamma distribution of the historical rainfall in the cluster.[26] Because the typical age at cutting varies across sub-Saharan African countries, McGavock and Novak (2023) focuses on rainfall shocks during the year the girl reached the first percentile of the distribution of age at FGM. Given that in Nigeria, more than 80% of the cuts occur within the first year of life, we focus on rainfall shocks during the year of birth. θ_b and γ_v are survey cluster and year of birth fixed effects. *Age* indicates the age of the girl at the time of the survey, and u is the error term.

The results of this analysis are reported in Table B1 for both the whole sample and the restricted sample of women who were at least 3 years old at the time of the survey. Our findings show that the estimated coefficient of rainfall shocks across the two samples is close to zero and statistically not different from zero. These

[26]The rainfall information was provided by Lindsey Novak and Tamara McGavock, who constructed a database on annual precipitation in DHS clusters between 1900 and 2017 using monthly precipitation information gathered by the University of Delaware at the 0.5 x 0.5 degree grid.

results support the hypothesis that economic shocks alone are unlikely to drive major changes in the prevalence of FGM, and that the effect of 3G networks on the prevalence of the practice is unlikely to be caused solely by their potential effects on income. Our results align with those of McGavock and Novak (2023). While they show that, in some settings, negative economic shocks increase the prevalence of FGM, they do not find any effect for ethnic groups where cutting occurs early in life, as in the case of Nigeria.

As a robustness check, we re-estimate the main regression of the paper, equation 1, using rainfall shock as an additional control variable to assess whether meteorological shocks could be confounding the effect of 3G. Table B2 presents the results of this analysis, which are very similar to those observed in Table 3.

Table B1: Effect of rainfall shocks on the probability of FGM in Nigeria

Dep var: FGM (0/1)	(1)	(2)
Rainfall shock year of birth	-0.0133	-0.0081
	(0.0097)	(0.0148)
N	29,503	15,751
Mean dep. var	0.16	0.16

Note: Columns 1-2 estimate the impact of rainfall shocks during year of birth on the probability of being cut. Columns 1 uses all the sample of daughters born within the period studied: 2007 and 2018. Columns 2 uses the sample of daughters born within the period studied (2007 and 2018) that were at least 3 years old at the time of the survey. More than 95% of the women cut in Nigeria are cut within the first 2 years of life.***p<0.01;**p<0.05,*p<0.1.

Table B2: Effect of 3G network availability on the probability of FGM controlling for rainfall shocks

Dep var: FGM (0/1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3g available	-0.035**	-0.049*	-0.055**	-0.013	-0.024	-0.064*	-0.044***	-0.040***
	(0.016)	(0.027)	(0.026)	(0.055)	(0.017)	(0.034)	(0.010)	(0.015)
N	29,503	15,751	29,542	15,463	10,962	2,568	29,503	15,751
Mean dep var.	0.159	0.163	0.159	0.164	0.163	0.163	0.159	0.163
Estimation method	Sun & Abraham	Sun & Abraham	Callaway & Sant'Anna	Callaway & Sant'Anna	Chaisem. & D'Haultf.	Chaisem. & D'Haultf.	TWFE	TWFE
Analytical sample	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2	All girls	Girls>2

Note: Columns 1-8 report the estimates of the impact of 3G network availability at the time of birth on the probability of being cut. In these regression models, rainfall shocks are added as a control variable. Because the introduction of 3G across survey clusters was staggered, we use various difference-in-differences estimation methods. Columns 1 and 2 report the results of the method described in Sun and Abraham (2021). Columns 3 and 4 report the results of the method described in Callaway and Sant'Anna (2021). Columns 5 and 6 report the results of the method described in Chaisemartin and D'Haultfœuille (2020). Columns 7 and 8 report the results of a two-way fixed effects. Each estimation method is run using two different samples. Columns 1, 3, 5 and 7 use the whole sample of women born within the period studied: 2007 and 2018. Columns 2, 4, 6 and 8 use the sample of women born within the period studied (2007 and 2018) that were at least 3 years old at the time of the survey. More than 95% of the women cut are cut within the first 2 years of life.***p<0.01;**p<0.05,*p<0.1.

Appendix C 3G network availability, cultural change, and other outcomes: Individual level analysis

In this Appendix, we explore the association between 3G network availability, cultural change, and economic outcomes using an alternative empirical approach. Rather than using the share of individuals in the LGA with 3G network available, in this section we define an alternative measure of exposure based on whether the individual lives in a village with 3G network available at the time of the survey. Specifically, we will estimate the following regression:

$$\begin{aligned} Outcome_{ilt} =& \delta_0 + \delta_1 3G\ network\ available_{it} + \delta_2 Never\ received\ 3G\ network_i \\ &+ Year\ of\ interview_t + \nu_l + u_{ilt} \end{aligned} \tag{5}$$

where $Outcome_{it}$ indicates the outcome of interest for individual i, living in LGA l and interviewed in year t. $3G\ network\ available_{it}$ is a dummy variable that indicates whether individual i interviewed in year t has 3G network available. $Never\ received\ 3G\ network_i$ is a dummy variables equal to 1 if individual i lives in a location that never received 3G during the study period. $Year\ of\ interview_{it}$ and ν_l are year-of-interview (survey) and county (LGA) fixed effects. u is the error term. Standard errors are clustered by county. The main parameter of interest is δ_1, which measures the association between the availability of 3G network and the outcome of interest. Unlike in the main analysis, exposure to 3G networks is defined at the individual level based on the geocoded location of the villages/neighborhoods. However, individuals and villages in the sample are only interviewed once during the study period. Thus, the empirical framework used is not a difference-in-differences and the causal interpretation of the analysis does not rely on the parallel trends assumption. Rather, the interpretation of d_1 as the causal effect of 3G network availability on the outcome of interest mainly relies on no unobservable variables correlated with both timing of 3G network expansion and the outcome of interest. To limit endogeneity concerns, we introduced a variable indicating whether individual i lives in a location unexposed during the study period, which implies that the variation used for the identification of the parameter of interest d_1 comes from individuals living in locations that at some point during the study period received 3G network, but that were interviewed either before or after the arrival of the network.

The results of these estimations broadly support the main conclusions of the

study. The results of the analysis for FGM support and the belief that FGM is a religious requirement are reported in Table C1, showing negative associations between availability of 3G networks and both the support for FGM and the belief that FGM is a religious requirement, which are mainly driven by women.

Also in line with the evidence provided above, the results reported in Table C2 show that 3G network availability is overall associated with a higher level of bargaining power for women, and less for men. Consistently, the results reported in Table C3 show that the availability of 3G networks is associated with a higher number of lifetime sexual partners for women, and a lower age at first intercourse for men.

Finally, Table C4 shows the results for wealth and labor force participation, showing no statistical association between the availability of 3G networks and both wealth and labor force participation.

Table C1: 3G network availability and beliefs about FGM: Individual exposure to 3G network

	All		Women		Men	
	Support FGM	Beliefs FGM linked to religion	Support FGM	Belief FGM linked to religion	Support FGM	Belief FGM linked to religion
	(1)	(2)	(3)	(4)	(5)	(6)
3G network available	-0.095***	-0.042***	-0.057**	-0.031**	0.020	-0.028
	(0.029)	(0.013)	(0.027)	(0.014)	(0.090)	(0.048)
N	83,039	86,366	61,038	63,468	21,996	22,893
Mean dep var.	1.542	0.172	1.534	0.159	1.564	0.207

Note: Columns 1-6 estimate the association using OLS between 3G network availability at the time of the survey measured at the individual level and the support for FGM and the belief that FGM is a religious requirement. The regressions estimated include LGA fixed effects, year of interview fixed effects, and a dummy variable indicating whether the village of residence did not receive 3G during the study period. Thus, the variation used in the estimations arises from locations that at some point receive 3G network during the study period but were interviewed either before or after the arrival of 3G network. Columns 1 and 2 report the results using the full sample, Columns 3 and 4 report the results using the sample of women, and Columns 5 and 6 report the results using the male sample. Standard errors clustered at the LGA level. ***p<0.01;**p<0.05,*p<0.1.

Table C2: 3G network availability and bargaining power within the household: Individual exposure to 3G network

	(1)	(2)	(3)	(4)	(5)
Respondent	Women	Women	Women	Women	Men
Final say on	Health care	Large HH purchases	Visits family relatives	Manage women money	Large HH purchases
3G network available	0.060***	0.060***	0.037	0.011	-0.113***
	(0.021)	(0.019)	(0.023)	(0.020)	(0.038)
N	86,808	86,581	86,718	78,326	33,965
Mean dep var.	1.500	1.442	1.643	1.344	2.569

Note: Columns 1-6 estimate the association using OLS between 3G network availability at the time of the survey measured at the individual level and different measures of bargaining power within the household for men and women. The variables indicate the final say of the respondent on different household decisions for married individuals. The variable takes the value 3 if individual takes the decision alone, 2 if individuals participate in the decision and 1 if the decision is taken by another person. The regressions estimated include LGA fixed effects, year of interview fixed effects, and a dummy variable indicating whether the village of residence did not receive internet during the study period. Thus, the variation used in the estimations arises from locations that at some point receive 3G network during the study period but were interviewed either before or after the arrival of 3G network. Standard errors clustered at the LGA level.***p<0.01;**p<0.05,*p<0.1.

Table C3: 3G network availability and other sexual behavioral outcomes: Individual exposure to 3G network

	(1)	(2)	(3)	(4)	(5)
	Age at 1st marriage	Age at 1st intercourse	N lifetime sexual partners	N sexual partners (last 12m excluding husband)	Used condom last relation (0/1)
Panel A: Women					
3G network available	0.262**	-0.000	0.331*	-0.000	-0.011**
	(0.103)	(0.082)	(0.177)	(0.008)	(0.005)
N	90,609	97,002	95,233	120,587	91,717
Mean dep var.	17.938	16.822	1.744	0.104	0.064
Panel B: Men					
3G network available	-0.101	-0.285*	-0.148	-0.028	-0.048***
	(0.192)	(0.166)	(0.226)	(0.019)	(0.014)
N	27,181	34,670	32,759	47,943	32,929
Mean dep var.	25.286	20.323	4.302	0.256	0.177

Note: Columns 1-5 estimate the association using OLS between 3G network availability at time of survey measured at the individual level and sexual behavioral outcomes for mean and women. The regressions estimated include LGA fixed effect, year of interview fixed effects, and a dummy variable indicating whether the village of residence did not receive internet during the study period. Thus, the variation used in the estimations arises from locations that at some point receive 3G network during the study period but were interviewed either before or after the arrival of 3G network. Panel A reports the results using the sample of women, and Panel B reports the results using the male sample. Standard errors clustered at the LGA level.***p<0.01;**p<0.05,*p<0.1.

Table C4: 3G network availability, household wealth and labor force participation: Individual exposure to 3G network

	All		Women		Men	
	HH Wealth (1)	Labor force participation (2)	HH Wealth (3)	Labor force participation (4)	HH Wealth (5)	Labor force participation (6)
3G network available	0.005	0.007	0.009	0.001	-0.009	0.016
	(0.034)	(0.010)	(0.033)	(0.012)	(0.037)	(0.013)
N	169,172	168,568	120,998	120,516	48,173	48,051
Mean dep var.	0.000	0.672	-0.018	0.616	0.044	0.811

Note: Columns 1-6 estimate the association using OLS between 3G network availability at the time of the survey measured at the individual level and both the wealth index and labor force participation. The regressions estimated include LGA fixed effects, year of interview fixed effects, and a dummy variable indicating whether the village of residence did not receive 3G during the study period. Thus, the variation used in the estimations arises from locations that at some point receive 3G network during the study period but were interviewed either before or after the arrival of 3G network. Columns 1 and 2 report the results using the full sample, Columns 3 and 4 report the results using the sample of women, and Columns 5 and 6 report the results using the male sample. Standard errors clustered at the LGA level.***p<0.01;**p<0.05,*p<0.1.