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Essays on the Health Economics of Female Genital Cutting

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ABSTRACT

ESSAYS ON THE HEALTH ECONOMICS OF FEMALE GENITAL CUTTING

By

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Committee Chair: Dr. Thomas Mroz

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I investigate the impact of a legal ban on female genital cutting (FGC) using background information on girls and their families. Furthermore, I incorporate the impact of income shocks, represented by drought events, in addition to the aforementioned factors, and analyze how both exogenous variables influence the prevalence of cutting. Using the previous results and a two-stage estimation, I assess the effects of FGC on health and education outcomes.

My analysis relies on the Demographic and Health Surveys conducted in Senegal and Mali from 1995 to 2018, which offer nationally representative data on health, education, and FGC. I specifically focus on girls aged 14 or younger and gather retrospective information regarding the age at cutting. Also, I develop a strategy to handle missing data on the age at cutting for girls whose information was not recalled during the surveys.

My study uniquely examines the combined impact of the law banning FGC and income shocks. Local droughts serve as a proxy for economic shocks, affecting agricultural production and household incomes. I investigate how the law and exogenous droughts influence the likelihood of FGC. To measure drought, I use rainfall data from the University of Delaware, matched to each cluster in the DHS data from Senegal and Mali. By applying a gamma distribution, I generate an extended realization of weather events, classifying a cluster as experiencing a drought event if its rainfall falls below the 15th percentile.

The results indicate that while the ban reduced the prevalence of FGC, income shocks significantly alter the effect of the law. The study shows that when families face income shocks, they offset the effect of their loss in revenue by engaging in more cutting. Building on these findings, I

calculate the predicted probability of undergoing FGC at different ages. I use these age-specific probabilities as instrumental variable to estimate the effects of FGC on health and education outcomes. The findings demonstrate adverse health consequences resulting from FGC, as well as diminished school attendance and fewer years of education for girls who have undergone the procedure.

ESSAYS ON THE HEALTH ECONOMICS OF FEMALE GENITAL CUTTING

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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Dedication

To my loving wife, family, and friends, whose unwavering support and encouragement have been the cornerstone of my journey, this thesis is dedicated to you!

Acknowledgments

As I near the completion of this dissertation, the culmination of years of dedication to my Ph.D. in Economics, I would like to express my profound gratitude to those who have played a pivotal role in helping me achieve this significant milestone.

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Once again, I extend my deepest gratitude to all those who have played a part in my academic journey. It is through your combined efforts and unwavering belief in me that I stand here today, ready to embark on the next chapter of my professional career.

Table of Contents

List of Tables

List of Figures

Introduction

In 2020, the United Nations International Children's Emergency Fund (UNICEF) estimated that more than 200 million girls and women in 30 countries worldwide had experienced female genital cutting (FGC) (World Health Organization (WHO), 2008; Berg et al., 2010). Approximately 3 million girls were cut every year, typically before age 15. In Egypt, Sudan, Somalia, Mali, Guinea, Sierra Leone, Eritrea, and Djibouti, the prevalence of FGC is above 80 percent, varying by ethnicity, religion, and other cultural aspects. Figure 1 shows the FGC prevalence for African countries where data are available. Research studies have identified a correlation between FGC practice and multiple health issues. Women who are cut are more likely to experience mental and psychosocial problems and post-traumatic stress disorder (Vloeberghs et al., 2013; Wagner, 2015). Zabin et al. (1998) provide evidence of the potential effect on the reproductive system. Other studies look at the correlation between pregnancy and birth outcomes (Jones et al., 1999; Banks et al., 2006). FGC increases complications for a woman's first delivery, stillbirths, and miscarriages (Abdulcadir, 2014). The current body of literature also argues that FGC increases the probability of extended labor, leading to fistulas. The evidence from 27 small countries with a high prevalence shows that the cost of treating the health complications of FGC is about 1.4 billion USD per year. This cost could increase by 68 percent, reaching 2.3 billion by 2047 if the prevalence of FGC remains steady. However, if countries impose a ban on the practice, there could be a reduction in the cost by 60 percent (WHO, 2022).

Different studies have also identified the practice of FGC outside of developing countries. For instance, in 1985 the Prohibition of Female Circumcision Act was enacted in the United Kingdom (UK) with the aim of prohibiting the practice of FGC. However, the law lacked the necessary enforcement mechanisms and penalties to effectively tackle the issue. Subsequently, the Female Genital Mutilation Act 2003 was passed in order to strengthen the legal framework regarding FGC in the UK. This legislation criminalized the act of FGC, irrespective of the location where it took place, and imposed penalties for those involved in performing, aiding, or abetting the procedure. Gele (2012) reveals that Somali immigrants in Scandinavia had worse perinatal outcomes than native Swedish or Norwegian women, even though they all have regular care. The most recent estimates of FGC in the United States were assembled by the Centers for Disease Control and Prevention (CDC) (Goldberg et al., 2012). Using data from the 1990 U.S. Census and country-specific prevalence estimates, they predicted that in 1990, 168,000 girls and women had experienced FGC; with 48,000 being younger than 18 years old. For 2014, the estimated numbers were updated to 513,000 women, representing a 35% increase. The change can be explained in part by the surge in the foreign-born U.S. population of women and girls from countries where FGC is practiced (Goldberg et al., 2016; Mather & Feldman-Jacobs, 2015).

Despite a global decline, the practice remains persistent in Sub-Saharan countries. In 2014, the Committee on the Elimination of Discrimination Against Women and the Committee on the Rights of the Child provided legal support to enforce laws prohibiting FGC in several countries. However, as we will discuss below, efforts to eradicate the practice have not been entirely successful in countries like Senegal. The persistence of FGC underscores the importance of policy-driven analyses to assess the factors driving its demand and to evaluate the effectiveness of legal and institutional reforms aimed at combating the practice. FGC could have significant implications for health, labor market participation, educational attainment, and women's overall productivity due to its physiological and psychological effects. Moreover, since FGC is practiced within communities that share common values and norms, studying it can provide insights into the transaction costs and social welfare implications associated with the practice. In this case, transaction costs refer to the economic and non-economic costs incurred by individuals and communities when engaging in FGC-related activities. These costs may include financial expenses, time, effort, social obligations, and potential risks or consequences. By examining FGC within these specific communities, researchers can better understand the dynamics of the practice, including the social, cultural, and traditional factors that influence its perpetuation. This knowledge can shed light on the underlying motivations, decision-making processes, and social structures related to FGC. Furthermore, understanding the social welfare implications of FGC is crucial for assessing its impact on individuals and communities. This includes considering the potential physical and psychological health effects on women and girls, the societal norms and expectations surrounding FGC, and the broader implications for gender equality and women's rights.

I propose a comprehensive study that utilizes a unique approach to identify the underlying factors driving the persistence of FGC. The study aims to provide valuable insights into the complex web of factors that contribute to FGC, ultimately informing the design of targeted interventions and policies to effectively address this practice. Understanding these contributing factors is crucial for developing strategies aimed at promoting gender equality, safeguarding women's rights, and eliminating FGC from affected communities. I leverage strong first-stage evidence to conduct a second-stage analysis, presenting evidence of the consequences of FGC on health and education outcomes. Existing literature on the health and education consequences of FGC has limitations in terms of methodology, as it often fails to account for confounding determinants such as background conditions (Bonessio et al., 2001; Fernandez-Aguilar & Noel, 2003; Essen et al., 2002). Furthermore, most available research primarily focuses on psychological, medical, and anthropological aspects of FGC. This study seeks to address these gaps by assessing the overall factors affecting the demand for FGC highlighted in existing literature, while also providing long-term evidence on causally identified impacts on health and education outcomes for young girls and women. This analysis answers three key questions: (1) How has a legal ban affected the prevalence of FGC? (2) What factors contribute to the demand for FGC? (3) How does FGC affect different health and education outcomes?

The first two questions provide evidence for the demand for FGC. I utilize two different exogenous variations to causally address these questions and analyze how different household characteristics explain the prevalence of FGC. In January 1999, Senegal implemented a ban on FGC, which creates a natural experiment for identification purposes. I use Mali as a comparison country where no law against FGC has been adopted. The variation in exposure to the law based on country of origin and a girl's year of birth serves as a key component of the identification strategy. The study assumes that parents' behavior, influenced by economic and cultural factors, drives the decision to engage their daughters in FGC. I focus on a sample of girls (0-14 years old) for whom the data allows to observe their parents' background characteristics. To assess the law's impact on the prevalence of FGC, I employ a difference-in-difference estimator within a survival analysis framework, controlling for ethnic and temporal variation in FGC across the country and birth cohorts. Only the combination of the two variations is treated as exogenous, and this first stage allows us to determine an exogenous hazard of cutting at any specific age.

The final question poses challenges due to potential endogeneity issues that may affect the validity of estimates establishing the impact of FGC on education and health outcomes. Omitted variable bias could potentially arise as FGC involves numerous unobservable behavioral aspects, and capturing them accurately through survey questionnaires presents significant challenges. To address this issue, I use a two-stage estimation technique that leveraged a source of variation resulting from two factors: the implementation of the 1999 law prohibiting FGC and the occurrence or not of droughts during the study period. Drought events can cause a decline in agricultural productivity and crop yields, impacting the income of households reliant on rain-fed agriculture. This decrease in income can be considered an income shock since it is an unexpected event that affects household revenues. Consequently, drought events serve as a form of exogenous variation, improving the accuracy of estimating the prevalence of FGC. In the first stage of the analysis, I estimate the probability of being cut by incorporating the aforementioned factors: the 1999 law and the occurrence or absence of droughts in each year of the study. This approach allows for a comprehensive estimation of the relationship between FGC and its impact on various outcomes, accounting for the exogenous variations provided by the law and drought events.

From the first stage analysis, I estimate the hazard of undergoing FGC for each girl in the sample at various ages. This estimation allows me to determine the probability of FGC occurrence at the age of the survey. To calculate this probability, I follow a three-step process. In the first step, I obtain the hazard functions for all previous ages leading up to the observed age at the survey. These hazard functions represent the likelihood of experiencing FGC at each age. In the second step, I compute the probability of not being cut at each age by subtracting the previously computed hazard functions from 1. The survival functions indicate the probability of not undergoing FGC up to each age. Finally, in the third step, I derive the probability of undergoing FGC for each girl at the age observed at the survey by subtracting the product of each survival function from 1. This calculation provides an estimate of the probability of being cut for each girl at a specific age at the time of the survey.

The obtained probability serves as an exogenous variable, not influenced by other factors or endogeneity issues. This probability serves to estimate the effect of FGC on various health and education outcomes. By using this exogenous variable, I can examine the causal relationship between FGC and these outcomes, while accounting for the potential impact of FGC. Essentially, the first stage estimation provides a measure of the hazard of undergoing FGC at different ages, and this information is used to obtain a probability of being cut by any particular age; that represents the exogenous variable for analyzing the impact of FGC on health and education outcomes.

I include in the model girls' background information and demonstrate that the implementation of the 1999 legal ban on FGC in Senegal reduced the prevalence of FGC. The introduction of the law is associated with an 18 percent reduction in the probability of girls undergoing the practice. The heterogeneous results on the combined effect of drought and the law suggest that households are responsive to drought events that represent an income loss. They behave in a way consistent with the expectation of increasing future marriage outcomes for their girls and potentially for the household. The heterogeneity observed in the wealth distribution shows that low-income households have a higher value in the practice of FGC, regardless of the presence of the ban and the high cost of performing FGC.

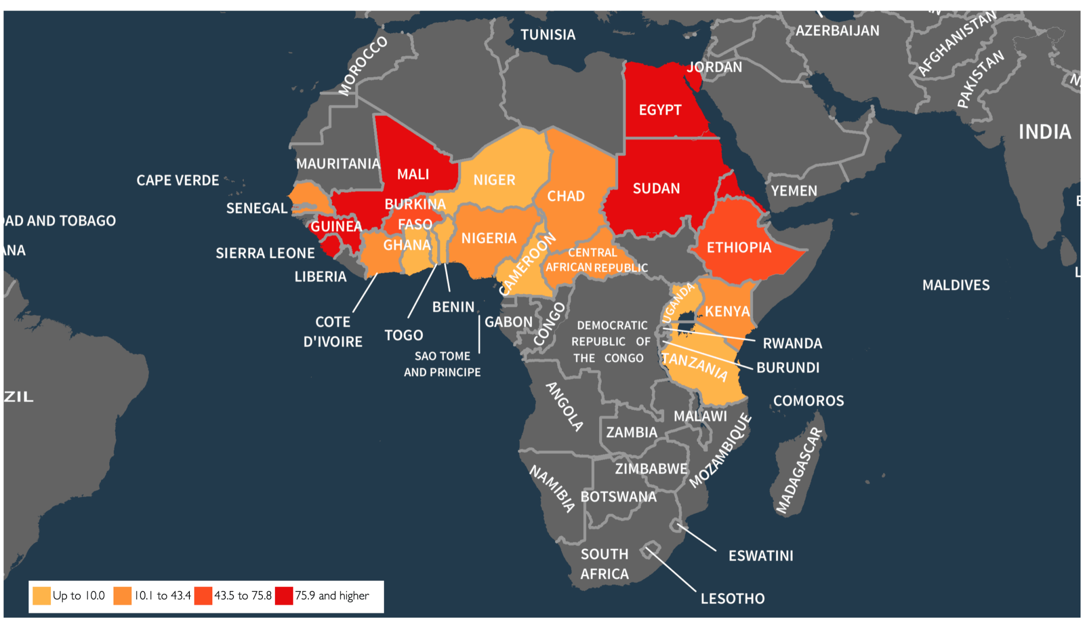
The results show that the adoption of the law in 1999 has created a legal deterrence effect, making the practice of FGC riskier for those performing or supporting it. The law has increased the awareness and understanding of the consequences of FGC among communities, leading to a decrease in social acceptance and support for the practice. The legal ban on FGC could have started a shift in social norms and attitudes toward the practice. As the law communicated a clear message that FGC is illegal, it may have influenced community perceptions, leading to a gradual change in FGC. This change or fear generated by the existence of the law could have contributed to the reduction in FGC prevalence. I conduct some heterogeneous analysis to access the factors underlying the prevalence of FGC. I introduce an additional variation and account for income levels, I utilize drought events as a proxy, assuming that it remains constant during each year a girl is at risk of undergoing cutting. The results yield some new contributions to the literature on the factors contributing to the prevalence of FGC. The results provide insights into the impact of the legal ban on FGC and how it interacts with drought events in Senegal. The legal ban has a significant reducing effect on FGC, but the occurrence of drought events during the post-ban period can increase the likelihood of FGC so much as to eliminate the effect of the law change. Precisely, living in Senegal and experiencing drought events is associated with a lower likelihood of FGC. But the combined effect of living in Senegal, the post-ban period, and drought events positively affect the prevalence of FGC.

On the marriage market, I find that women who have undergone FGC have a slightly higher hazard of getting married or cohabiting at a younger age compared to women who have not undergone FGC. Families possibly perceive marrying off girls at a young age as a way to secure economic benefits, such as dowry or financial support from the groom's family. FGC serves as a cultural practice that facilitates the transition into marriage and enhances a girl's eligibility as a bride, thereby increasing the likelihood of early marriage/cohabitation (Lowe et al., 2019). Also, FGC is associated with an increased likelihood of early childbirth.

The paper makes numerous significant contributions. First, I formalize a methodology to examine the economic and social environment regarding the potential age at cutting. Second, I look at heterogeneity between and within regions and ethnicities in Senegal. Third, the study exploits the timing of a legal change in girls' and women's cutting. Fourth, the research contributes to two major areas of literature investigating the persistence of FGC practices in many developing countries (Fenske, 2012; Crisman et al., 2016; Garcia-Hombrados, 2017; Acemoglu & Jackson, 2017). It further adds to the literature that explores the nature, origin, and persistence of FGC (Bellemare et al., 2015; Efferson et al., 2015; Wagner, 2015; Novak, 2020; Poyker, 2016; Vogt et al., 2016; Becker, 2018; Harari, 2019; Diabate & Mesple-Somps, 2019). Fifth, the paper significantly contributes to understanding the effect of legal restrictions on FGC prevalence. The approach is distinct from those currently utilized, as I identify a more reliable control group based on cultural and local factors. Furthermore, the research sheds light on the channels through which parents decide whether or not to cut their daughters at any particular age given that they had not yet been cut.

The remaining sections of the dissertation follow the subsequent structure. In the following sections of Chapter , I discuss the suitability of Mali as a control group for Senegal and provide the background leading to the adoption of the ban against FGC in Senegal. Next, I present the relevant literature related to the research, followed by a detailed description of the datasets and empirical methods to answer the research questions. In Chapter 1.7, I present the results showing the impact of FGC on health and education outcomes, respectively. In the final chapter, Chapter 2.6, I discuss potential misreporting, and evidence in the chapter suggests that it did not affect the results. Ultimately, in the conclusion, I thoroughly discuss the results, and policies that could contribute to eliminating FGC.

Figure 1. Percentage of Women who Experienced Female Genital Cutting



Source: Demographic and Health Survey

Chapter 1: Legal Ban on Female Genital Cutting: Evidence From the 1999 Law Adopted in Senegal

1.1 Overview of the Female Genital Cutting in Senegal and Mali

Female genital cutting is a practice that can impose a specific cultural or gender identity on its recipients due to its social and cultural significance within certain communities. The act of undergoing FGC is often considered a rite of passage and a symbol of femininity, purity, and cultural belonging. In societies where FGC is practiced, it is often seen as a way to control women's sexuality, preserve virginity, and ensure conformity to traditional gender roles and expectations. Many ethnicities consider the practice a cultural norm from which they cannot depart (Shell-Duncan and Hernlund, 2001b). The World Health Organization (2012) classifies FGC into four types. Type I, also known as clitoridectomy, involves the partial or total removal of the clitoris. Type II, also known as excision, includes the partial or complete removal of the clitoris and the labia minora. Type III, also known as infibulation, narrows the vaginal opening by sewing or stitching the labia together. Type IV includes all other procedures that modify the female genitalia for non-medical reasons.

In Senegal, FGC is predominantly practiced on girls aged 0 to 14, although there are instances where it occurs at later ages. It is estimated that around 25 percent of girls and women in Senegal have undergone this procedure. FGC in Senegal has deep historical and cultural roots and is strongly tied to religious traditions. The procedure is believed to serve purposes such as diminishing a woman's sexual desire and preserving her virginity until marriage (Gee, 2019). It is considered a significant rite of passage into womanhood and is often seen as a prerequisite for marriage (Nour, 2008). Despite increasing awareness of its harmful effects, FGC continues to be prevalent in Senegal, particularly in rural areas and among specific ethnic groups. The most common type of FGC practiced in Senegal is Type II, involving the removal of the clitoris and part of the labia minora. In some cases, the entire external genitalia is excised, and the vaginal opening is sewn closed, leaving only a small opening for urine and menstrual blood.

The practice of FGC is deeply ingrained in tradition and is associated with notions of cleanliness, beauty, and desirability for women. Inter-ethnic marriages can also influence the prevalence of FGC in certain contexts within Senegal (Wander et al., 2020). According to Allen et al. (2015), approximately 25 percent of women aged 15 to 49 in Senegal have undergone FGC, with a higher prevalence among specific ethnic groups. In 2018, data from the Demographic and Health Surveys (DHS) revealed that regions in southeast Senegal reported FGC rates ranging from 64 percent to 76 percent. The majority of these women were subjected to FGC before the age of ten, with 80 percent experiencing it before the age of five. Traditional practitioners without adequate knowledge of gynecological health typically perform FGC in Senegal (UNICEF, 2013; Berg et al., 2014).

However, FGC has potentially no health benefits and can lead to various physical and psychological complications. The current literature on FGC stipulates that physical complications may include severe pain, bleeding, infections, difficulties in urination, sexual dysfunction, and childbirth complications. It also argues that the potential psychological impact of FGC can be equally devastating, with many girls and women suffering from anxiety, depression, and post-traumatic stress disorder (PTSD) due to the procedure. Despite efforts by the Senegalese government and international organizations to combat FGC, the practice persists in many parts of the country. Resistance to change remains significant, as FGC is viewed by many as an integral part of their cultural and religious identity.

FGC has been the subject of national and international attention for many years. In 1999, the United Nations (UN) declared February 6 as the International Day of Zero Tolerance for FGC to raise awareness of the issue and encourage action to eliminate the practice. Different laws have attempted to classify FGC as a violation of human health rights. Countries adopted Article No. 24 of the Child's Rights from the United Nations Convention to prevent the practice. Senegal is one of the early countries to adopt a legal code against FGC. In 1999, Senegal implemented Law No. 99-05, which specifically targeted and condemned the practice of sexual cuttings, also known as FGC. The purpose of this law was to "address and eradicate the harmful practice of FGC, protecting the rights and well-being of women and girls in Senegal". Shell-Duncan et al.

(2013) indicate that Senegal implemented a criminal law that explicitly forbids the violation of "the integrity of the genital organs of a female person." The law applies to individuals who engage in or attempt to engage in such violations, as well as those who incite or instruct others to carry out these acts. The penalty for such offenses includes imprisonment for a period of six months to five years. In cases where the cutting results in death, the punishment may involve hard labor for life. Also, combining the provisions of the law and the penal code may result in a fine ranging from $45 to $1,800. The law makes it illegal to perform the procedure on any person, with penalties ranging from a fine to imprisonment for up to five years. It also criminalizes anyone who promotes or encourages the practice or who fails to report it to the authorities. It applies to all forms of FGC, regardless of the age of the person undergoing the procedure or the context in which it occurs. The law was passed shortly before the visit of the then-U.S. First Lady Hillary Clinton. The legislative work leading to the adoption was unpopular and many politicians and groups campaigned against the law. Therefore, the ban was considered a shock and unexpected. However, Shell-Duncan et al. (2013) show that knowledge about the law was widely spread using radio and television throughout the country. Some cases were brought to Court, and convictions were shared through broad media coverage.

The implementation of the FGC ban in Senegal has been a gradual process, marked by significant challenges. While the law provides a strong legal framework for addressing the issue, its effectiveness has been limited by a lack of resources and political will. Enforcement of the law has been inconsistent, with many cases going unreported or unprosecuted. In recent years, however, there has been renewed momentum in the fight against FGC in Senegal. The government has taken steps to strengthen its response, including the establishment of specialized units within the police force to investigate cases of FGC. Non-governmental organizations (NGOs) have also played a critical role in raising awareness and providing support to women and girls affected by the practice. There was a significant focus on enforcing the law within regions/ethnicities with higher FGC prevalence. At the time, many non-governmental organizations concentrated on different areas based on individuals' beliefs regarding FGC. They provided information and discussion groups to incentivize the communities to take action. Shell-Duncan et al. (2013) indicate that the laws were more effective within communities where FGC had been actively contested. In more traditional societies, the impact was negligible because many households continued the practice underground.

In this study, I compare Senegal with a similar country, Mali where no legal ban on FGC exists. In Mali, FGC is prevalent across all regions, with the highest prevalence rates found in the southern and western parts of the country. According to the 2018 Demographic and Health Survey (DHS), 85.2 percent of women and girls aged 15-49 in Mali have undergone FGC. The practice is most common among the Bambara, Mandingue, and Soninke ethnic groups, although it is also practiced by other ethnic groups, including the Fulani and Tuareg.

FGC is deeply rooted in cultural and religious beliefs in Mali. Many communities believe that FGC is necessary for a girl to become a woman, to maintain her purity and modesty, and to prepare her for marriage. FGC is also believed to increase a woman's sexual pleasure by removing "excess" female genitalia. Many women who have undergone FGC view it as a rite of passage and an essential part of their cultural identity.

In recent years, there has been a growing movement to end FGC in Mali. The government, civil society organizations, and international organizations have been working to raise awareness about the harmful effects of FGC and to promote alternative rites of passage that do not involve cutting. Many communities have also been working to abandon the practice, with some declaring their villages "FGC-free". However, progress has been slow, and there is still much work to be done to end FGC in the country. Mali does not currently have a specific law criminalizing Female Genital Cutting. While the country has taken some steps towards addressing the issue, including developing a national strategy to eliminate the practice and implementing awareness campaigns, there is no legal ban that criminalizes FGC in Mali. Many attempts to introduce legislation against FGC have failed as attempts to pass legislation against FGC have failed to gain parliamentary approval.

1.2 Literature Review

The present dissertation contributes to several strands of literature. Firstly, it is related to medical research analyzing the health consequences of FGC. One early study by Morison et al. (2001) identified the correlation between traditional female genital cutting and adult women's reproductive morbidity in the Gambia. However, later studies have examined various relevant health outcomes. For instance, Banks et al. (2006) studied six African countries and looked at obstetric outcomes for women who had undergone female genital cutting, considering the types of FGC defined by the World Health Organisation, types I, II, and III. They found that these forms increased obstetric complications by 1.03, 1.29, and 1.31 percentage points, respectively. Furthermore, FGC appears to lead to one to two additional perinatal deaths per 100 births. However, the participants of this study were selected during hospital interventions, and they found evidence of heterogeneity in the treatment, suggesting that the women who experienced cutting compared to those who did not present a wide variety of differences. Wagner (2015) conducted a large-scale analysis that studied the health consequences and the economic aspect of the practice. It used phases IV and V of the DHS data for 13 West African countries to analyze the effect of FGC on health outcomes such as BMI and fertility. The paper found no significant relationship on BMI and no evidence that FGC is related to long-term health consequences or causes infertility; however, FGC is likely associated with increased numbers of children ever born to women on average.

Most of the articles in this category are from the medical research field. They have inconclusive findings due to sample representativity, weak methodology, and failure to model for confounding factors such as socioeconomic backgrounds. Some of these studies often use non-scientifically collected data, which potentially introduces sample selection bias. In addition, health complications from FGC are rare events, and it is statistically challenging to detect any effect using a small sample. The existing studies show the need for further analysis that presents more causally identified evidence on the health consequences of FGC.

Secondly, this dissertation contributes to the literature that identifies the factors contributing to FGC's persistence. Different studies argue that establishing or strengthening individual and group identity explains the rationality behind the choice of cutting. For example, Coyne and Coyne (2009) built the identity economics of FGC by using a rational choice model. Based on this rationality, since FGC is closely related to an individual's ethnicity, it is challenging to disrupt the practice of FGC. Different social groups compare the costs and benefits of engaging in FGC to preserve an individual's identity. Chesnokova and Vaithianathan (2010) show that FGC increased the probability of getting married, and cut women lived in wealthier households. In certain communities, older women are considered the ”gatekeepers” and should encourage the practice. The model also defines a mechanism of social capital accumulation for younger women and a high-value commodity for older women (Shell-Duncan & Hernlund, 2000). Other studies have also formalized FGC as a social coordination norm, and the decision to adhere is made at the community level. Bellemare et al. (2015) find in West Africa that factors at the individual, household, and village levels explain the persistence of FGC. It suggests that a higher prevalence of FGC is associated with support for its continuation and is driven by individual-level factors such as education, ethnicity, and religion. Novak (2020) formalized a theoretical explanation based on Bellemare et al.'s (2015) findings. The findings of the study revealed that FGC is deeply entrenched in social norms, with individuals conforming to the practice due to social pressure and expectations. The study identified specific tipping points where behavior change interventions could have a significant impact on reducing FGC. I build on this work and extend some of the work in a different setup. I contribute to this literature in two ways. In my analysis, I adopt a two-fold approach to understand the factors influencing parents' decisions regarding the FGC status of their daughters. Firstly, I examine observable economic and cultural factors that play a role in parents' choices regarding FGC. These factors may include variables such as household income, education levels, cultural norms, and access to healthcare services. By studying these factors, I aim to gain insights into the decision-making process of parents and the determinants of FGC practices. Secondly, I investigate the impact of economic shocks, specifically focusing on drought events, on the consideration of FGC within families. Droughts can have significant repercussions on household livelihoods, particularly in regions where rain-fed agriculture is the primary source of income. By analyzing how economic shocks, such as droughts, influence families' considerations of FGC, I aim to understand the interplay between external factors and the perpetuation of this practice. By combining these two approaches of analysis, I hope to shed light on the complex dynamics underlying parents' decisions regarding FGC and how economic shocks can potentially influence these decisions. This research contributes to a deeper understanding of the societal and economic factors that shape FGC practices and can inform interventions aimed at reducing its prevalence.

Lastly, this dissertation contributes to the literature that identifies the impact of specific legislative changes. To date, the evidence suggests that a successful way of changing FGC practice should start at the local level (Coyne and Coyne, 2014). Other studies find that national laws may contribute in limited or perverse ways to changing behaviors. (Bharadwaj et al., 2013; Bertrand et al. 2007). However, the effectiveness of these interventions in reducing the prevalence of FGC is a topic of debate in the literature. Some studies suggest that community-based approaches, such as education and awareness-raising campaigns, are more effective than legal interventions in reducing the prevalence of FGC (Shell-Duncan et al., 2013; Mackie, 2000). These studies argue that community-based approaches are more culturally appropriate and have a greater chance of success, as they involve working with communities and engaging them in discussions on the health and social consequences of FGC. However, other studies suggest that legal interventions, such as criminalizing the practice of FGC, can be effective in reducing the prevalence of FGC (Berg et al., 2014; Yoder et al., 2013). These studies argue that legal interventions send a strong message that FGC is not acceptable and may deter parents from having their daughters cut.

I contribute to the literature by identifying the mechanisms that lead to the decision to cut a girl and the role of legal reform in addressing and reshaping an individual's behavior. This work introduces another approach to studying how a legal change has impacted the prevalence of FGC, accounting for heterogeneity at the ethnic level. An analytical challenge for many of these studies is the non-random selection of the population studied concerning unobservable characteristics. I overcome this by using the Demographic and Health Surveys data. I build on the recent literature to include relevant information on the family background as an essential factor in understanding the practice. However, I expand the scope of identity by examining the household characteristics of the interviewed women and their girls. By incorporating this information, I investigate the effects of cutting on health and education outcomes, utilizing exogenous variations in the timing of the law and droughts as determinants of the timing of FGC.

1.3 Data

1.3.1 *Demographic and Health Survey Data*

This analysis uses the Demographic and Health Surveys (DHS) data from Senegal and Mali from 1995 to 2018. I combine the data from Senegal and Mali to evaluate the effect of the law banning FGC. DHS conducts nationally representative household and individual surveys in multiple countries worldwide. Data are collected for different modules, including FGC, and the variables are consistently defined over time. The response rates tend to vary across sampling domains, and sample weights are used to obtain nationally representative estimates of indicators (Karmaker, 2011). The data collector is instructed to prioritize privacy when engaging in discussions related to modules specifically designed for women, focusing on topics such as cutting, during the survey implementation. The cross-sectional survey is implemented every 4 or 5 years, and it collects data on women from 15 to 49 years old during each round. For instance, if the survey was conducted in 2000, the year of birth of a woman interviewed could go back to 1951.

Each survey collects information on health, education, family planning, and female genital cutting; and it is conducted on about 5,000 to 30,000 households every five years. In the main questionnaire, different modules vary from year to year; however, since 1989, the FGC module has always been included in all DHS surveys. Women self-report whether they have undergone FGC and provide information on the FGC status of each of their daughters[1]. In the early years of the DHS survey (1996, 2001), the respondent provided information on only one daughter. However, in more recent surveys (2005-2019), data on the age at cutting was collected for all

[1] In the questionnaire, women are asked, “Have you ever been circumcised?”, and they answer for themselves and their daughters. The response rate for this question ranges from 80 percent to 96 percent.

young daughters aged 0 to 14. The retrospective collection of daughters' age at cutting occurred during the interview. To analyze the data, I create a sample that includes all girls and match them to their respective mothers, mothers' partners, and household information. Besides, I limit the sample to girls aged 14 or younger to ensure consistency in survey responses, as the survey is administered to women aged 15 and older. Including women aged 15 and older would create an overlap and confound girls and mothers in the analysis. This specification is important because the study distinctively utilizes information on parents and households. Since I could not observe background information on households and parents for women aged 15 to 49 in the data, restricting the sample to a younger age group ensures accurate capture of these key details.

In this analysis, it is important to observe the age at which girls undergo FGC. However, in the sample, there is limited information available for about 15 percent and 27 percent of girls, respectively. The survey only indicates that they have been cut at early ages or at an age prior to their current age at the time of the survey. To address this issue, I use a specific strategy to capture the age at cutting for these two groups. For girls who were cut during early ages, I assume that the age at cutting falls within the range of 0 to 5 years old. For the second group of girls, I argue that they were cut sometime between the age of 0 and their observed age at the time of the survey. By utilizing this strategy, it becomes possible to estimate the distribution of the age at cutting for these girls despite the limited information provided in the survey. I provide more details about the approach and its implementation in section 1.4.

1.3.2 *Weather Data*

In this study, I also investigate how the adoption of the law and income shocks, specifically droughts, impact the hazard of FGC by utilizing local droughts as a proxy for local economic conditions (Gong & Jones, 2015; Kaur, 2019; Shah & Steinberg, 2017; McGavock & Novak, 2021). Weather conditions are exogenous events that can severely impact economic productivity in Africa, where households mainly rely on rain-fed agriculture for economic livelihood. Droughts reduce agricultural production and can significantly impact households' incomes. To create a local drought indicator, I use rainfall data from the University of Delaware (UDel) that is calculated from information on climatologically aided interpolation obtained from local weather stations, which provides a reliable measure of rainfall data (Dell, Jones, & Olken, 2012; Burke, Gong, & Jones, 2015). The data combine a monthly measure of precipitation at a 0.5×0.5 degree grid covering terrestrial areas around the earth, and the 1950-2017 period is used to obtain an extended range of rainfall realization for areas in Senegal and Mali.

I match each cluster in the Demographic and Health Surveys (DHS) data to the specific weather grid cell using GPS information. I obtain rainfall shocks at the grid level by adapting a method used by McGavock and Novak (2021) and Corno et al. (2020). In order to identify drought events, I utilize rainfall data for each year and each specific geographical grid. To analyze these data, I fit a gamma distribution to the rainfall data from 1950 to 2017 and obtain an extended representation of weather events. The gamma distribution provides a statistical model that allows for the characterization of the probability distribution of rainfall in a particular location over a given period of time. By fitting a gamma distribution to the historical rainfall data for a specific grid, I can estimate the parameters of the distribution. To classify a cluster or geographical area as having experienced a drought event, I compare the distribution of rainfall for that specific grid in a particular year to the extended rainfall distribution from 1950 to 2017. Specifically, I identify a cluster as having experienced a drought event if the amount of rainfall in that year falls below the 15th percentile of the extended gamma distribution calculated based on the historical data for that grid (Miguel, et al., 2004). By using this approach, I am able to define and identify drought events based on statistical analysis and establish a threshold for determining when a cluster or grid has encountered conditions that are considered significantly drier than the historical average.

This definition captures droughts accurately in Sub-Saharan Africa, where rainfall below that percentile drastically impacts the production of the substantial maize crop. Moreover, this definition abstracts from comparing types of soils in nature and does not consider infinitesimal changes in rainfall to tag them as drought events drastically (McGavock & Novak, 2023). It is important to note that this definition does not account for variations in soil types found in nature. Soils can vary in their moisture retention capacity and resilience to drought conditions. Therefore, the definition does not consider soil-specific characteristics when identifying drought events. Further, it does not incorporate infinitesimal changes in rainfall amounts, which refers to extremely small or incremental changes. By not including these subtle variations, the definition ensures a clear distinction between drought and non-drought conditions without considering minor rainfall fluctuations that may not significantly impact agricultural outcomes.

1.4 Empirical Strategy

To address FGC participation, I define a first-stage estimation using a natural experiment created by the legal ban on FGC in Senegal in 1999. I define exposure to the law by using a girl's age at cutting and her country of birth to obtain a hazard ratio. Only the combination of both indicators guarantees the exogeneity of the treatment. To estimate the baseline hazard, I use a logistic model with the following specification for a girl i who experienced FGC at any age A_m:

$$logit[h(A_m|X)_{i,t,g}] = \beta_1 + \beta_2\big[Post_t \times Senegal_{i,g}\big] + \Gamma X_{i,g,t} + \zeta_g + \tau_t + \tau_{A_m} \quad (1)$$

In this equation, the dependent variable $h(A_m|X)_{i,t,g}$ takes the value of one if a girl is cut at age $A = A_m$ and zero if $A < A_m$. When the data meet the condition $A > A_m$, I drop the girl's observation. The variable $Senegal_{i,g}$ is an indicator variable $(= 1)$ for a girl who lives in Senegal. The coefficient β_1 is the baseline log-odds of experiencing FGC for a girl who meets the reference values for all other variables in the model. To account for region-invariant characteristics that affect the outcome of interest rather than the law itself, I use a region-fixed effect ζ_g, which captures correlation over regions. It accounts for the potential heterogeneity or variation in the hazard of experiencing FGC across different regions. The model also includes year τ_t and age τ_{A_m} fixed effects. The first term represents the time-specific effect. It captures the potential time-varying factors that affect the hazard of experiencing FGC. The second term represents the age-specific effect. It accounts for the potential variation in the hazards of experiencing FGC at different ages. I cluster the standard errors at the regional level to allow correlations within regions across time. The coefficient β_2 represents the effect of the interaction term between the variables

"Post" and "Senegal" on the hazard of experiencing FGC. It measures the hazard of cutting post the adoption of the 1999 law banning FGC in Senegal, assuming that I control for pre-enactment differences and other changes that occur around the adoption year and confounding factors.[2]

I develop a first-stage analysis model that incorporates FGC participation. Given that FGC is a decision that can be made at any age of a girl's life, provided she has not been cut previously, a hazard analysis approach is appropriate. This analysis captures the hazard of being cut at any age and the heterogeneous impacts at different ages. The model defines a time period considered to be between the moment a girl is at risk of cutting for the first time and the age when she is eventually cut. The objective is to determine how the risk of cutting evolves globally across girls and also at an individual level in terms of covariates. The model allows for time-varying baseline risk while incorporating individual differences in the survival functions within the same fitted model. In the context of the analysis, "time-varying baseline risk" refers to the fact that the risk or probability of experiencing FGC can change over time. It recognizes that the likelihood of being cut may differ at different ages or time periods. Meanwhile, the model takes into account the unique characteristics and circumstances of each individual when estimating the risk of FGC. Survival functions represent the probability of surviving without experiencing the event of interest (in this case, being cut) over time. By incorporating individual differences, the model recognizes that different factors or covariates may influence the risk of FGC for each individual. Overall, the model captures both the time-varying nature of the baseline risk for FGC and the individual-specific factors that contribute to the probability of being cut, all within a single fitted model. The

[2]The preferred specification in this analysis includes controls for two additional policies implemented in different years. The first policy, the 2005 Reproductive Health Law, was introduced to address the reproductive health needs of predominantly young individuals. This law aimed to provide access to reproductive services, which could include various aspects such as family planning, sexual education, and healthcare services related to reproductive health. The second policy implemented in 2010 is the TOSTAN Dignity for All initiative. TOSTAN is an organization that focuses on promoting human rights and supporting communities in achieving social change. The Dignity for All program specifically aims to educate communities on human rights, empowering individuals to understand and advocate for their rights and dignity.

By including controls for these two policies in the preferred specification, the analysis takes into account their potential influence on the outcomes being studied. It recognizes that these policies may have had independent effects on the variables of interest, such as education, health, or social norms related to FGC. Controlling these policies helps to isolate the specific impact of the 1999 law banning FGC and provides a more comprehensive understanding of the factors influencing the outcomes under investigation.

model can also be viewed as a flexible, discrete-time hazard model that allows for fixed effects of different factors such as households, communities, regions, and calendar years.

To achieve the goal of analyzing the risk of FGC across different ages, the data should ideally contain information on cutting status for each year of the time period and also include measurements of the relevant factors mentioned earlier. However, since such data is not available, I use an alternative approach. Assuming that the majority of the factors influencing FGC remain relatively constant during the analyzed time period, I transform the available data to approximate the desired structure. This involves duplicating the observation for each potential age of cutting, ranging from 0 to 14 years. For example, if an individual was cut at age A, their observation is replicated multiple times to represent each possible age of cutting. The factors that are not constant over time are updated each year for each girl in the sample. By employing this approach, the data is transformed into a person-year panel format, where each individual contributes a specific number of "person-years" to the sample. Specifically, an individual who experienced cutting at age A contributes $A + 1$ person-years. This method allows for an approximation of the risk of FGC across different ages and facilitates the analysis of the impact of various factors on the likelihood of being cut.

The data exhibits a specific characteristic; approximately 15 percent of girls have information indicating only that they were cut at early ages. For another 27 percent of girls in the sample, the data only reveals that they were cut at an age prior to the age at which the survey was conducted. In the analysis, for girls cut during early ages, I estimate the age at cutting to fall within the range of 0 to 5 years. For the second group, I assume that their cutting occurred at some point between age 0 and the age observed at the time of the survey. Instead of disregarding or excluding these observations, I incorporate the likelihood that cutting took place at some previous age. This is achieved by summing the probabilities of being cut across the relevant age range. By incorporating these probabilities, the analysis acknowledges the uncertainty regarding the exact age at which cutting occurred for these individuals and considers a range of possible ages within the given data limitations.

In the following analysis, I employ an event study methodology, based on Autor's (2003) approach, to assess the magnitude and statistical significance of the coefficients before the implementation of the legal ban on FGC. The event study allows for a detailed examination of how FGC evolved over a specific time period leading up to the adoption of the 1999 law banning FGC. By analyzing the pre-treatment trends, it is possible to clearly observe the baseline patterns and dynamics of FGC before any intervention occurs.

The event study approach involves estimating a series of regression models that capture the relationship between the treatment indicator, time indicators, and the FGC variable. These models are estimated for each time period leading up to the treatment. To account for any factors that may affect the outcome variable independently of the treatment and that vary over time, the event study framework includes age-fixed effects and time-fixed effects or polynomial functions of time as control variables. This ensures that the analysis controls for time-varying factors and focuses on identifying the specific impact of the treatment on FGC.

By analyzing the coefficients associated with the time indicators in the event study, I can assess whether there are any systematic changes in the outcome variable over time prior to the treatment. This estimation provides valuable insights into the pre-existing trends in the outcome variable and serves as a baseline for comparison when assessing the treatment effect following its implementation. The significance and magnitude of these coefficients in the event study are key for establishing the robustness of the estimated treatment effect. They help determine whether any observed changes in the outcome variable can be attributed to the treatment or if they are a result of pre-existing trends. By identifying and accounting for these pre-existing trends, the event study methodology enhances the validity and reliability of the estimated treatment effect, providing more credible evidence of the causal impact of the treatment.

The equation is as follows:

$$logit[h(A_m|X)_{i,t,g}] = \sum_{k=1986, k\neq 1998}^{k=2012} \gamma_k Senegal_{i,t,g} + \Gamma X_{i,t,g} + \zeta_g + \tau_t + \tau_{A_m} \quad (2)$$

As in the previous equation, $h(A_m|X)_{i,t,g}$ is the hazard of experiencing FGC at any age A_m for a girl i in time period t and country g, $Senegal_{i,t,g}$ is an indicator variable equal to one if the girl i lives in Senegal and was born in year t and was A_m years old, $\Gamma X_{i,t,g}$ are the coefficients associated with the covariates $X_{i,t,g}$ in the model, representing their respective effects on the hazard of FGC. They capture the relationship between the covariates and FGC while accounting for the treatment and time effects. ζ_g is a region-fixed effect; τ_t and τ_{A_m} are time-specific and age-specific effects. The parameters of interest, the γ_k's, estimate the effect of the legal ban in year k following its adoption. They are the coefficients associated with the time indicators k representing each time period leading up to the treatment. They capture the average effect of time on the hazard of FGC, taking into account the treatment indicator (Senegal) and controlling for other factors in the model. Estimating equation 2 allows us to test whether the treatment affects outcomes before the adoption year and to test the parallel trend assumption.

Finally, I introduce a novel approach that combines temporal and spatial variations to assess income shocks, with drought used as a proxy for such shocks. In Sub-Saharan Africa, weather conditions are exogenous events that can significantly impact households' incomes, given their reliance on rain-fed agriculture. Droughts, in particular, reduce agricultural production and can thus have a severe economic impact. Furthermore, prior research has shown that FGC plays a crucial role in the marriage market, as girls who have undergone FGC receive a higher bride price (Cloward, 2016; Chesnokova & Vaithianathan, 2010; García-Hombrados & Salgado, 2019; Ouedraogo & Koissy-Kpein, 2012; Wagner, 2015). Recently, McGavock and Novak (2021) found that the timing of cutting and drought are causally related.

To test the hypothesis that FGC is responsive to income shocks resulting from drought, I use the following specification equation:

$$\begin{aligned} logit[h(A_m|X)_{i,t,g}] = \beta_1 + \beta_2 Drought_{i,t,g} + \beta_3 \big[Post_t \times Senegal_{i,g}\big] \\ + \beta_4 \big[Post_t \times Drought_{i,t,g}\big] + \beta_5 \big[Drought_{i,t,g} \times Senegal_{i,g}\big] \\ + \beta_6 \big[Post_t \times Senegal_{i,g} \times Drought_{i,t,g}\big] + \theta X_{i,t,g} + \zeta_g + \tau_t + \tau_{A_m} \end{aligned} \tag{3}$$

where $Drought_{i,t,g}$ represents an indicator variable of drought as defined in section 1.3.2 for a girl i in region g at time t. All other variables are defined as in equation 1. The results from this model define the main contribution of this paper to the literature. In equation 3, the coefficient β_6 represents the interaction term between the variables $Post_t$, $Senegal_{i,g}$, and $Drought_{i,t,g}$. This term captures the joint effect of being in the post-law period (after 1999), residing in Senegal, and experiencing a drought event (an income shock) on the hazard of being cut. The coefficient β_6 is of particular importance because it reflects the combined influence of these three factors on the prevalence of FGC. It captures the potential synergistic effect that occurs when all three conditions are present simultaneously. This interaction term allows us to examine how the impact of the 1999 law banning FGC in Senegal, and the occurrence of drought events interact and jointly affect the likelihood of FGC. If β_6 is statistically significant and has a meaningful magnitude, it indicates that the combination of being in the post-law period, living in Senegal, and experiencing a drought event has a substantial impact on the prevalence of FGC. This finding would suggest that these three factors together contribute significantly to the variation in cutting. It helps provide insights into the complex interplay between policy implementation, contextual factors, and external income shocks (such as droughts) in shaping the prevalence of FGC. It allows for a more nuanced understanding of the dynamics and complexities surrounding FGC practices and can inform targeted interventions and policies aimed at reducing the prevalence of FGC in the future.

1.5 Results

I present the results of the first stage estimation and provide a comprehensive analysis of the findings. Furthermore, I examine the varying effects of FGC on these outcomes based on the girl's area of residence and wealth distribution. The estimations account for a combined $urban/rural \times year$ fixed effects. In the first column of the table for each result, I also control for other potential policies that may influence the status of FGC following the implementation of the legal ban. I also control for other potential policies that may influence the status of FGC following the implementation of the legal ban. The preferred specification in this analysis includes controls for two additional policies implemented in different years. The first policy, the 2005 Reproductive Health Law, was introduced to address the reproductive health needs of predominantly young individuals. This law aimed to provide access to reproductive services, which could include various aspects such as family planning, sexual education, and healthcare services related to reproductive health. The second policy implemented in 2010 is the TOSTAN Dignity for All initiative. TOSTAN is an organization that focuses on promoting human rights and supporting communities in achieving social change. The Dignity for All program specifically aims to educate communities on human rights, empowering individuals to understand and advocate for their rights and dignity. By including controls for these two policies in the preferred specification, the analysis takes into account their potential influence on the outcomes being studied. It recognizes that these policies may have had independent effects on the variables of interest, such as education, health, or social norms related to FGC. Controlling these policies helps to isolate the specific impact of the 1999 law banning FGC and provides a more comprehensive understanding of the factors influencing the outcomes under investigation. However, prior to showing the first stage estimation results, I present descriptive statistics of the main sample.

I provide a complete description of the sample of all girls aged 0 to 14 used for my analysis. Firstly, I describe the differences between girls who were cut and those uncut. Secondly, I compare Senegal (treatment) to Mali (control) and present some of their characteristics. Finally, I show the distribution of FGC in both countries before and after the law.

Table 1. Summary Statistics: Mean and Standard Deviations (in Parenthesis) of Cut and Uncut Girls in Senegal

	FGC	No FGC	All Sample
Girl's age	6.243 (3.726)	5.352 (3.736)	5.554 (3.752)
Religion (Muslim=1)	0.984 (0.124)	0.963 (0.19)	0.968 (0.177)
Area of residence (Urban=1)	0.212 (0.408)	0.355 (0.479)	0.323 (0.468)
Mother age	34.124 (7.229)	33.173 (7.38)	33.389 (7.356)
Mother education (Total yr.)	0.839 (2.129)	1.727 (3.394)	1.525 (3.173)

Table 1. Summary Statistics: Mean and Standard Deviations (in Parenthesis) of Cut and Uncut Girls in Senegal (continued)

	FGC	No FGC	All Sample
Mother cut	0.985 (0.121)	0.238 (0.426)	0.408 (0.491)
Mother married	0.951 (0.217)	0.944 (0.23)	0.946 (0.227)
Occupation (Agric. Sector=1)	0.339 (0.473)	0.223 (0.416)	0.249 (0.433)
Husband/partner's age	47.096 (11.405)	45.206 (11.264)	45.636 (11.324)
Partner education (Total yr.)	1.179 (3.217)	1.924 (4.052)	1.701 (3.823)
Partner occupation (Agric. Sector=1)	0.414 (0.493)	0.291 (0.454)	0.319 (0.466)
Wealth index			
Poorest (1^{st} Quintile)	0.397 (0.489)	0.253 (0.435)	0.29 (0.452)
Poorer (2^{nd} Quintile)	0.314 (0.464)	0.244 (0.429)	0.26 (0.439)
Middle (3^{rd} Quintile)	0.202 (0.401)	0.225 (0.418)	0.22 (0.414)
Richer (4^{th} Quintile)	0.07 (0.256)	0.165 (0.371)	0.143 (0.35)
Richest (5^{th} Quintile)	0.018 (0.131)	0.113 (0.317)	0.091 (0.288)
Ethnicity			
Wolof	0.009 (0.096)	0.411 (0.492)	0.319 (0.466)
Poular	0.619 (0.486)	0.252 (0.434)	0.336 (0.472)
Serer	0.004 (0.065)	0.168 (0.374)	0.131 (0.337)
Mandingue	0.175 (0.38)	0.058 (0.234)	0.085 (0.279)
Diola	0.057 (0.232)	0.032 (0.175)	0.037 (0.19)
Soninke	0.045 (0.207)	0.015 (0.123)	0.022 (0.147)
Other senegalese	0.044 (0.205)	0.028 (0.164)	0.031 (0.174)
Other senegal	0.045 (0.208)	0.037 (0.188)	0.039 (0.193)
Region			
Dakar	0.016 (0.126)	0.079 (0.269)	0.064 (0.245)
Ziguinchor	0.052 (0.221)	0.064 (0.244)	0.061 (0.239)
Diourbel	0.004 (0.064)	0.11 (0.313)	0.086 (0.28)
Saint-Louis	0.06 (0.238)	0.086 (0.281)	0.08 (0.272)
Tambacounda	0.198 (0.398)	0.054 (0.227)	0.087 (0.282)

Table 1. Summary Statistics: Mean and Standard Deviations (in Parenthesis) of Cut and Uncut Girls in Senegal (continued)

	FGC	No FGC	All Sample
Kaolack	0.013 (0.111)	0.106 (0.308)	0.085 (0.279)
Thies	0.075 (0.264)	0.082 (0.274)	0.08 (0.272)
Louga	0.041 (0.199)	0.081 (0.273)	0.072 (0.259)
Fatick	0.065 (0.246)	0.081 (0.273)	0.077 (0.267)
Kolda	0.122 (0.327)	0.074 (0.262)	0.085 (0.279)
Matam	0.155 (0.362)	0.038 (0.192)	0.065 (0.246)
Kaffrine	0.011 (0.105)	0.076 (0.265)	0.061 (0.239)
Kedougou	0.065 (0.246)	0.033 (0.177)	0.04 (0.196)
Sedhiou	0.123 (0.329)	0.036 (0.187)	0.056 (0.23)
Observations	19,662	66,845	86,507

1.5.1 *Descriptive Statistics*

Table 1 presents a comprehensive summary of statistics comparing cut and uncut girls in Senegal. The table includes various variables related to the girls, their mothers, partners, wealth index, ethnicity, and region, along with their corresponding mean values and standard deviations. The aim is to provide insights into the differences between these groups across multiple dimensions. Overall, the table includes 19,662 observations of cut girls and 66,845 observations of uncut girls, totaling 86,507 observations.

The mean age at the time of the survey of cut girls is 6.243 years, while for uncut girls, it is lower at 5.352 years. Considering the entire sample, the mean age of girls is 5.554 years. When it comes to religion, the statistics indicate that 98.4% of cut girls belong to the Muslim religion, while for uncut girls, this percentage is slightly lower at 96.3% and in the entire sample a vast majority of girls, approximately 96.8% identify as Muslims. The table shows that 21.2% of cut girls reside in urban areas, while for uncut girls, this percentage is higher at 35.5% and in the entire sample, approximately 32.3% of girls live in urban areas.

The table also provides statistics related to mothers and partners. The mean age of mothers of cut girls is 34.124 years, whereas, for mothers of uncut girls, it is slightly lower at 33.173 years. Considering the entire sample, the mean age of mothers is 33.389 years. In terms of education, mothers of cut girls have an average of 0.839 years, while mothers of uncut girls have a higher average of 1.727 years of education. Overall, mothers in the entire sample have an average of 1.525 years of education. The variable "Mother cut", indicates whether the mother has undergone cutting. The statistics reveal that 98.5% of mothers of cut girls have been cut while for mothers of uncut girls, the percentage is considerably lower at 23.8%. For the entire sample, approximately 40.8% of mothers had been cut. The table shows that 95.1% of mothers of cut girls are married, while for mothers of uncut girls, this percentage is lower at 94.4%. For the entire sample, approximately 94.6% of mothers are married. The mean age of husbands/partners of cut girls is 47.096 years, while for husbands/partners of uncut girls, it is slightly lower at 45.206 years. Partners of cut girls have an average of 1.179 years of education, whereas partners of uncut girls have a higher average of 1.924 years. Overall, partners in the entire sample have an average of 1.701 years of education.

Furthermore, the table provides information on the wealth index, ethnicity, and region. The DHS data also provides a synthesized wealth index, which captures income and allows to document differences between cut and uncut girls. The wealth index is divided into quintiles, ranging from poorest to richest. The percentages indicate the distribution of cut and uncut girls across these quintiles. For example, 39.7% of cut girls belong to the poorest quintile, while for uncut girls, this percentage is lower at 25.3%. The distribution across the quintiles provides insights into the economic status of the girls' households. The table presents the distribution of cut and uncut girls across various ethnic groups in Senegal. For each ethnic group, the percentage of cut and uncut girls is provided. For example, 61.9% of cut girls belong to the Poular ethnic group, while for uncut girls, this percentage is lower at 25.2%. The ethnic distribution highlights the diversity within the study population. The table includes the distribution of cut and uncut girls across different regions of Senegal. Each region is represented by the percentage of cut and uncut girls. For example, 1.6% of cut girls reside in Dakar, while for uncut girls, this percentage is slightly higher at 7.9%.

The regional distribution provides insights into the geographical representation of the study sample. For instance, I assume that some of the disproportions of cut girls in Dakar are explained by the fact that urban areas typically have different social dynamics, access to information, and exposure to external influences, which can contribute to a lower prevalence of FGC. The lower percentage of girls who have undergone cutting in Dakar could be reflective of the urban-rural divide in cultural practices and awareness regarding FGC. The findings also show that the prevalence of FGC can vary across ethnic and cultural groups. Dakar, being a cosmopolitan city, is likely to have a more diverse population with a mixture of different ethnic groups, each with its own cultural practices. Some ethnic groups may have a lower prevalence or different attitudes towards FGC, which could contribute to the lower percentage of girls who have undergone cutting in Dakar.

To sum up, the analysis reveals an age difference between cut and uncut girls, suggesting that, on average, cut girls are older at the time of the survey. This finding suggests that the practice of FGC may occur at a later stage in a girl's life, potentially driven by the belief that being cut enhances their prospects in the marriage market and conveys positive signals to potential partners. The higher percentage of cut girls identifying as Muslims compared to uncut girls suggests that FGC is more prevalent within the Muslim community in the study population. This may indicate the influence of religious beliefs and cultural norms on the practice of FGC. The differences in urban and rural residence percentages between cut and uncut girls suggest potential variations in geographic location and access to resources. It could also be the case that monitoring any legislation against FGC is difficult in rural areas, and the cultural aspect tends to be more ingrained in the beliefs of communities living further away. The average years of education for mothers and partners reveal disparities between the two groups. It indicates a potential link between FGC and limited educational opportunities for girls. The same pattern is observed for partners, with uncut girls' partners having a higher average education level. The significant difference in the percentage of mothers who have undergone cutting indicates the intergenerational transmission of the practice. It suggests that mothers who have undergone FGC are more likely to have their daughters undergo the procedure as well. The distribution across wealth quintiles reveals differences in the economic status of households. This suggests a potential association between FGC and economic factors. The variations in the distribution of cut and uncut girls across different ethnic groups and regions reflect the diversity within the study sample. It highlights that the practice of FGC may be more prevalent in certain ethnic groups or regions. These different observations highlight the importance of including variables such as education, religion, geographic, and economic disparities in the model.

Table 2 presents summary statistics for various variables categorized by countries, specifically Senegal and Mali. It provides information on the mean values and standard deviations for each variable, offering insights into the characteristics of the main sample. The mean age of girls in Senegal is 5.554 years, while in Mali, it is slightly higher at 7.088 years. The overall mean age for the entire sample is 6.362 years. In Senegal, 22.7% of girls have undergone female genital cutting, whereas, in Mali, this percentage is significantly higher at 72.6%. Considering the entire sample, approximately 49% of girls have experienced cutting. In Senegal, 96.8% of girls identify as Muslims while in Mali, the percentage is slightly lower at 92.1%. For the entire sample, approximately 94.3% of girls belong to the Muslim religion. The table shows that 32.3% of girls in Senegal reside in urban areas, while in Mali, this percentage is lower at 25.7%. The mean age of mothers in Senegal is 34.124 years, and, in Mali, it is slightly lower at 32.765 years. In terms of education, mothers in Senegal have an average of 1.525 years, while in Mali, the average is lower at 0.838 years. In Senegal, 40.8% of mothers have been cut, and, in Mali, the percentage is significantly higher at 89.5%. The table shows that 94.6% of mothers in Senegal are married, while in Mali, this percentage is slightly higher at 97.2%. For the entire sample, approximately 95.9% of mothers are married. The mean age of husbands/partners in Senegal is 45.636 years, while in Mali, it is slightly lower at 44.722 years. Partners in Senegal have an average of 1.701 years of education, whereas, in Mali, the average is lower at 1.322 years. The statistics show that 31.9% of partners in Senegal work in the agricultural sector, while in Mali, the percentage is much higher at 55.5%. Considering the entire sample, approximately 44.3% of partners work in the agricultural sector. The table shows the percentages of girls belonging to each wealth quintile in Senegal and

Mali. For example, in Senegal, 28.6% of girls belong to the poorest quintile, while in Mali, this percentage is lower at 20.6%.

Table 2. Summary Statistics: Mean and Standard Deviations (in Parenthesis) by Countries

	Senegal	Mali	All Sample
Girl's age	5.554 (3.752)	7.088 (4.033)	6.362 (3.977)
Is the girl cut?	0.227 (0.419)	0.726 (0.446)	0.49 (0.5)
Religion (Muslim=1)	0.968 (0.177)	0.921 (0.269)	0.943 (0.232)
Area of residence (Urban=1)	0.323 (0.468)	0.257 (0.437)	0.288 (0.453)
Mother age	34.124 (7.229)	32.765 (7.279)	33.06 (7.322)
Mother education (Total yr.)	1.525 (3.173)	0.838 (2.328)	1.163 (2.782)
Mother cut	0.408 (0.491)	0.895 (0.306)	0.665 (0.472)
Mother Married	0.946 (0.227)	0.972 (0.166)	0.959 (0.198)
Occupation (Agric. Sector=1)	0.249 (0.433)	0.284 (0.451)	0.268 (0.443)
Husband/partner's age	45.636 (11.324)	44.722 (10.458)	45.146 (10.878)
Partner education (Total yr.)	1.701 (3.823)	1.322 (3.44)	1.494 (3.624)
Partner Occupation (Agric. Sector=1)	0.319 (0.466)	0.555 (0.497)	0.443 (0.497)
Ethnicity			
Wolof	0.319 (0.096)		
Poular	0.336 (0.486)		
Serer	0.131 (0.065)		
Mandingue	0.085 (0.38)		
Diola	0.037 (0.232)		
Soninke	0.022 (0.207)		
Other senegalese	0.031 (0.205)		
Other senegal	0.039 (0.208)		
Bambara		0.287 (0.287)	
Malinke		0.087 (0.087)	
Peulh		0.136 (0.136)	
Sarakole		0.128 (0.128)	
Sonrae		0.062 (0.062)	
Dogon		0.086 (0.086)	

Table 2. Summary Statistics: Mean and Standard Deviations (in Parenthesis) by Countries (continued)

	Senegal	Mali	All Sample
Tamacheck		0.033 (0.033)	
Senoufo		0.087 (0.087)	
Bobo		0.03 (0.03)	
Other Mali		0.065 (0.065)	
Region			
Dakar	0.064 (0.245)		
Ziguinchor	0.061 (0.239)		
Diourbel	0.086 (0.28)		
Saint-louis	0.08 (0.272)		
Tambacounda	0.087 (0.282)		
Kaolack	0.085 (0.279)		
Thies	0.08 (0.272)		
Louga	0.072 (0.259)		
Fatick	0.077 (0.267)		
Kolda	0.085 (0.279)		
Matam	0.065 (0.246)		
Kaffrine	0.061 (0.239)		
Kedougou	0.04 (0.196)		
Sedhiou	0.056 (0.23)		
Kayes		0.362 (0.362)	
Koulikoro		0.372 (0.372)	
Sikasso		0.393 (0.393)	
Egou		0.362 (0.362)	
Mopti		0.355 (0.355)	
Toumbouctou		0.203 (0.203)	
Gao		0.183 (0.183)	
Kidal		0.069 (0.069)	
Bamako		0.304 (0.304)	

Table 2. Summary Statistics: Mean and Standard Deviations (in Parenthesis) by Countries (continued)

	Senegal	Mali	All Sample
Wealth index			
Poorest (1^{st} Quintile)	0.286 (0.452)	0.206 (0.405)	0.258 (0.437)
Poorer (2^{nd} Quintile)	0.26 (0.439)	0.213 (0.41)	0.243 (0.429)
Middle (3^{rd} Quintile)	0.22 (0.414)	0.209 (0.407)	0.216 (0.412)
Richer (4^{th} Quintile)	0.143 (0.35)	0.198 (0.398)	0.162 (0.369)
Richest (5^{th} Quintile)	0.091 (0.288)	0.174 (0.379)	0.120 (0.325)
Observations	86,507	96,225	182,732

The differences observed between the subgroups in Senegal and Mali provide valuable insights into the varying contexts and characteristics of the two countries. The substantial difference in the prevalence of FGC between Senegal and Mali suggests that FGC is a reality in both countries, however, it is more common and deeply ingrained in Mali. The descriptive statistics of other variables also highlight the heterogenous composition of observations available in the sample. The variation in characteristics between different populations allows for better generalization of the results to similar contexts or populations. The differences between the two countries help establish their distinct characteristics and ensure that they represent separate populations. However, I will verify the validity of the parallel trend assumption in this particular context as there is a potential that the differences in characteristics between the two countries can influence their pre-treatment trajectories and potentially confound the estimation of the treatment effect.

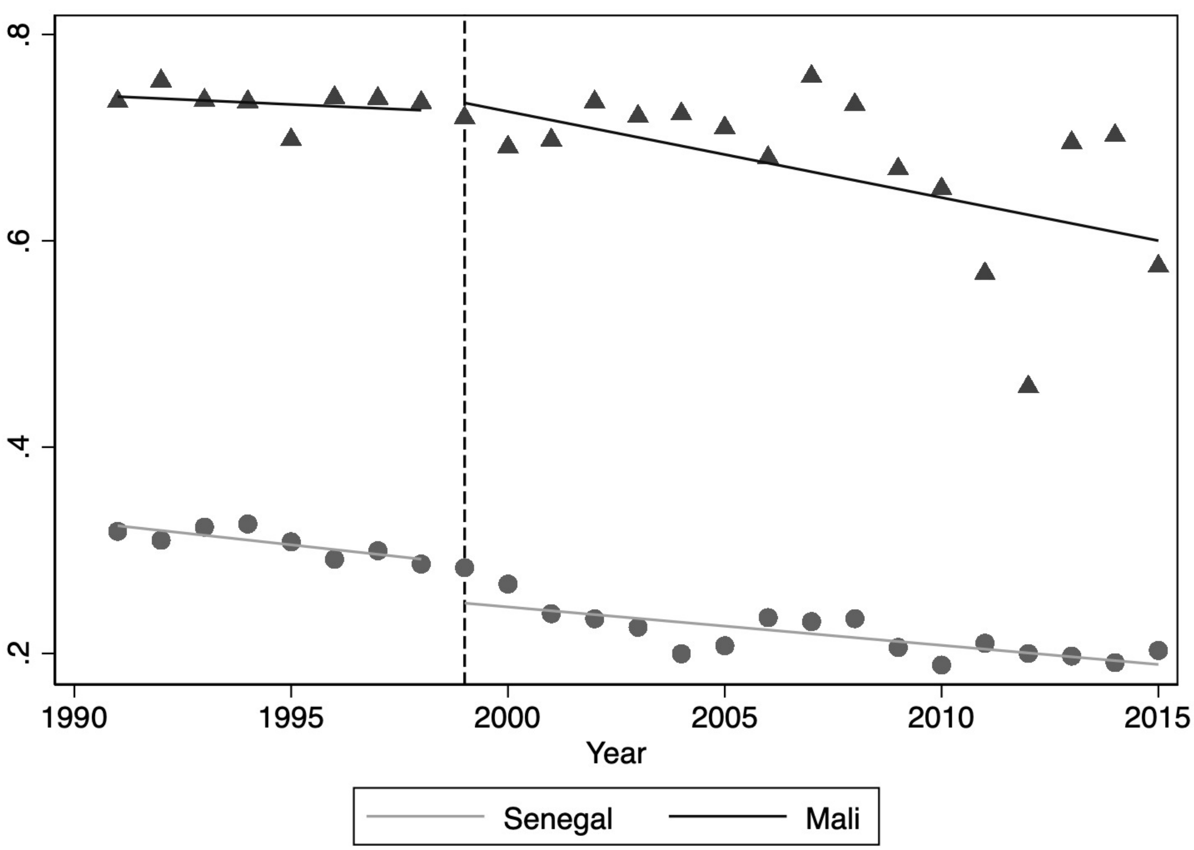
By combining the information from both tables, a difference-in-difference (DiD) analysis will provide insights into the causal effects of the adoption of the legal ban by comparing the changes in the prevalence of FGC over time between Senegal and Mali. In this study, the first stage estimates of a DiD analysis account for observed differences by incorporating the observable characteristics from tables 1 and 2. However, it is possible that other unobserved characteristics could have caused differences in the treatment and control groups' outcomes. To address this potential issue, I include a combined $urban/rural \times year$ fixed effects in the models, which helps to account for unobserved heterogeneity and obtain unbiased and precise estimates.

Before showing the results, of the DiD analysis, I provide a graphical representation of the trend in FGC for girls aged 0 to 14 in Senegal and Mali to visually demonstrate the parallel trend assumption. Figure 2 shows the trend of female genital cutting prevalence over time in both countries, specifically before and after the adoption of a law related to FGC. The graph illustrates that prior to the introduction of the law, the cutting trend in both Senegal and Mali follows a similar pattern. This similarity in the pre-treatment trends, which I will test statistically, is crucial for the validity of the DiD analysis. The parallel trend assumption assumes that, in the absence of the treatment (law adoption), the treatment and control groups would have experienced similar trends over time.

By observing similar patterns in the cutting trend for girls aged 0 to 14 in Senegal and Mali before the law, we can reasonably assume that this assumption holds. The parallel trend assumption is essential because it allows us to attribute the differences in the post-treatment period between the treatment and control groups to the treatment itself. If the cutting trend in Senegal and Mali had been substantially different before the law, it would suggest that other factors unrelated to the treatment may have influenced the outcomes. By establishing the parallel trends assumption, I can then examine the differential changes in female genital cutting prevalence between Senegal and Mali after the law adoption. This analysis enables the estimation of the causal effect of the law on female genital cutting, as any divergences in the cutting trend post-treatment can be attributed to the law.

In a DiD setting, Equation 1 provides a summary of the estimation method used. It includes both region and year-fixed effects in the model. The key assumption underlying the unbiased estimation of β_2 is that the trends in the outcomes (in this case, female genital cutting prevalence) for both countries (Senegal and Mali) are parallel before the law is enacted. I test this assumption using an event study. Figure 3 illustrates the results of this event study by plotting the coefficient and standard error estimates for all leads and lags. The point estimates and their 95 percent confidence intervals are shown in the graph. In the pre-adoption period, the leads coefficient of the treatment, denoted as γ_k for all $k \leq 1998$, is observed to be close to zero and not statistically significant. This indicates that there are no significant differences in the trend of female genital cutting prevalence between girls in Mali and Senegal before the legal ban. This finding is important because it establishes Mali as a suitable control group for Senegal in the post-adoption period. With no significant trend differences observed between the two countries prior to the law, any divergences in female genital cutting prevalence in the post-adoption period can be attributed to the adoption of the 1999 law in Senegal. This serves as the basis for identifying the causal impact of the law on the prevalence of female genital cutting.

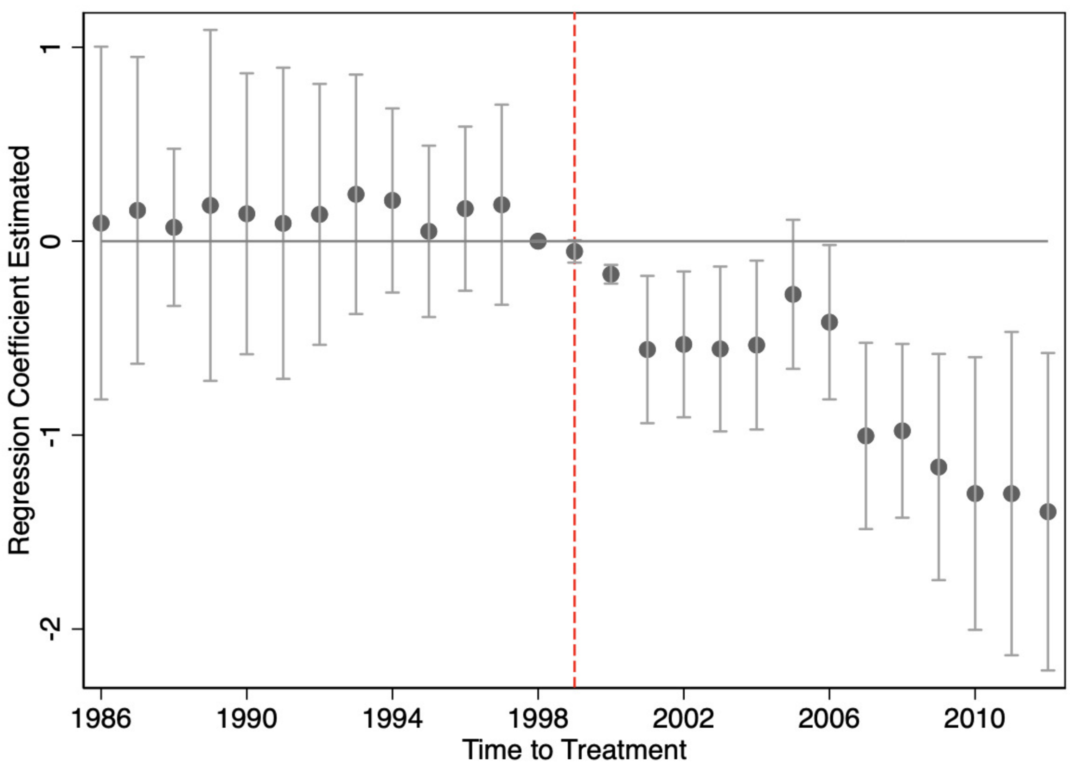
Figure 2. Female Genital Cutting Trend in Senegal and Mali



Notes: The markers in the circle shapes represent the average proportion of FGC in Mali and Senegal. The dotted black line represents the year 1999 when the law was passed

The lead coefficients of the treatment, i.e., γ_k for all $k \leq 1998$, are all essentially close to zero throughout the pre-adoption period, indicating no significant trend differences of FGC prevalence between girls in Mali and Senegal before the legal ban. Therefore, Mali serves as a suitable control group for Senegal in the post-adoption period, and the identification strategy should help identify the causal impact of the adoption of the 1999 law banning FGC on its prevalence.

Figure 3. Event Study of Female Genital Cutting Prevalence



Notes: The dotted circles are the point estimates for every year from 1986 to 2012 with 95 percent confidence intervals of FGC prevalence. The solid red line represents the year 1999 when the law was passed

In summary, the event study and the leads coefficient analysis provide evidence supporting the assumption of parallel trends in female genital cutting prevalence between Senegal and Mali before the law's adoption. This strengthens the identification strategy and allows for the estimation of the causal impact of the law banning female genital cutting in Senegal.

1.5.2 *First Stage Results: Effect of the Legal Ban on the Prevalence of Female Genital Cutting*

Table 3 provides the answer to the first research question: how has the legal ban influenced the prevalence of FGC? It presents the estimates for the hazard of FGC among girls aged 0 to 14 in Senegal. The table includes three columns, each presenting different specifications of the estimation model. The coefficient estimates for the interaction term $Senegal \times Post$ capture the differential effect of the law adoption on FGC prevalence in Senegal compared to Mali. The negative coefficient of -0.947 in column (1) suggests that the law has a further reducing effect on FGC prevalence in Senegal after its adoption in 1999. This coefficient indicates that the law has a significant impact on reducing FGC prevalence among girls in Senegal compared to Mali. The specification in column (1) includes a full set of various control variables listed in tables 1 and 2 to account for factors that may confound the prevalence of FGC. These variables are age dummies to account for differences across age groups, and family background variables such as education, region, wealth, and religion. Also "Year FE" denotes the inclusion of year-fixed effects, which capture time-specific factors that may affect FGC prevalence. "Region FE" indicates the inclusion of region-fixed effects, which control for unobserved heterogeneity across regions. And "Survey FE" denotes the inclusion of survey fixed effects, which capture any idiosyncrasies related to the data collection process. The standard errors reported in parentheses provide information about the precision of the estimates. The estimates are statistically significant at the 1% level (indicated by ***) in all specifications, indicating robust and reliable results. Comparing the AIC and BIC values, I observe that the model with all fixed effects (FE) (year, region, and survey) has the lowest AIC and BIC values among the three models. Therefore, based on the AIC and BIC criteria, the model in column (1) is considered the best model thus indicating the importance of controlling for year, region, and survey fixed effects.

The adoption of the law in 1999 has created a legal deterrence effect, making the practice of FGC riskier for those performing or supporting it. The law has increased the awareness and understanding of the consequences of FGC among communities, leading to a decrease in social acceptance and support for the practice. The legal ban on FGC could have started a shift in social norms and attitudes toward the practice. As the law communicated a clear message that FGC is illegal, it may have influenced community perceptions, leading to a gradual change in FGC. This change or fear generated by the existence of the law could have contributed to the reduction in FGC prevalence. The legal prohibition on FGC has prompted increased public awareness campaigns to highlight the penalty and negative consequences associated with the practice. These efforts could have enhanced knowledge and understanding among community members, leading to a decrease in the prevalence of FGC. The estimates in Table 3 provide quantitative evidence of the impact of the law, but further analysis would be needed to gain a deeper understanding of the underlying dynamics and processes behind the finding.

To further explore the estimates found above, Table 4 presents the marginal effect of the model in Table 3. The table presents the marginal effect estimates of the impact of the 1999 law on the prevalence of FGC among girls aged 0 to 14 in Senegal. The interaction term $Senegal \times Post$ captures the differential effect of the law adoption on FGC prevalence in Senegal compared to Mali. The results for the preferred model in column (1) showing the negative coefficient -0.124 suggests that the law has a further reducing effect on the hazard of FGC among girls in Senegal after its adoption in 1999. This coefficient indicates that the law leads to a reduction of 12.4 percentage points in the likelihood of FGC among girls in Senegal. The standard errors reported in parentheses provide information about the precision of the estimates. The estimates are statistically significant at the 1% level (indicated by ***) in all specifications, indicating robust and reliable results. The inclusion of fixed effects, such as year, region, and survey, in the model helps control for time-varying factors and unobserved heterogeneity. The model specifications in columns (2) and (3) remove some of these fixed effects, and clearly show the importance of adding the different fixed effects as an additional layer to obtain efficient estimates.

The findings suggest that the legal ban has a substantial impact on reducing the prevalence of FGC. These results have significant implications for policy development and highlight the importance of continuing efforts to enforce legal measures to eradicate the practice. Besides, the results offer valuable insights for future research aimed at understanding the factors contributing to the demand for FGC and informing efforts to design effective interventions to eliminate this practice.

Table 3. First-Stage Estimates Logit Coefficient: Impact of the 1999 Law on the Prevalence of Female Genital Cutting for Girls (Ages 0-14) in Senegal

	(1)	(2)	(3)
$Senegal \times Post$	-0.947***	-0.674***	-1.285***
	(0.014)	(0.014)	(0.011)
Mean	0.693	0.693	0.693
Year FE	Yes	No	No
Region FE	Yes	Yes	No
Survey FE	Yes	No	Yes
Observations	1,051,213	1,051,213	1,051,213
BIC	851931.011	862659.234	866394.677
AIC	851148.882	862043.012	866039.164

The table presents estimates for the hazard of FGC among girls aged 0-14. The dependent variable is a binary variable taking value 1 if the girl has undergone FGC and 0 if not. The variable Post is a dummy variable that takes the value 1 for years in and after 1999 (the year of the legal ban's adoption). The variable Senegal is a binary variable that takes the value 1 if the girl lives in Senegal and 0 otherwise. The control variables include girls' age dummies and family background variables such as education, region, wealth, and religion. The estimation in column (1) includes a $urban/rural \times year$. Robust standards errors clustered at the region level are reported in parentheses.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 4. Marginal Effect of the Impact of the 1999 Law on the Prevalence of Female Genital Cutting for Girls (Ages 0-14) in Senegal

	(1)	(2)	(3)
$Senegal \times Post$	-0.124***	-0.089***	-0.171***
	(0.002)	(0.002)	(0.002)
Mean	0.693	0.693	0.693
Year FE	Yes	No	No
Region FE	Yes	Yes	No
Survey FE	Yes	No	Yes
Observations	1,051,213	1,051,213	1,051,213

The table presents the marginal effect of the 1999 law banning FGC on its prevalence for girls aged 0-14. The dependent variable is a binary variable for FGC, with a value of 1 if the girl is cut and 0 otherwise. Post is a dummy variable that takes a value of 1 for years in and after 1999, which is the year of the adoption of the FGC ban. Senegal is a binary variable that equals 1 if the girl lives in Senegal and 0 otherwise. The control variables consist of girls' age dummies, and family background characteristics such as education, region, wealth, and religion. The estimation in column (1) includes a $urban/rural \times year$ trend. Robust standards errors clustered at the region level are reported in parentheses.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

1.5.3 *Heterogeneous Impact of the Legal Ban*

This section explores the factors that contribute to the demand for FGC by introducing additional levels of variation. The research question focuses on understanding the role of legal bans in explaining differences in characteristics within specific groups, particularly in terms of residence, wealth, and education. The goal is to address the following research question: What factors underlie the demand for female genital cutting?

To investigate this question, the analysis examines how the impact of the legal ban on the prevalence of FGC varies across different socioeconomic and household factors. Specifically, I assess whether the effect of the ban differs depending on factors such as the settlement type (rural or urban), the age of girls, and household wealth.

Previous research has indicated significant geographical variability in the prevalence of FGC, suggesting that the practice may be more prevalent in rural compared to urban areas. Moreover, low-income households have been found to have incentives to engage in FGC. By considering these factors, I aim to provide insights into how legal bans interact with socioeconomic and household characteristics in shaping the demand for FGC.

The findings from this analysis have important implications for policy decisions regarding FGC. By examining the differential impact of legal bans across various factors, policymakers can gain a deeper understanding of the underlying factors driving the demand for FGC. This knowledge can inform the development of targeted interventions and policies aimed at reducing the prevalence of FGC in specific subgroups or regions.

The first set of heterogeneous effect estimates is obtained using Equation 3. To introduce additional variation and account for income levels, I utilize drought events as a proxy, assuming that it remains constant during each year a girl is at risk of undergoing cutting. The findings reported in Table 6 provide novel insights into the existing body of literature regarding the factors contributing to the prevalence of FGC. The table presents the first-stage estimates of the combined effects of the 1999 law banning FGC and drought on the prevalence of FGC in Senegal for girls aged 0 to 14. The coefficients in each column represent the marginal effect estimates and I also provide the corresponding hazard coefficients of being cut in table 5. I only interpret the marginal estimates in the preferred specification in column (1) of table 6. The coefficient for the variable Drought is 0.033, and it is statistically significant at the 5% level. This suggests that drought events are associated with a higher probability of being cut for girls aged 0 to 14 in Mali. The positive coefficients indicate the effect of drought on FGC prevalence. In other words, during periods of drought associated with a loss in households' revenue, there is an increase in the likelihood of girls being cut.

Table 5. First-Stage Estimates - Logit Coefficients: Effect of the 1999 Law and Droughts on Female Genital Cutting Prevalence for Girls (Ages 0-14) in Senegal

	(1)	(2)	(3)
Drought	0.021*	0.022*	0.028**
	(0.010)	(0.009)	(0.010)
$Senegal \times Post$	-1.204***	-1.237***	-1.522***
	(0.013)	(0.013)	(0.011)
$Post \times Drought$	0.152***	0.191***	0.246***
	(0.009)	(0.019)	(0.027)
$Senegal \times Drought$	-0.759***	-0.745***	-0.711***
	(0.018)	(0.018)	(0.018)
$Senegal \times Post \times Drought$	1.350***	1.394***	1.418***
	(0.032)	(0.032)	(0.031)
Mean	0.693	0.693	0.693
Year FE	Yes	No	No
Region FE	Yes	No	Yes
Survey FE	Yes	Yes	No
Observations	1,051,213	1,051,213	1,051,213

The table estimates the hazard of being cut for girls (ages 0 - 14). The dependent variable is a binary variable coded 1 if the girl is cut and 0 otherwise. The dummy variable Post takes a value of 1 for the years 1999 and after, which is the year of legal adoption. Another binary variable, Senegal, equals 1 if the girl resides in Senegal and 0 otherwise. Additionally, the model includes control variables such as girl age dummies, and family background variables including education, region, wealth, and religion. The estimation in column (1) includes a $urban/rural \times year$. Robust standards errors clustered at the region level are reported in parentheses.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 6. Marginal Effects of the 1999 Law and Droughts on the Prevalence of Female Genital Cutting for Girls (Ages 0-14) in Senegal

	(1)	(2)	(3)
Drought	0.033***	0.043***	0.042***
	(0.002)	(0.002)	(0.002)
$Senegal \times Post$	-0.445***	-0.525***	-0.531***
	(0.001)	(0.001)	(0.001)
$Post \times Drought$	0.021***	0.037***	0.033***
	(0.004)	(0.003)	(0.003)
$Senegal \times Drought$	-0.361***	-0.436***	-0.437***
	(0.003)	(0.002)	(0.002)
$Senegal \times Post \times Drought$	0.465***	0.501***	0.507***
	(0.006)	(0.005)	(0.005)
Mean	0.693	0.693	0.693
Year FE	Yes	No	No
Region FE	Yes	No	Yes
Survey FE	Yes	Yes	No
Observations	1,051,213	1,051,213	1,051,213

The table presents coefficients representing the marginal effect of the 1999 law banning FGC and droughts on FGC prevalence for girls aged 0-14. The dependent variable is a binary variable coded 1 if the girl is cut and 0 otherwise. The dummy variable Post takes a value of 1 for the years 1999 and after, which is the year of legal adoption. Another binary variable, Senegal, equals 1 if the girl resides in Senegal and 0 otherwise. Additionally, the model includes control variables such as girl age dummies, and family background variables including education, region, wealth, and religion. The estimation in column (1) includes a $urban/rural \times year$. Robust standards errors clustered at the region level are reported in parentheses.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

The coefficient for the interaction between Senegal and the Post variable is -0.445, and it is statistically significant at the 1% level. This negative coefficient indicates that the legal ban implemented in 1999 has significantly reduced the effect on the prevalence of FGC among girls in Senegal. This result corresponds to the previously obtained in the model without the "Drought" variable. It shows that this new specification recovers the expected results of the impact of the 1999 law on the prevalence of FGC. The coefficient for the interaction between the Post variable and Drought is 0.021, and it is statistically significant at the 1% level. This positive coefficient suggests that during the post-ban period, the occurrence of drought events is associated with an increase in the likelihood of FGC in Mali. The coefficient for the interaction between Senegal and Drought is -0.361, and it is statistically significant at the 1% level. This negative coefficient indicates that living in Senegal and experiencing drought events are associated with a lower likelihood of FGC compared to living in Mali.

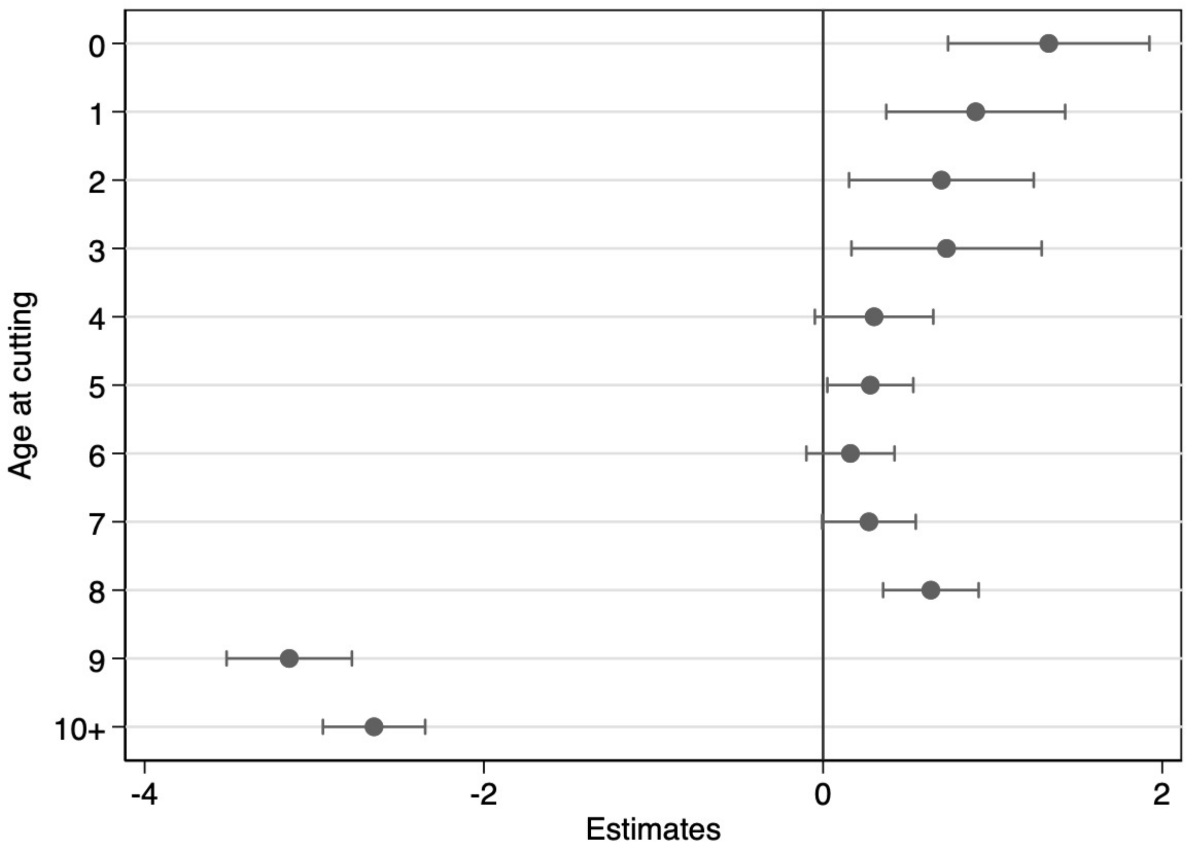
The coefficient for the triple interaction of Senegal, Post, and Drought is 0.465, and it is statistically significant at the 1% level. This positive coefficient suggests that the combined effect of living in Senegal, the post-ban period, and drought events positively affects the prevalence of FGC. It shows that the impact of the law and drought on FGC prevalence is higher when they occur together. These results provide insights into the impact of the legal ban on FGC and how it interacts with drought events in Senegal. The legal ban has a significant reducing effect on FGC, but the occurrence of drought events during the post-ban period can increase the likelihood of FGC so much as to eliminate the effect of the law change. Precisely, living in Senegal and experiencing drought events are associated with a lower likelihood of FGC prior to 1999. But the combined effect of living in Senegal, and drought events positively affects the prevalence of FGC after the law change in 1999.

The law had a significant impact in reducing FGC prevalence in Senegal. However, during periods of drought, when households experienced a loss in income, the effectiveness of the law in preventing FGC appears to be compromised. This is supported by the positive coefficient and magnitude for the "Post x Drought" term, which suggests that the impact of drought on FGC prevalence is more pronounced after the implementation of the law. the results suggest that while the law has a significant negative effect on FGC prevalence in Senegal, the presence of drought, in combination with the law, can lead to an increase in FGC prevalence. This highlights the importance of considering contextual factors, such as economic conditions, when assessing the effectiveness of interventions aimed at reducing FGC. Further, it emphasizes the need for targeted efforts during challenging periods, particularly when households face income shock, to ensure continued progress in combating the practice of FGC.

According to the findings, I argue that the practice of FGC in households is driven by the belief that it enhances marriage prospects and signals positive attributes to the community. I will confirm this assumption later in section 2.5.3 of the paper by looking at the dynamics of FGC on the marriage market. The households respond to drought events, which they likely interpret as a loss of income, by engaging in FGC with the expectation of improving future marriage outcomes for their girls and potentially benefiting the entire household. Despite the increased costs associated with the legal ban on FGC, parents weigh the potential future benefits against the opportunity costs and continue to practice FGC. This finding aligns with a study by Corno et al. (2020) that also found a link between drought-induced income shocks and child marriage. However, it is important to note that the first-stage estimations in the current study focus on young girls who are not likely to be considered marriageable in the near future. Therefore, the results suggest that parents are engaging in the practice of FGC prematurely, preparing their daughters for marriage at an early age.

The second heterogeneity analysis aims to investigate the joint impact of the legal ban on FGC and drought shocks on the girls' age-specific hazard of being cut. To conduct this analysis, I perform a total of 11 separate regressions with the same specifications for each potential age ranging from 0 to 14 years old. Each potential age is represented as a dummy variable, with 14 years old being the reference category. Due to a small sample size, girls aged 10 years old and above are combined into a single group. I calculate the estimates and confidence intervals using equation 3 for each potential age at which cutting may occur. Figure 4 plots the coefficients and the confidence intervals for the interaction $Senegal \times Post \times Drought$. The estimates for ages 0 to 8 years old were predominantly positive and statistically significant. This indicates that even after the implementation of the law, households are more likely to cut girls aged 0 to 8 years old to FGC when they experience income shocks, particularly in the presence of drought events. The results suggest that the practice of FGC is prevalent and tends to occur at an early age for these girls, particularly in the presence of drought events. The positive log-odds ratio suggests a higher probability of FGC for younger girls within this age group.

Figure 4. Odds Ratio of Cutting at Different Ages



Notes: The odds ratio is estimated from a simple discrete-time hazard model using a standard logistic regression model. The coefficients are from the interaction of Senegal, Post (=1 if the year of birth $\geq$ 1999), and whether a girl has experienced a drought. The base age is 14 years old. The dashed lines are confidence intervals within 95 percent for the estimates

However, as girls progress in age and reach nine years old and above, the log-odds ratio of undergoing FGC decreases. This implies that the likelihood of FGC decreases for girls aged nine and older compared to the younger age group, even when confronted with drought shocks. These findings suggest that as girls become older, they are less likely to undergo FGC even when drought occurs.

The findings suggest that the likelihood of undergoing FGC varies across different age groups, following an age gradient. Among girls in the youngest age group (0 to 8 years old), the study reveals the highest hazard of experiencing FGC. However, as girls grow older, the hazard of undergoing FGC declines. This finding is consistent with the understanding that FGC is often performed during early childhood. It suggests that interventions and efforts to prevent FGC should particularly focus on younger girls, as they are more vulnerable to the practice. Furthermore, the results highlight the potential interaction between income shocks, represented by drought events, and the likelihood of FGC. The fact that income shocks have a stronger impact on girls aged 0 to 8 years old suggests again that economic factors play a significant role in influencing decisions regarding FGC within households. Overall, the findings highlight the age-specific patterns of FGC prevalence in relation to both the legal ban and the occurrence of drought. The results suggest that the risk of FGC is higher for younger girls, they underscore the importance of age-specific approaches in addressing the practice for girls at an early age.

The third heterogeneity in table 7, presents the results of the analysis, examining the impact of the 1999 law on the prevalence of FGC in Senegal for girls aged 0 to 14. The analysis focuses on two dimensions of heterogeneity: the area of residence (urban vs. rural) and wealth (poorest, middle, and richest). The results in marginal effects magnitude provide insights into how these factors influence the prevalence of FGC. In the urban area, the coefficient of -0.120 indicates that the combined effects of the law, post-law period, and drought shocks have a statistically significant negative impact on the prevalence of FGC among girls living in urban areas. This means that urban girls are less likely to be subjected to FGC when they face the combined effects of the law, post-law period, and drought shocks compared to other urban girls who do not experience these factors. In the rural area, the coefficient of -0.124 suggests that the combined effects of the law, post-law period, and drought shocks have a statistically significant negative impact on the prevalence of FGC among girls living in rural areas. This implies that the combined effects of the law, post-law period, and drought shocks are not that different from rural to urban areas.

In terms of the income distribution of girls' households, the results reveal interesting patterns. The findings related to wealth indicate that the impact of the law, post-law period, and drought shocks on the prevalence of FGC varies among different wealth groups in Senegal. I find that the impact of the combined factors on FGC prevalence is positive for the poorest wealth group. This means that in the presence of drought shocks, the likelihood of FGC increases for girls in the poorest wealth group in Senegal during the post-law period. For the middle and richest wealth groups, the likelihood of FGC slightly decreases for girls. Among low-income girls (poorest wealth quintile), there is an increase of 13.4 percentage points in the prevalence of FGC after the ban is implemented and in the presence of an income shock. This suggests that despite the legal ban and the associated costs, low-income households continue to engage in the practice of FGC, indicating the persistence of traditional norms and values that prioritize the practice. The poorest households may face economic challenges. They may also face higher societal pressure to conform to traditional practices. These factors may contribute to a higher prevalence of FGC among the poorest girls. On the other hand, middle-income girls (middle wealth quintile) experience a decrease of 2.7 percentage points in the prevalence of FGC, indicating a partial shift away from the practice. The most significant decrease is observed among high-income girls (richest wealth quintile), with a substantial reduction of 26.4 percentage points. The findings indicate that higher-income households display a greater level of responsiveness to the legal ban on FGC, resulting in a higher likelihood of abandoning the practice. This observation can be partly explained by the fact that affluent households have the means to delay the procedure for their daughters. It is important to note that these are general explanations and the actual reasons for the observed results may be influenced by a range of factors specific to the context and culture of Senegal. Further research and analysis would be needed to explore these factors in more depth and understand the nuances of FGC prevalence within different wealth quintiles, especially the richest.

The findings shed light on the intricate dynamics surrounding the prevalence of FGC and the effects of the legal ban in the context of economic difficulties faced by households. Although the ban has contributed to a decline in FGC rates in both urban and rural regions, it appears that low-income households persist in practicing FGC despite the legal prohibition and its associated costs. This suggests that economic factors may contribute to the perpetuation of FGC within certain income brackets.

In certain societies where FGC is prevalent, the practice is often associated with cultural and social norms surrounding marriage and dowry customs. In these contexts, FGC may be seen as a prerequisite for marriage and a means to enhance a girl's eligibility for marriage. Poor-income households, despite facing economic hardship, may perceive FGC as a strategy to increase their daughters' chances of securing a marriage proposal and, consequently, a bride price. For families living in poverty, the bride price can represent a significant economic benefit. It serves as a form of wealth transfer from the groom's family to the bride's family, providing financial support and potentially improving their economic standing. The bride price can help alleviate financial burdens and provide resources for the family, such as income, livestock, or other assets. In this context, poor-income households may view FGC as an investment in their daughters' future and a means to improve their economic situation. They may prioritize the potential economic gains from the bride price over the immediate economic hardship they face. The practice of FGC, despite economic challenges, may be driven by the belief that undergoing FGC increases the perceived value of their daughters in the marriage market, leading to higher bride prices and better economic prospects for the family.

To effectively address the prevalence of FGC, policymakers should develop targeted interventions that specifically cater to the unique needs and challenges faced by low-income households. By tailoring interventions to address the socioeconomic circumstances of these communities, it is more likely that the practice of FGC can be effectively reduced in such contexts.

Table 7. Heterogeneous Impact of the 1999 Law and Droughts on the Prevalence of Female Genital Cutting for Girls (Ages 0-14) in Senegal

	Area of Residence		*Wealth*		
	Urban	Rural	Poorest	Middle	Richest
	(1)	(2)	(3)	(4)	(5)
$Senegal \times Post \times Drought$	-0.120***	-0.124***	0.134***	-0.027***	-0.264***
	(0.004)	(0.002)	(0.022)	(0.008)	(0.058)
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Survey FE	Yes	Yes	Yes	Yes	Yes
Observations	1,035,532	1,035,532	1,035,532	1,035,532	1,035,532

The table reports the coefficients of the marginal effects and standard errors from estimating equation 3 of different characteristics on FGC prevalence for girls (ages 0 - 14). The dependent variable is a binary variable for cutting, coded 1 if the girl is cut and 0 otherwise. Post is a dummy variable that takes value 1 for years in and after 1999 (the adoption year). Senegal is a binary variable that equals 1 if the girl lives in Senegal and 0 otherwise. The control variables are girl age dummies; family backgrounds such as education, region, wealth, and religion. All specifications contain a $region \times year$ trend. Robust standards errors clustered at the region level are reported in parentheses..
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

1.6 Sensitivity Analysis

In the subsequent analysis, I conduct various falsification exercises to provide more robustness checks for the parallel trend condition and to examine the absence of anticipation effects.

For the first exercise, I hypothetically assign the legal change to the years 1995, 1996, 1997, and 1998, and restrict the analysis to girls born prior to the implementation of the legal ban in 1999. This placebo check aims to assess whether the effect observed in the main analysis could be attributed to pre-law differential trends. The results of this exercise are presented in Table 8 and provide support for the argument that the effect observed in the main analysis is not driven by pre-law differential trends. The estimated coefficients were both statistically insignificant and of minimal magnitude, suggesting that the evolution of the outcomes did not differ between the treated and control groups before the ban's enactment. Taken together, these falsification exercises provide strong evidence in support of the main findings that the legal ban has a significant impact on reducing the prevalence of FGC. These results have important policy implications and highlight the importance of continued efforts to enforce legal measures aimed at eliminating this practice. Furthermore, the findings contribute to the existing literature on the factors contributing to the demand for FGC and can inform the development of effective interventions.

Table 8. Falsification Tests for the Prevalence of Female Genital Cutting for Girls (Ages 0-14) in Senegal

	Falsification: Fake Adoption Years			
	(1995)	(1996)	(1997)	(1998)
$Senegal \times Post \times Drought$	0.009	0.006	-0.004	0.002
	(0.004)	(0.021)	(0.028)	(0.014)
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Survey FE	Yes	Yes	Yes	Yes
Observations	1,054,110	1,054,110	1,054,110	1,054,110

The table provides estimates for the hazard of FGC for girls aged 0 to 14 years. The dependent variable is a binary variable representing whether the girl has undergone FGC, coded as 1 if she has been cut and 0 otherwise. The variable Post is a dummy variable that takes a value of 1 for the years after the fake adoption years mentioned in the table. The variable Senegal is a binary variable that equals 1 if the girl lives in Senegal and 0 otherwise. The control variables include age dummies for the girls, as well as family background variables such as education, region, wealth, and religion. Robust standards errors clustered at the region level are reported in parentheses.
*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

1.7 Conclusion

The analysis presented in this study focuses on examining the impact of the 1999 legal ban on FGC on its prevalence in Senegal. The first stage of the analysis explores the effect of the legal ban by estimating the hazard of FGC among girls aged 0 to 14 in Senegal. The hazard coefficient of -0.947 indicates that the law has had a significant impact on reducing FGC prevalence in Senegal after its adoption in 1999. The findings provide quantitative evidence of the impact of the law in reducing FGC prevalence. The legal ban implemented in 1999 has created a legal deterrence effect, making the practice of FGC riskier for those performing or supporting it. The law has increased awareness and understanding of the consequences of FGC among communities, leading to a decrease in social acceptance and support for the practice. The clear message communicated by the law that FGC is illegal may have influenced community perceptions and gradually changed social norms and attitudes toward the practice. Furthermore, the legal prohibition on FGC has potentially increased public awareness campaigns highlighting the penalties and negative consequences associated with the practice. These efforts have likely enhanced knowledge and understanding among community members, contributing to a decrease in the prevalence of FGC.

To understand the factors behind the demand for FGC, I explore the effectiveness of the legal ban on FGC in specific household contexts. I introduce an additional variation by incorporating drought events as a secondary source of exogenous variation. Droughts can affect economic conditions, and households facing income shocks may be more likely to engage in FGC due to financial constraints or as a coping mechanism. By exploiting this exogenous variation, the study provides further evidence of the effectiveness of the legal ban on FGC prevalence. The analysis findings make valuable new contributions to the existing literature on the factors influencing the prevalence of FGC. I find that drought events are associated with a higher probability of girls being cut in Senegal. This implies that during periods of drought, which are associated with a loss of household income, there is an increased likelihood of FGC. This finding highlights the importance of considering contextual factors such as economic conditions when assessing the impact of legal measures on FGC prevalence. Furthermore, I investigate how the effect of the ban varies across different socioeconomic and household factors such as urban, rural, wealth, and education. Previous research has highlighted geographical variability in the prevalence of FGC, with rural areas having a higher prevalence compared to urban areas. Low-income households have also been found to have incentives to engage in FGC. The results show that the practice of FGC is prevalent and tends to occur at an early age for these girls, particularly in the presence of drought events. The likelihood of cutting increases for girls in the poorest wealth group in Senegal during the post-law period. These different factors provide insights into how legal bans interact with socioeconomic and household characteristics in shaping the demand for FGC.

Chapter 2: Effect of Female Genital Cutting on Health and Education Outcomes

2.1 Introduction

Female Genital Cutting (FGC) is a deeply rooted cultural practice with significant implications for the health and well-being of women and girls worldwide (Vissandjée et al., 2014). Its prevalence in many societies poses a challenge to public health and calls for a comprehensive understanding of its consequences (Toubia, 1994). In Senegal, the 1999 law banning FGC represented a major policy intervention aimed at curbing this practice. It provides a framework that allows to examine the impact of FGC on health and education. In fact, establishing the direct effect of FGC on health and education outcomes remains challenging due to potential endogeneity and omitted variable biases. This chapter aims to contribute to the literature by investigating the effect of FGC on health and education outcomes. To overcome the challenges associated with endogeneity and omitted variable biases, I employ an instrumental variable approach using the results of the first stage estimation in the previous chapter . Specifically, I leverage the exogenous variation provided by the interaction between the 1999 law banning FGC and the occurrence of droughts, which I show affects the prevalence of FGC. The first stage estimation estimates the hazard of FGC for girls aged 0 to 14, accounting for various control variables, including age, family background characteristics (education, region, wealth, and religion), and fixed effects to control for time-varying factors and unobserved heterogeneity across regions. The results of this first stage analysis demonstrate the differential impact of the law and drought on the prevalence of FGC in Senegal, providing a robust basis for instrument construction.

Using the instrument derived from the first stage estimation, I proceed to estimate the causal effect of FGC on health and education outcomes among women and girls. These outcomes include measures such as maternal health (ever experienced a pregnancy termination or a c-section at the time of the survey), a measure of health utilization, and educational attainment. By employing a two-stage least squares (2SLS) regression framework, I can address the endogeneity concerns associated with FGC, providing more reliable estimates of the causal effects.

The findings from this analysis will contribute to the understanding of the consequences of FGC on health and education outcomes. It will inform policymakers and stakeholders about the potential long-term effects of this practice and help design effective interventions to mitigate its negative impact. Furthermore, the study will provide insights into the broader debate surrounding the eradication of FGC and highlight the importance of policy measures and social interventions in promoting the well-being of women and girls.

Overall, this chapter employs a rigorous instrumental variable approach to estimate the causal effects of FGC on health and education outcomes. By leveraging the exogenous variation provided by the 1999 law banning FGC and drought occurrences, we aim to contribute to the existing literature and provide valuable insights into the consequences of this harmful practice, ultimately informing policy discussions and interventions aimed at eliminating FGC and promoting the well-being of women and girls in Senegal.

2.2 Overview of the Effect of Female Genital Cutting on Health and Education

Female genital cutting is a widespread practice that involves the partial or total removal of the external female genitalia for non-medical reasons. Despite efforts to eradicate FGC, it remains prevalent in many countries, particularly in Africa and the Middle East. This review aims to summarize the current knowledge about the health and education effects of FGC on girls and women.

One of the most serious health consequences of FGC is obstetric complications. In a study conducted in Sudan, Almroth et al. (2005) found that women who had undergone FGC were more likely to experience primary infertility than those who had not. Gage et al. (2012) also found that women who had undergone FGC had higher fertility rates, lower contraceptive use, and more adverse pregnancy outcomes than those who had not. In addition to obstetric complications, FGC can also cause a range of immediate and long-term physical and psychological health problems. Berg and Denison (2013) conducted a realist synthesis of controlled studies and identified several factors that influence the effectiveness of interventions aimed at preventing FGC. They concluded that interventions should address the cultural and social factors that contribute to the persistence of the practice, as well as provide education and support for affected individuals. Chibber et al. (2011) reported that FGC can lead to obstetric complications such as prolonged labor, perineal tears, and obstructed labor. The authors also highlighted the psychological consequences of FGC, including depression, anxiety, and post-traumatic stress disorder (PTSD). In a similar vein, Abdulcadir et al. (2011) discussed the immediate and long-term physical and psychological health effects of FGC, emphasizing the need for appropriate care and management of affected individuals.

Finally, FGC has been linked to increased risk of infection and other health problems. Kaplan et al. (2014) reported that women who had undergone FGC were more likely to experience urinary tract infections, bacterial vaginosis, and sexually transmitted infections (STIs) than those who had not. In a study conducted in Somalia, Gele et al. (2016) found that women who had undergone FGC had higher rates of cervical cancer and other gynecological problems. FGC has a range of negative health consequences for women, including obstetric complications, physical and psychological health problems, sexual dysfunction, and an increased risk of infection. Efforts to eradicate FGC should focus on addressing the cultural and social factors that contribute to its persistence, as well as providing education and support for affected individuals.

There is a significant connection between FGC, education, and marriage outcomes for girls and women. Research consistently demonstrates that FGC is linked to lower levels of educational achievement among women. Those who have undergone FGC are less likely to receive a formal education, exhibit lower literacy rates, and have fewer years of schooling compared to uncut women. Within certain communities, FGC is regarded as a traditional rite of passage, symbolizing the transition from childhood to adulthood and marriage.

As evidenced by the present study, FGC tends to increase the likelihood of marriage while simultaneously reducing investments in education. Parents make decisions regarding FGC based primarily on the financial incentives associated with the practice. If the cost of FGC outweighs the cost of educating their daughters, parents are more inclined to choose the former. Consequently, educational opportunities for girls are diminished as parents allocate resources towards pre-marital investments.

Conversely, households may opt to abandon the practice if the risks and financial losses associated with FGC become more prevalent. In such cases, parents recognize that prioritizing education for their daughters represents a more advantageous long-term investment. As the cost of FGC rises, parents are more likely to invest in education to secure better opportunities for their daughters.

On the other hand, education is a key factor in the fight against FGC, as it can empower individuals and communities to reject the practice. A study conducted in Mali by Mackie and LeJeune (2008) found that education was the most important factor associated with the abandonment of FGC. In a study conducted among medical students in Egypt, it was found that approximately 58.7% of female students expressed a positive stance regarding the discontinuation of the practice. (Abolfotouh et al., 2015). Another study conducted by Alo et al. 2011, in Nigeria, also stated that educated mothers were found to be less likely to favor the cutting of their daughters.

In addition to reducing the prevalence of FGC, education can also help to mitigate its negative effects. In a study conducted in Ethiopia, Johansen et al. (2021) found that education was associated with a lower risk of obstetric complications among women who had undergone FGC. The author suggested that education may help women to access appropriate care during pregnancy and childbirth, thereby reducing the risk of complications.

The research papers in this section have thus far established a correlation between FGC and the outcomes mentioned. In this study, I build upon the findings from my previous analysis in chapter to investigate and determine any causal relationship between FGC, health, and education outcomes.

Table 9. Means and Standard Deviations (in Parenthesis) of the Outcomes Variable of the Full-Sample

	Mean	Std. deviation	Min	Max	Observations
Panel A: Girls sample					
Has health card	0.497	(0.500)	0	1	182,732
Education	0.199	(0.399)	0	1	182,732
Total year education	1.159	(2.707)	0	21	182,732
Panel B: Mothers sample					
Pregnancy terminated	0.221	(0.415)	0	1	70,184
C-section	0.023	(0.149)	0	1	70,184

2.3 Data and Variables

The data utilized in this section are derived from the Demographic and Health Surveys (DHS) program, a widely recognized and comprehensive survey that collects data on various health and population indicators across countries worldwide. These surveys incorporate inquiries pertaining to FGC to gauge the prevalence of the practice and its sociodemographic determinants. FGC-related questions are typically posed to mothers of reproductive age (typically 15-49 years) in countries where FGC is prevalent as part of the DHS surveys. The data gathered through these surveys provide valuable insights into the prevalence, trends, and sociodemographic characteristics associated with FGC in diverse regions and countries.

An important measure from the DHS data is the prevalence of FGC among girls and mothers. These surveys ascertain whether a woman has undergone FGC and, if so, the type and severity of the procedure. Furthermore, the DHS data encompass sociodemographic variables linked to FGC, including age, educational attainment, socioeconomic status, living in urban or rural area, and ethnic or cultural background. Analyzing these variables aids in identifying patterns and associations with the practice of FGC within specific populations.

Moreover, the DHS surveys furnish information on temporal trends in FGC prevalence. By conducting multiple surveys within the same country over different time periods, researchers and policymakers can track changes in FGC prevalence and evaluate the efficacy of interventions and initiatives aimed at curbing the practice.

Although the available literature on FGC offers limited evidence regarding its impact on health outcomes, numerous psychological, medical, and international organizations assert that FGC leads to long-term reproductive health complications. These complications may include difficulties during childbirth, infertility, stillbirths, and child mortality. Consequently, my analysis focuses on examining the effect of FGC on pregnancy termination, and cesarean section births (c-section). Besides, I investigate how FGC influences hospital utilization proxy by the possession of a health card. While the ideal scenario would involve measuring hospital utilization directly, the lack of precise information necessitates the use of health card possession as a proxy. The possession of a health card is often indicative of access to healthcare services, as it is associated with financial arrangements that make healthcare more affordable. Certain hospitals or healthcare systems require individuals to present a health card in order to receive services or benefits. Based on these considerations, I argue that the possession of a health card can serve as a reasonable measure of hospital utilization. I define the health card variable using a modality that not only asks whether the girl has a health card but also whether the enumerator was able to visually confirm the card. The selection of other variables is based on the current literature on the effects of FGC on health outcomes. I assume that FGC adversely affects the health status of girls and significantly influences the observed outcomes. Moreover, I analyze how the decision to attend school and the duration of schooling are influenced by the occurrence of FGC. Furthermore, I explore the demand side by investigating the response of the marriage market to FGC, particularly in terms of age at first marriage/cohabitation and age at the birth of the first child.

Table 9 presents the means and standard deviations (in parentheses) of several outcome variables from the full sample. The sample size for these variables is 182,732 observations. The variable health card is a binary variable that takes the value one if the respondent reports that her girl has a health card and if the enumerator has visually confirmed the physical copy of the card, and zero otherwise. The mean value of 0.497 suggests that approximately 49.7% of the girls in the sample have a health card. This suggests that the possession of a health card is prevalent among the girls in the sample, indicating that on average, these girls have been registered or enrolled in a healthcare system or program. This registration may provide them with various benefits, including regular health monitoring, immunizations, and access to medical treatments when necessary. The next outcome variable is pregnancy termination. The survey asks whether or not a mother has experienced a pregnancy that did not result in a live birth. Approximately 22.1 out of every 100 mothers in the sample have undergone a terminated pregnancy at some point. The terminated pregnancy could refer to induced abortions, miscarriages, or other pregnancy outcomes that did not result in a live birth. This finding indicates that terminated pregnancies are relatively common among the mothers in the sample. The average proportion of mothers who have undergone a c-section is 0.023 in the sample. These mothers have had a c-section delivery for at least one of their childbirths. A c-section, or cesarean section, is a surgical procedure in which a baby is delivered through an incision in the mother's abdomen and uterus. The low average proportion suggests that c-sections are less common.

On the education perspective, firstly, on average, 19.9% of individuals in the sample have received some form of education or some level of educational attainment. "Some form of education" encompass various levels of education, ranging from basic primary education to higher levels such as secondary or tertiary education. This finding indicates that a minority of individuals in the sample have received education, while the majority may have no formal education. The standard deviation is 0.399, suggesting a larger variation in educational attainment among the girls compared to the health card variable. This implies that there may be disparities in educational access or differences in educational levels among the girls. Secondly, the average number of years of formal education completed by individuals in the sample is 1.159. This figure represents the average duration of education among those who have received education. It indicates that the level of educational attainment, on average, is relatively low, possibly reflecting limited access to education or high dropout rates. The standard deviation of 2.707 indicates a relatively high degree of variability in the education levels of the girls. This suggests a wide range of educational levels, with some girls having received several years of education while others have received none.

These results provide a descriptive overview of the outcome variables in the full sample and give an indication of the average values and the degree of variation within the sample.

2.4 Empirical Strategy

Consider the following structural equation analyzing the effect of cutting status on an outcome:

$$Outcomes_{i,g,t} = \alpha_0 + \alpha_1(\widehat{FGC_A})_{i,g,t} + \Gamma X_{i,g,t} + \zeta_g + \tau_t + \vartheta_{i,g,t} \tag{4}$$

In Equation 4, I examine various health and education outcomes of interest for girls in region g at time t. The variable $(\widehat{FGC_A})_{i,g,t}$ represents the instrument for cutting status for girl i at age A observed at the time of the survey. It derives from the predicted probability of a girl being cut, calculated using the hazard rate model from the first stage analysis. I will provide further details on how it is obtained below. The sample includes girls aged up to 14 years at the time of cutting, and the vector $X_{i,g,t}$ consists of households and parents' characteristics. To account for region-level and time-invariant characteristics other than cutting status that contributes to changes in the $Outcomes_{i,g,t}$, I incorporate a vector of region and year fixed effects, ζ_g, and τ_t respectively.

The practice of FGC itself involves many unobservable behaviors, and accurately measuring them through questionnaires presents a significant challenge. The behavioral aspects of cutting, which are rooted in parents' core beliefs, are particularly difficult to capture accurately. As a result, certain unobservable factors remain unaccounted for in many analyses. Additionally, unobserved heterogeneity among regions can introduce bias in the estimation of equation 4. One could argue that FGC is primarily practiced in regions with worse health and education outcomes. To address this concern, I include a $region \times year$ fixed effect in all specifications to control for regional trends and characteristics associated with FGC.

Omitted variable bias is another potential issue, as it is not possible to perfectly control for variables that indicate parents' attitudes toward FGC such as cultural beliefs, social norms, religious beliefs, and traditional practices. This bias arises because it is challenging to fully capture and measure certain variables that reflect parents' deep-seated beliefs and values, such as cultural beliefs, social norms, religious convictions, and traditional practices. These core beliefs are inherent to individuals and may not be easily quantifiable through standard survey questions or observable variables. As a result, when estimating the impact of health and education on FGC using ordinary least squares (OLS) regression, the omission of these unobservable variables can lead to biased estimates.

To mitigate the endogeneity problem, I employ a two-stage estimation approach. In the first stage, I develop a model to disentangle FGC participation. The first stage analysis utilizes a hazard analysis approach since the decision-making regarding cutting occurs at different ages throughout a girl's life. This approach captures the hazard of being cut over time and the heterogeneous impact at different ages. I define a duration of interest by considering the moment a girl is at risk of cutting for the first time. The risk of cutting begins at birth, and I observe from the data the age when a girl is eventually cut. The objective is to understand how the risk of cutting evolves globally across girls and also at an individual level in terms of the covariates. The model incorporates time-varying baseline risk and accounts for individual differences in the survival functions within the same fitted model. Essentially, I utilize a flexible, discrete-time hazard model that incorporates fixed effects related to different factors, regions, and calendar years. I duplicate the data for each $t = 0, 1, ..., 14$ and obtain a person-year panel format where a daughter who is cut at age A_m contributes $A_m + 1$ "person-years" to the sample.

The first stage estimation yields reliable estimates through two different specifications. The first specification employs the implementation of the law as a natural experiment, while the second incorporates in addition to the previous model, an exogenous variation provided by a drought index. The most efficient and reliable estimate, used for the analyses in this section, is obtained from the latter specification.

I define the hazard of being cut at every age ($A = 0, 1, 2, ..., 14$) as a function of factors such as a girl's age, her social and demographic characteristics, her parents' characteristics and other specific factors. It captures the probability that cutting occurs at any age A observed at the survey for girl i given that she has not been cut at previous ages ($0, 1, 2, ..., A - 1$). Let $h(A|X)_{i,t,g}$ denote the hazard of a girl being cut at exactly A given the explanatory variables $X_{i,t,g}$. This hazard function is calculated using the aforementioned specification and the model as outlined in equation 1, which incorporates the effects of the 1999 law and the income shock represented by drought events. After obtaining the hazard function for all previous ages leading up to the observed age at the survey, I compute the survival function which is 1 minus the hazard. Therefore, the predicted probability of being cut at the age of the survey is the product of all the survival functions leading up to the age at survey substrated from 1.

Let us assume that a girl i is observed in the survey at age A, the instrument for cutting status is defined as follows:

$$\begin{aligned}(\widehat{FGC_A})_{i,g,t} &= 1 - \prod_{a=o}^{A}\Big[1 - Pr\{\text{cut at age a / given not cut before age a}\}\Big] \\ &= 1 - \Big[[1 - h(a=0|X)_{i,t,g}] \times [1 - h(a=1|X)_{i,t,g}] \times ... \times [1 - h(a=A|X)_{i,t,g}]\Big]\end{aligned} \tag{5}$$

Here, $h(a = 0|X)_{i,t,g}$, $h(a = 1|X)_{i,t,g}$, ..., $h(a = A|X)_{i,t,g}$ represent the hazard functions obtained from the combined effect of the 1999 law and the droughts, as estimated using model 3. And $\Big[[1-h(a=0|X)_{i,t,g}] \times [1-h(a=1|X)_{i,t,g}] \times ... \times [1-h(a=A|X)_{i,t,g}]\Big]$ is the survival function for not being cut by age A or earlier.

Appendix A offers a more detailed explanation and notation regarding the construction of the sample and the methodology employed to derive the hazard of cutting at each age. The process is straightforward for the girls' sample. However, in addition to analyzing the girls' sample, I also apply the same model to predict the probabilities of mothers undergoing FGC. By utilizing the model developed for girls, I can estimate the likelihood of mothers being cut based on similar factors that were found to be significant in the girls' sample. This out-of-sample prediction of FGC probabilities for mothers expands the scope of analysis, enabling the estimation of the effect of FGC on outcomes observed for only mothers, pregnancy termination, and c-sections.

2.5 Results: Effect of Female Genital Cutting on Health and Education Outcomes

This section addresses the research question: How does FGC impact various health and education outcomes? In the models presented here, I choose to incorporate survey, year, and region-fixed effects for several reasons. The inclusion of survey fixed effects helps account for unobservable differences across countries that are not directly observable, such as variations in social norms related to sexual behavior, cutting rates, access to health services, and diverse responses to FGC. These unobservable differences may also vary within the same country across different time periods, justifying the use of within-survey estimation. Further, I employ a linear probability model (LPM) to estimate the model with binary outcomes. Angrist and Pischke (2009) argue that using an LPM does not necessarily violate the assumptions of ordinary least squares (OLS) and enhances the interpretability of the results.

Table 10. Second Stage Results: Effects of Female Genital Cutting on Having a Health Card Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable

	Naive OLS		*2SLS*	
	(1)	(2)	(3)	(4)
Had FGC	0.0024**	0.0016*	0.1867***	0.1800***
	(0.0008)	(0.0007)	(0.0062)	(0.0074)
Mean	0.497	0.497	0.497	0.497
Region FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Survey FE	No	Yes	No	Yes
Observations	182,732	182,732	182,732	182,732

The table uses the girls' sample and reports coefficients and standard errors from estimating equation 4. The dependent variable in each case is an indicator of whether the girl has a health card at the time of the survey. I define the probability of being cut from a baseline hazard model detailed in chapter . All models control variables are family background such as region, wealth, religion, education, and marital status. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time. I also include in specifications (2 and 4) a $region \times year$ trend and other controls that could potentially affect the probability of having a health card such as different health policies enacted through the time period
*$p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

2.5.1 *Health Outcomes*

Table 10 presents the second stage estimates of the effects of FGC on the likelihood of having a health card, using the combined effect of the exposure to the 1999 law and the income shock as an instrumental variable. The estimations, from equation 4 control for various factors such as family background characteristics (e.g., region, wealth, religion, education, marital status), and specifications (2 and 4) include a $urban/rural \times year$ fixed effects and other controls related to health policies enacted over the time period. Region, year, and survey fixed effects are also included to account for unobservable differences across regions, time periods, and survey-specific factors. The table provides results from both the naive ordinary least squares (OLS) and two-stage least squares (2SLS) estimations. In the naive OLS estimations, the coefficient is positive and statistically significant in both model 1 ($0.0024, p < 0.01$) and model 2 ($0.0016, p < 0.05$). However, these estimates may suffer from endogeneity bias, as there might be unobserved confounding factors affecting both FGC and the variable "having a health card".

Table 11. Second Stage Results: Effects of Female Genital Cutting on Pregnancy Termination Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable

	Naive OLS		*2SLS*	
	(1)	(2)	(3)	(4)
Had FGC	0.0257***	0.0206***	0.0168**	0.0138*
	(0.0035)	(0.0035)	(0.0061)	(0.0061)
Mean	0.221	0.221	0.221	0.221
Region FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Survey FE	No	Yes	No	Yes
Observations	70,184	70,184	70,184	70,184

The table uses the mothers' sample and reports coefficients and standard errors from estimating equation 4. The dependent variable is an indicator of whether a woman had experienced a pregnancy termination. I define the probability of being cut from a baseline hazard model detailed in section 3. All models control variables are family background such as region, wealth, religion, education, and marital status. I also include in specifications (2 and 4) a $region \times year$ trend. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

To address this endogeneity concern, the 2SLS estimations are performed using exposure to the 1999 law and the income shock as an instrumental variable for the probability of being cut prior to the age at the survey. The positive and statistically significant coefficient in column (4) shows that FGC is associated with an 18 percent increase in the probability of having a health card. This result suggests that FGC has a positive effect on the likelihood of having a health card when using the instrumental variable approach.

The results indicate that girls who have undergone FGC have an 18 percentage point higher probability of possessing a health card compared to girls who have not undergone FGC. This finding takes into account potential endogeneity issues and controls for other relevant factors. The statistical significance of the result suggests that the observed effect is unlikely to be due to chance. The positive coefficient suggests a positive association between FGC and the likelihood of having a health card. This implies that girls who have undergone FGC may have higher utilization of healthcare services, as indicated by their possession of a health card. One possible explanation for this finding is that FGC could have negative health consequences, leading girls to seek medical care more frequently to address health issues related to FGC. It is important to note that this interpretation assumes a causal relationship between FGC and health card possession, as supported by the instrumental variable approach employed in the analysis. By accounting for potential endogeneity, the analysis provides stronger evidence of a causal link between FGC and healthcare utilization. These results highlight the potential implications of FGC on health. They provide evidence that FGC is associated with an increased likelihood of possessing a health card, suggesting that girls who have undergone FGC may experience worsened health conditions. The fact that girls who have undergone FGC are more likely to possess a health card suggests that they may require more healthcare services to address the health issues arising from FGC. It is plausible that these girls seek medical attention to alleviate the physical and psychological consequences of the procedure. By utilizing healthcare services more frequently, they may be attempting to manage and mitigate the negative effects of FGC on their health. Overall, the results highlight the impact of FGC on health outcomes and emphasize the importance of addressing FGC as a public health issue. By recognizing and addressing the negative health consequences of FGC, we can strive to improve the well-being and healthcare outcomes of girls and mothers affected by this practice. These findings also underscore the urgent need for comprehensive healthcare interventions and support for girls and mothers affected by FGC. Health systems should be equipped to address the specific needs and challenges faced by this population, providing appropriate medical care, counseling, and support services. Also, efforts to prevent FGC should be intensified to protect girls from the immediate and long-term health risks associated with this practice.

Using the estimates for the probabilities of being cut for mothers, table 11 presents the results of the effects of FGC on pregnancy termination. In model 4 of table 11, the coefficient for Had FGC is estimated to be 0.0138 ($p < 0.05$) in the 2SLS estimation, which investigates the effects of FGC on pregnancy termination using the combined effect of exposure to the 1999 law and an income shock as instrumental variables. The coefficient indicates that there is a statistically significant positive effect of FGC on the likelihood of pregnancy termination. Mothers who have undergone FGC have a higher probability of experiencing a pregnancy termination compared to mothers who have not undergone FGC, after accounting for potential endogeneity and controlling for other factors. This finding suggests that FGC is associated with an increased risk of pregnancy termination in this context. First, FGC involves the removal or alteration of female genitalia, which can lead to physical complications and health issues. These complications may include infections, scarring, urinary problems, and difficulties during childbirth. Women who have undergone FGC may be at a higher risk of experiencing pregnancy-related complications, which could increase the likelihood of pregnancy termination. Second, FGC is a traumatic experience that can have long-lasting psychological effects on women. It may lead to feelings of shame, fear, and anxiety, particularly in relation to reproductive health. These psychological factors can contribute to increased stress levels and may influence women's decisions regarding pregnancy continuation, leading to a higher likelihood of pregnancy termination. Third, FGC is often deeply rooted in cultural and social norms in certain communities. In some contexts, it is believed that FGC is necessary for marriageability or to preserve virginity. This cultural belief system, combined with societal pressures and expectations, may influence women's decisions regarding pregnancy termination. Women who have undergone FGC may face unique challenges and constraints when it comes to reproductive decision-making, which could increase the likelihood of pregnancy termination. It is important to note that these potential mechanisms are not mutually exclusive and may interact with one another to influence the impact of FGC on pregnancy termination. Further research is needed to explore these mechanisms in greater detail and to develop targeted interventions and policies aimed at addressing the negative reproductive health consequences of FGC and supporting women in communities.

Table 12. Second Stage Results: Effects of Female Genital Cutting on C-Section Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable

	Naive OLS		*2SLS*	
	(1)	(2)	(3)	(4)
Had FGC	-0.0042**	-0.0041**	0.0039*	0.0038*
	(0.0013)	(0.0013)	(0.0017)	(0.0017)
Mean	0.023	0.023	0.023	0.023
Region FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Survey FE	No	Yes	No	Yes
Observations	70,184	70,184	70,184	70,184

The table uses the mothers' sample and reports coefficients and standard errors from estimating equation 4. The dependent variable is an indicator of whether a woman had experienced a c-section. I define the probability of being cut from a baseline hazard model detailed in section 3. All models control variables are family background such as region, wealth, religion, education, and marital status. I also include in specifications (2 and 4) a $region \times year$ trend. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 12 presents the results of the effects of FGC on cesarean section (c-section) deliveries. In model 4 of table 12, the coefficient for Had FGC is estimated to be 0.0038 (p<0.05) in the 2SLS estimation, which examines the effects of FGC on cesarean section (c-section) deliveries using the combined effect of exposure to the 1999 law and an income shock as instrumental variables. The coefficient indicates that there is a statistically significant positive effect of FGC on the likelihood of having a c-section. Mothers who have undergone FGC are more likely to have experienced a c-section delivery compared to mothers who have not undergone FGC, after accounting for potential endogeneity and controlling for other factors. This finding suggests that FGC is associated with an increased likelihood of c-section deliveries in this context. The interpretation of this coefficient as a causal effect depends on the validity of the instrumental variables and the underlying assumptions of the instrumental variable approach. The statistical significance suggests that the combined effect of exposure to the 1999 law and the income shock provides evidence of a causal relationship between FGC and c-section deliveries, indicating that FGC has a substantial impact on the likelihood of c-sections in this population. These results highlight the potential implications of FGC on obstetric outcomes and the mode of delivery. Women who have undergone FGC may face increased risks or complications during childbirth, necessitating the need for c-sections. This could be due to anatomical changes resulting from FGC or other factors associated with the practice. These anatomical changes may hinder the passage of the baby during vaginal delivery, making a c-section the preferred or necessary mode of delivery. FGC can have adverse effects on maternal health, including infections, urinary problems, and other complications. These health conditions may increase the likelihood of requiring a c-section as a safer option for both the mother and the baby. FGC-related health issues may make vaginal delivery riskier or less feasible, leading to a higher likelihood of c-section deliveries. However, it is important to interpret these findings cautiously and consider them within the specific context and limitations of the study.

The difference between the second-stage estimates and the OLS estimates in some cases can be attributed to several factors. One possible reason is the presence of measurement errors in the survey-collected outcomes. These errors introduce noise and can bias the OLS estimates towards zero, leading to an underestimation of the true effects. In contrast, the instrumental variable approach utilized in the second stage remains unaffected by these measurement errors. Consequently, the instrumental variable estimates tend to be larger in magnitude. Another factor contributing to the larger second-stage estimates is related to the nature of the instrument used. In this case, the instrument is derived from a natural experiment, which provides a source of exogenous variation that is not influenced by unobserved family factors such as ethnicity, religion, and parents' characteristics like education, and wealth. As a result, the instrument is more effective in capturing the true causal relationship between FGC and the outcomes of interest. Furthermore, it is important to note that the OLS estimate reflects the average difference in outcomes between individuals who have experienced FGC and those who have not, without accounting for any specific subgroup effects. In contrast, the two-stage estimate, obtained through instrumental variable analysis, captures the effect of FGC specifically for the population affected by the instrument. This population represents a subset of individuals whose FGC status is influenced by the instrument which is the combination of the 1999 law banning FGC in Senegal and droughts, resulting in a more localized estimation known as the local average treatment effect (LATE). By focusing on this subgroup, the instrumental variable approach provides a more targeted and precise estimate of the causal effect.

In summary, the larger second-stage estimates in this study, compared to the OLS estimates, can be attributed to several factors. Firstly, the presence of measurement errors in the outcomes is accounted for in the instrumental variable estimation, resulting in more accurate estimates. Secondly, the effectiveness of the instrument derived from a natural experiment provides a strong basis for identifying the causal impact of FGC on the outcomes. Lastly, by estimating a localized treatment effect for the population affected by the instrument, the analysis focuses on the specific group whose FGC was affected by the exogenous instrument, leading to more precise and relevant findings regarding the impact of FGC on the outcomes of interest. Together, these factors contribute to a more robust and accurate assessment of the impact of FGC on the outcomes under investigation.

Table 13. Second Stage Results: Effects of Female Genital Cutting on Education Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable

	Naive OLS		*2SLS*	
	(1)	(2)	(3)	(4)
Panel A: Extensive Margin				
Had FGC	-0.012***	-0.012***	-0.046***	-0.050***
	(0.002)	(0.002)	(0.002)	(0.002)
Mean	0.199	0.199	0.199	0.199
Panel B: Intensive Margin				
Had FGC	-0.101***	-0.119***	-0.080***	-0.091***
	(0.005)	(0.005)	(0.006)	(0.006)
Mean	1.159	1.159	1.159	1.159
Region FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Survey FE	No	Yes	No	Yes
Observations	182,732	182,732	182,732	182,732

The table uses the girls' sample and reports coefficients and standard errors from estimating equation 4. The dependent variables in panels A and B capture respectively the decision to attend school and once in school the number of years completed at the time of the survey. I define the probability of being cut from a baseline hazard model detailed in section 3. All models control variables are family background such as region, wealth, religion, education, and marital status. I also include in specifications (2 and 4) a $region \times year$ trend. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country.
$*p < 0.05$, $**p < 0.01$, $***p < 0.001$

2.5.2 *Education Outcomes*

In table 13, I examine the sample of girls 0 to 14 at the time of the survey, the effects of FGC on education using the combined effect of exposure to the 1999 law, and an income shock as instrumental variables. The table presents estimates for two distinct measures of education. Specifically, it examines the extensive margin (Panel A), which represents the decision to attend school, and the intensive margin (Panel B), which captures the number of years of formal education completed. Column (4) of each panel provides the most efficient estimates. It is based on a model that controls for the same various factors defined above such as family background characteristics (e.g., region, wealth, religion, education, marital status). The column also includes a $region \times time$ trend, region-fixed effects, year-fixed effects, and survey-fixed effects to account for unobservable differences across regions, time periods, and survey-specific factors.

In Panel A, which captures the decision to attend school (extensive margin), the coefficient for Had FGC is estimated to be -0.050 ($p < 0.001$) in the 2SLS estimation. This suggests that girls who have undergone FGC are significantly less likely to attend school compared to girls who have not undergone FGC. It suggests that girls who have undergone FGC are estimated to have a 5% lower likelihood of ever attending school compared to girls who have not undergone FGC. The negative coefficient indicates a negative effect of FGC on educational attainment, implying that FGC is associated with reduced educational participation. This difference in the IV and the OLS coefficients can be attributed to the IV method's ability to address potential endogeneity issues and control for omitted variables that may bias the OLS estimate. By using the combined effect of the exposure to the 1999 law and the income shock as an instrument, the IV approach effectively isolates the exogenous variation in FGC status, providing a more reliable estimate of the causal effect.

In Panel B, which focuses on the number of years completed in school (intensive margin), the coefficient for Had FGC is estimated to be -0.091 ($p < 0.001$) in the 2SLS estimation. It suggests that girls who have undergone FGC are estimated to have completed approximately 9.1% fewer years of education compared to girls who have not undergone FGC. This implies that girls who have undergone FGC tend to have fewer years of education compared to girls who have not undergone FGC. The negative coefficient suggests a negative effect of FGC on educational achievement, indicating that FGC is associated with lower educational attainment among those who do attend school. Both results indicate a significant negative relationship between FGC and education, suggesting that FGC has detrimental effects on educational outcomes.

The difference in the magnitude of the IV change between Panel A and Panel B could be due to the nature of the outcomes being measured and the presence of additional factors that influence educational attainment beyond the direct effect of FGC. The relationship between FGC and the number of years of education may be more complex and influenced by additional factors such as educational quality, parental investment, and socio-economic conditions. These additional factors may attenuate the direct effect of FGC on educational outcomes, leading to a smaller difference between the IV and OLS coefficients in Panel B.

These findings highlight the importance of addressing FGC as a barrier to education and promoting educational opportunities for girls and girls affected by FGC. These results provide quantitative estimates of the impact of FGC on education. They indicate that FGC is associated with a lower likelihood of attending school and a significant reduction in the number of years of education completed. Several potential mechanisms could explain this relationship. First, FGC can lead to various health complications, including pain, infections, and long-term physical and psychological effects. These health consequences may negatively impact a girl's ability to attend school regularly, concentrate on her studies, or engage in physical activities required for learning. Second, FGC is often deeply rooted in sociocultural traditions and norms. In communities where FGC is prevalent, there may be strong societal expectations and beliefs that prioritize marriage and childbearing over education for girls. This cultural context may create barriers and discourage families from investing in girls' education, leading to lower school attendance rates among girls who have undergone FGC. Third, FGC is prevalent in many economically disadvantaged communities. Poverty and limited resources can contribute to lower educational opportunities and higher dropout rates. Families who prioritize FGC may allocate fewer resources to girls' education, resulting in reduced access to schooling or early withdrawal from formal education. Fourth, FGC is often associated with gender-based discrimination and inequality. Girls who have undergone FGC may face additional challenges and restrictions related to gender roles and expectations within their communities. These societal barriers can limit their educational opportunities and reinforce traditional gender norms that prioritize domestic roles over formal education. By understanding these mechanisms, policymakers and stakeholders can design interventions and policies that address the barriers faced by girls who have undergone FGC and promote inclusive and equitable access to education for all girls, irrespective of their FGC status.

Table 14. Effects of Female Genital Cutting on the Hazard of Age at First Marriage/Cohabitation

	(1)	(2)	(3)
Had FGC	0.002*	0.002*	0.005***
	(0.001)	(0.001)	(0.001)
Region FE	Yes	Yes	Yes
Year FE	Yes	No	No
Survey FE	Yes	No	Yes
Observations	992,934	992,934	992,934

The table uses the mothers' sample and reports coefficients and standard errors from estimating equation 6. The sample is the duplicate observations of each mother. The dependent variables take the value of one if the woman reports marriage at a specific age, and zero for each age less than the age at marriage. I define the probability of being cut from a baseline hazard model detailed in section 2.5.3. All models' control variables are background such as region, wealth, religion, and education. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 15. Effects of Female Genital Cutting on the Hazard of Age at First Birth

	(1)	(2)	(3)
Had FGC	0.001**	0.002***	0.002**
	(0.000)	(0.001)	(0.001)
Region FE	Yes	Yes	Yes
Year FE	Yes	No	No
Survey FE	Yes	Yes	No
Observations	1,159,851	1,159,851	1,159,851

The table uses the mothers' sample and reports coefficients and standard errors from estimating equation 6. The sample is the duplicate observations of each mother. The dependent variables take the value of one if the woman reports first birth at a specific age, and zero for each age less than the age at marriage. I define the probability of being cut from a baseline hazard model detailed in section 2.5.3. All models' control variables are background such as region, wealth, religion, and education. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

2.5.3 *Female Genital Cutting and the Marriage Market*

Within the marriage market, FGC serves as a signaling mechanism that communicates adherence to cultural norms and values. Women who have undergone FGC may be viewed as more modest, chaste, and obedient, which aligns with prevailing societal expectations. Consequently, families and potential suitors may prioritize girls who have undergone FGC, considering them more marriageable. In communities that practice FGC, it is often considered a cultural tradition and may be strongly linked to social norms and expectations surrounding marriage. FGC can be seen as a prerequisite for marriage, and girls who have not undergone the procedure may face challenges in finding suitable marriage partners. FGC is sometimes associated with notions of purity, modesty, and virginity. In communities that prioritize these values, FGC may be seen as a way to ensure a girl's chastity and enhance her marriage prospects. Families may perceive FGC as necessary to preserve their daughters' reputations and secure their position in the marriage market (Mackie, 1997). FGC can also be connected to economic considerations within the marriage market. In some communities, the practice of FGC is believed to increase a girl's value in terms of the dowry or bride price that the groom's family is expected to provide (Chesnokova and Vaithianathan, 2010; Molitor, 2014). The belief is that FGC enhances a girl's eligibility as a bride and justifies higher economic transactions during marriage negotiations.

There is some evidence in the literature on how FGC could potentially affect the marriage market (García-Hombrados and Salgado, 2019; Orchid Project, 2020). Kandal and Komba (2015) describe FGC as a prerequisite for marriage in some communities. I use a discrete-time hazard analysis since the question involves the decision of whether to get married or to have a child at every age of a woman. The model incorporates the sequential nature of the decision and the heterogeneous impacts at different ages. I duplicate the data for each woman for each potential age of marriage (first birth) $m = 15, 16, ..., 49$. The dependent variables take the value of one if the woman reports marriage (first birth) at age $m = m_i$, and zero for each $m < m_i$. Once the woman reports marriage (first birth), the woman's information for $m > m_i$ is dropped. For example, if the woman reports marriage at the age of 20, the dependent variable would be zero for

$m = 15, 16, 17, 18, 19$; equal to one for $m = 20$, and missing for $m = 21, 22, ..., 49$.

I investigate the effect of FGC and the marriage market using the following model:

$$LogitAge_i(a_j) = \alpha_0 + \alpha_1 F\widehat{GC}_{i,g,t} + \Gamma X_{i,g,t} + \zeta_g + \tau_t + \vartheta_{igt} \tag{6}$$

where $Age_i(a_j)$ represents the dummy indicators. $Age_i(a_j) = 1$ when the woman gets married (has first birth) at time t given no reported earlier marriage (first child). It equals zero at all prior ages. The other features remain the same as defined in equation 4.

Table 14 presents the results of estimating the effects of FGC on the hazard of age at first marriage/cohabitation. The hazard represents the probability or likelihood of a woman giving birth at a specific age. The preferred model in column (1) controls for all full sets of variables and time-fixed effects as described in section 1.5.2. The estimated coefficient is 0.002 with a p-value of less than 0.05. This suggests that mothers who have undergone FGC have a slightly higher hazard of getting married or cohabiting at a younger age compared to mothers who have not undergone FGC. The positive coefficient suggests that FGC is associated with an increased likelihood of early marriage/cohabitation. Intuitively, this result could be explained by several factors. In some communities, there are strong social and cultural norms that promote early marriage as a requirement for girls who have undergone FGC. It represents a signal of readiness for marriage or a cultural tradition associated with marriage readiness, leading to an increased likelihood of early marriage/cohabitation. Also, FGC is often rooted in patriarchal systems that emphasize control over women's sexuality and reproduction. In these contexts, FGC is perceived as a way to ensure female purity and chastity, which aligns with societal expectations of early marriage for women. The presence of FGC indicates conformity to these gender norms, increasing the likelihood of early marriage/cohabitation. In some communities, early marriage/cohabitation is driven by economic factors. Families perceive marrying off girls at a young age as a way to secure economic benefits, such as dowry or financial support from the groom's family. FGC serves as a cultural practice that facilitates the transition into marriage and enhances a girl's eligibility as a bride, thereby increasing the likelihood of early marriage/cohabitation.

In model (1) of table 15, the coefficient of interest is 0.001 for the hazard of age at first birth with a significance level of $p < 0.01$. This indicates that mothers who have undergone FGC have a statistically significant higher likelihood of giving birth at a younger age compared to mothers who have not undergone FGC. The positive coefficient suggests that FGC is associated with an increased likelihood of early childbirth. Intuitively, I interpret this result by several factors. FGC can have long-term physiological consequences for women's reproductive health. It may lead to complications such as obstructed labor, perineal tears, and infections, which can increase the likelihood of early childbirth. The physical trauma caused by FGC may accelerate the onset of childbirth or increase the risk of complications during pregnancy, pushing women to give birth at a younger age. In some societies, FGC is associated with societal expectations of early childbirth. FGC is linked to cultural beliefs surrounding fertility, motherhood, and marital obligations. Women who have undergone FGC face social pressure or cultural norms that emphasize early childbearing, leading to a higher likelihood of giving birth at a younger age. In contexts where FGC is prevalent, there may be limited access to contraception and family planning services. Women who have undergone FGC may have restricted control over their reproductive choices and limited knowledge about contraceptive methods, resulting in a higher likelihood of unintended pregnancies and early childbirth.

2.6 Conclusion

The study found that FGC has significant impacts on health, education, and the marriage market. In terms of health outcomes, girls who have undergone FGC have a higher probability of possessing a health card, indicating increased utilization of healthcare services. This suggests that FGC may have negative health consequences, leading girls to seek medical care more frequently. Using information from the mothers in the survey and an out-of-sample prediction, I find that FGC is also associated with an increased likelihood of pregnancy termination, potentially due to physical complications and psychological effects. Plus, mothers who have undergone FGC are more likely to have a cesarean section delivery, possibly due to FGC-related health issues.

For the education outcomes, FGC is negatively associated with both the likelihood of attending school and the number of years of education completed. Girls who have undergone FGC have a lower likelihood of attending school and tend to complete fewer years of education compared to those who have not undergone FGC. This suggests that FGC acts as a barrier to education, possibly due to health complications, and economic factors only through droughts.

In the marriage market, FGC likely serves as a signaling mechanism, communicating adherence to cultural norms and values. Women who have undergone FGC may be viewed as more modest, chaste, and obedient, making them more marriageable in communities where FGC is practiced. FGC is often considered a prerequisite for marriage, and girls who have not undergone the procedure may face challenges in finding suitable partners. FGC can be associated with notions of purity and virginity, and families may see it as necessary to secure their daughters' reputations and marriage prospects.

Overall, the findings highlight the negative impacts of FGC on health, education, and the marriage market. Addressing FGC as a public health issue is crucial to improve the well-being and healthcare outcomes of affected girls and women.

Chapter 3: Misreporting of Female Genital Cutting

3.1 Overview

Female Genital Cutting, as an entrenched practice, is deeply intertwined with cultural, social, and gender norms in numerous communities. It encompasses complex power dynamics, traditional beliefs, and notions regarding female purity, chastity, and marriageability. Moreover, FGC is often perpetuated across generations by family members who view it as a cultural obligation or a significant rite of passage. These underlying factors contribute to the sensitivity and challenges associated with reporting on FGC. Recent studies acknowledge the potential occurrence of misreporting during FGC surveys due to various factors. Understanding the prevalence and consequences of female genital cutting is crucial for the development of effective policies. However, misreporting presents a substantial obstacle for researchers aiming to obtain accurate data. FGC is typically surrounded by social stigma and taboo, which creates hesitancy among individuals to disclose their involvement or knowledge of the practice. Fear of judgment or social exclusion can result in underreporting or deliberate misreporting, thereby distorting the actual prevalence of FGC within a community. In societies where FGC is deeply ingrained, it may be perceived as a normative practice. Providing accurate information about FGC might contradict prevailing cultural norms or expectations, leading to misreporting that aligns with societal standards. In regions where FGC is illegal, individuals may be reluctant to disclose their participation in the practice due to concerns about legal consequences. This fear can contribute to underreporting or denial, further complicating efforts to accurately estimate the prevalence of FGC. Respondents may offer socially desirable responses instead of revealing the truth about FGC. This bias can stem from a desire to present oneself or one's community in a favorable light or to conform to perceived societal expectations.

3.2 Female Genital Cutting and Misreporting

The data collection method utilized in this study raises concerns regarding the validity of the obtained results. The Demographic Health and Survey questionnaire assigned the responsibility of reporting their girls' cutting status and age at cutting to the mothers. However, if there exists fear or social stigma surrounding FGC within a particular community, disclosing one's own or their girl's status becomes challenging, potentially leading to the provision of inaccurate information to surveyors.

Consequently, measurement errors and biases may affect the results of this study, thereby impacting the estimated effects of legal and income shocks, as well as health and educational outcomes. Nevertheless, the two-stage estimation employed in this analysis enables us to construct our strategy based on factors influencing the prevalence of FGC prior to the enactment of the law. Besides, the utilization of age at cutting as a means of defining exposure contributes to enhanced precision and reduced measurement error. The procedure to obtain the second stage estimates uses random age at the survey to identify the probability of cutting for girls and women Furthermore, since the surveys used in the analysis were conducted a decade after the law's implementation, the immediate fear effect following the law's adoption would not be captured in the data.

According to Shell-Duncan et al. (2013), parents' awareness of the law does not necessarily indicate the effectiveness of its implementation. They argue that parents may not have misreported their girls' status due to apprehension regarding legal penalties associated with non-compliance.

In the DHS, the primary questionnaire is administered to women aged 15 to 49 years old. Consequently, in households where a woman is at least 15 years old, she provides information related to herself and any daughters under 14 years old within the household. In such a scenario, it is possible to encounter a situation where both a mother and her daughter(s) are at least 15 years old, and they each independently respond to the main questionnaire. As a result, both the mother and her girl(s) can provide information regarding their own female genital cutting (FGC) status. In my investigation, I aim to determine whether the individual reporting the FGC status of a girl, specifically the mother versus the girl herself (if she is at least 15 years old), influences the impact of the 1999 law that was previously analyzed. By analyzing the reporter of the FGC status, I seek to discern whether the reduction in FGC prevalence is primarily attributable to the effect of the law or the individual who reports FGC status. The hypothesis is that if the decline in FGC prevalence after the enactment of the law is driven by the fear of legal consequences, then I would observe a decrease in the likelihood of cutting when considering the individual reporting FGC as a variable. To assess the impact of mothers reporting their girls' FGC status, I employ the following specification in my analysis:

$$\begin{aligned} logit[h(A_m|X)_{i,t,g}] = \beta_0 + \beta_1 \text{Mother Reports}_{i,t,g} + \beta_2 \big[Post_t \times \text{Mother Reports}_{i,t,g}\big] \\ + \Gamma X_{i,g,t} + \zeta_g + \tau_t + \tau_{A_m} \end{aligned} \tag{7}$$

This dummy variable, referred to as Mother Reports, indicates whether the FGC status is reported by the mother, taking a value of 1 if the mother reports for her girl and 0 if the girl self-reports. The results of this sensitivity analysis are presented in table 16. The findings indicate that there is no significant difference between mothers reporting their girls' FGC status and the girls reporting the same information themselves. The coefficient associated with the interaction of the variable Post (representing the period after the adoption of the law) and Mother Reports is small and lacks statistical significance. This implies that the decrease in the prevalence of FGC after the implementation of the law is not primarily driven by a fear of legal repercussions. In other words, the findings suggest that the reporting of FGC status by the mother or the girl herself does not significantly impact the observed decline in FGC prevalence. These results indicate that the reporting of FGC by mothers did not change after the introduction of the law, irrespective of whether the mother reported her daughter's status or not. Based on these findings, it can be concluded that the observed decrease in FGC prevalence in this study is not a consequence of mothers misreporting their girls' status in an attempt to avoid legal repercussions.

Table 16. Effects of the 1999 Law and Mothers Reporting Cutting Status on the Prevalence of Female Genital Cutting for Girls (Ages 0-14) in Senegal

	FGC
Mother Reports	-0.022
	(0.010)
Mother Reports $\times$ $Post$	-0.017
	(0.012)
Mean	0.693
Year FE	Yes
Region FE	Yes
Survey FE	Yes
Observations	1,051,213

The table estimates the hazard of being cut for girls (ages 0 - 14). The dependent variable is a binary variable coded 1 if the girl is cut and 0 otherwise. The dummy variable Post takes a value of 1 for the years 1999 and after, which is the year of legal adoption. Senegal equals 1 if the girl resides in Senegal and 0 otherwise. Additionally, the model includes control variables such as girl age dummies, and family background variables including education, region, wealth, and religion. The variable "Mother Reports" equals 1 the mother reports her girl's FGC status and 0 otherwise. The estimation includes a $region \times year$ trend. Robust standards errors clustered at the region level are reported in parentheses.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Conclusion

Despite a global decline in the prevalence of female genital cutting, the practice remains persistent in certain regions, especially in Africa. Legal support has been provided to enforce laws prohibiting FGC in several countries, but efforts to ban the practice have not been entirely successful. FGC has potentially significant implications for health, labor market participation, educational attainment, and women's overall productivity. Studying FGC within communities can provide insights into the factors that influence its perpetuation and shed light on its impact on individuals and communities.

I propose a comprehensive study to identify the factors driving the persistence of FGC. I aim to inform the design of interventions and policies to effectively combat this practice and promote gender equality. The existing literature on the health and education consequences of FGC has not been able to solve the endogeneity problem. This work proposes a two-stage estimation to address the issue of endogeneity directly by introducing two sources of variation provided by a law banning FGC and an income shock. The study answers three key questions: (1) How has a legal ban affected the prevalence of FGC? (2) What factors contribute to the demand for FGC? (3) How does FGC affect different health and education outcomes? It makes significant expansions by formalizing a methodology, exploring heterogeneity, contributing to the literature on the persistence of FGC, and providing valuable insights into the factors driving the persistence of FGC and its impact on health and education outcomes. It informs the development of strategies to combat FGC and promote gender equality.

In Senegal, FGC is performed in most cases on girls up to the age of 14, with around 25 percent of girls and women having undergone the procedure. FGC is deeply rooted in cultural and religious traditions, believed to diminish sexual desire and maintain virginity until marriage. Despite increasing awareness of its harmful consequences, FGC remains prevalent in rural areas and among specific ethnic groups in Senegal. The most common form is Type II, involving the removal of the clitoris and part of the labia minora, sometimes with complete removal of the external genitalia and sewing the vaginal opening shut.

In this analysis, I use Mali as a comparative country to Senegal. FGC is prevalent in Mali and no legal ban exists there. FGC rates are high across the country, particularly in the southern and western regions. Mali shares similar cultural and religious beliefs regarding FGC, considering it necessary for womanhood, purity, modesty, and marriage preparation. There is no specific law criminalizing FGC in Mali and attempts to pass legislation against FGC have failed to gain parliamentary approval.

My analysis uses Demographic and Health Surveys (DHS) data from Senegal and Mali collected between 1995 and 2018. I combine the data to examine the impact of the law banning FGC. The DHS surveys are nationally representative and collect information on various topics, including FGC, through consistent definitions and modules. The surveys are conducted every 4 or 5 years[3], interviewing women aged 15 to 49. To ensure data accuracy, I focus on girls aged 14 and younger, matching them to their mothers and household information.

In addition to the DHS data, I incorporate weather data to investigate the effects of the FGC ban and income shocks, such as droughts, on FGC. Droughts are used as a proxy for local economic conditions since they can significantly impact household incomes in rain-fed agriculture-dependent areas. I obtain rainfall data from the University of Delaware and match it to the DHS clusters using GPS information. By fitting a gamma distribution to the rainfall data, I identify drought events at the grid level. A cluster is classified as experiencing a drought if its rainfall distribution falls below the 15th percentile of the gamma distribution for that grid (Miguel, et al., 2004). It is important to note that the definition of drought used in this analysis does not consider soil-specific characteristics or infinitesimal rainfall changes. The focus is on capturing significant rainfall reductions that have a substantial impact on agricultural outcomes in Sub-Saharan Africa, particularly maize crops because it is one of the most important staple crops in the region, playing a crucial role in food security and livelihoods for millions of people. The law change in Senegal and the timing of the droughts provide exogenous variations in a girl's (or a woman's) status of

[3]The DHS data on FGC in Senegal is available for the years 2005, 2010, 2014, 2015, 2016, and 2017. In Mali, the data is available for the years 1995, 2001, 2006, and 2012. The variations in data collection intervals are attributed to factors such as resource availability, country-specific circumstances, survey design and implementation, and changes in survey content or methodology. These factors may affect the regularity of data collection for certain countries.

being cut.

I conduct a first-stage analysis to examine FGC participation, using a natural experiment created by the legal ban on FGC in Senegal in 1999. To ensure the exogeneity of the treatment, I define exposure to the law by considering a girl's age at cutting and her country of birth, obtaining a hazard ratio. I employ a logistic model to estimate the baseline hazard, incorporating various factors such as the girl's location, pre-enactment differences, and confounding factors. I cluster the standard errors at the regional level to account for correlations within regions over time. The analysis also controls for other policies enacted in 2005 and 2010.

I capture the hazard of FGC at different ages, by using a hazard analysis model that allows for time-varying baseline risk and individual differences. The model treats each age of potential cutting as a separate observation, resulting in a person-year panel format for analysis. I account for cases where the exact age at cutting was unknown by incorporating probabilities of cutting over relevant age ranges. I assess pre-treatment patterns and dynamics of FGC with an event study methodology, examining the relationship between treatment indicators, time indicators, and FGC. By including time-fixed effects and polynomial functions of time, the event study controlled for time-varying factors that could influence the outcome variable independently of the treatment. Analyzing the coefficients associated with time indicators allowed me to evaluate pre-existing trends and compare them to the treatment effect. I estimate the effect of the legal ban using a hazard function equation that included indicators for living in Senegal and birth years. By testing whether the treatment affected outcomes before the adoption year, I could evaluate the parallel trend assumption.

Besides, I introduce a novel approach that combined temporal and spatial variations to assess income shocks caused by drought. I hypothesize that FGC is responsive to income shocks resulting from drought and specified an equation that included indicators for drought, post-treatment periods, and their interactions. The model also considers other covariates and controls for the region and year-fixed effects.

The first set of results shows the impact of the legal ban on the prevalence of FGC. The result indicates that the law had a significant impact on reducing FGC prevalence among girls in Senegal. The adoption of the law in 1999 has created a legal deterrence effect, making the practice of FGC riskier for those performing or supporting it. The law has increased the awareness and understanding of the consequences of FGC among communities, leading to a decrease in social acceptance and support for the practice. The legal ban on FGC could have induced a shift in social norms and attitudes toward the practice. Overall, the findings suggest that the legal ban has had a substantial impact on reducing the prevalence of FGC. These results have important implications for policy development and emphasize the need to enforce legal measures to eliminate the practice. Legal measures play a crucial role in addressing the practice.

To further reduce FGC prevalence, it is important to strengthen and enforce existing laws related to FGC, ensuring that they are comprehensive, clear, and encompassing. Building upon the success of the legal ban, intervention programs should focus on raising awareness about the effects of FGC and promoting education. These programs can target different stakeholders, including communities, parents, religious leaders, and healthcare providers. By disseminating accurate information about FGC, these programs can help change societal norms and attitudes toward the practice. Furthermore, future research and interventions should identify gaps in enforcement, and explore opportunities for strengthening legal measures aimed at understanding and eliminating the demand for FGC.

In the second set of results, I make a significant contribution to the existing literature on FGC by examining the potential impact of income shocks on the effectiveness of the 1999 law banning FGC in Senegal. The results indicate that drought events, used as a proxy for income shocks, are associated with a positive impact on the log odds of the hazard rate of FGC. After the adoption of the 1999 law against FGC, girls aged 0-14 have a higher probability of undergoing cutting when there is a drought event. The finding suggests that the occurrence of droughts is associated with an increase in the prevalence of FGC, despite the presence of the 1999 law. The law plays a crucial role in reducing cutting, but the incidence of droughts may complicate the effectiveness of the law in mitigating the practice. These results provide insights into the impact of the legal ban on FGC and how it interacts with income shocks in Senegal. The legal ban has had a significant reducing effect on FGC, but the occurrence of shocks related to household revenue during the post-ban period can increase the likelihood of FGC so much as to eliminate the effect of the law change. In many contexts where FGC is prevalent, FGC may be seen as a prerequisite for marriage and a means to enhance a girl's eligibility for marriage. Poor-income households, despite facing economic hardship, may perceive FGC as a strategy to increase their daughters' chances of securing a marriage proposal and, consequently, a bride price. For families living in poverty, the bride price can represent a significant economic benefit. It serves as a form of wealth transfer from the groom's family to the bride's family, providing financial support and potentially improving their economic standing. The bride price can help alleviate financial burdens and provide resources for the family, such as income, livestock, or other assets. Poor-income households may view FGC as an investment in their daughters' future and a means to improve their economic situation. They may prioritize the potential economic gains from the bride price over the immediate economic hardship they face.

Finally, I examine the combined effect of the legal ban and droughts in explaining in-group differences in characteristics, such as living in urban or rural area, wealth, and education. The heterogeneity analysis reveals differences in the effect of the law based on the above characteristics. Compared to the base age of 14, and using the combined effect of the law and the drought, girls aged 0-8 are at a greater risk of cutting early. However, for girls aged nine and older, there is a decrease in the log-odds ratio of cutting. I also find that the impact of the combined factors on FGC prevalence is positive for the poorest wealth group. This means that in the presence of drought shocks, the likelihood of FGC increases for girls in the poorest wealth group in Senegal during the post-law period. For the middle and richest wealth groups, the likelihood of FGC slightly decreases for girls. Although the ban has contributed to a decline in FGC rates in both urban and rural regions, it appears that low-income households persist in practicing FGC despite the legal prohibition and its associated costs. This suggests that economic factors may contribute to the perpetuation of FGC within certain income brackets. In certain societies where FGC is prevalent, the practice is often associated with cultural and social norms surrounding marriage and dowry customs.

I find unexpected results among high-income girls. These households display a greater level of responsiveness to the legal ban on FGC, resulting in a higher likelihood of abandoning the practice. One possible explanation for this observation is that wealthier households possess the resources to postpone the procedure for their girls during income shocks. However, additional research is required to thoroughly elucidate the variations observed within the wealthiest households.

On the marriage market, I find that women who have undergone FGC have a slightly higher hazard of getting married or cohabiting at a younger age compared to women who have not undergone FGC. It is associated with an increased likelihood of early marriage/cohabitation. Also, FGC is associated with an increased likelihood of early childbirth. I argue that the findings indicate that households engage in FGC with the expectation of increasing future marriage outcomes for their girls and potentially for the household. Combining these results and the findings with income shock and the law, I argue that households engage in the practice, considering future marriage outcomes and potential benefits for their girls and households, despite the increased costs imposed by the ban. In response to drought events, which signify income loss, households engage in the practice with the aim of improving future marriage outcomes for their girls and potentially benefiting the household. Even when confronted with increased costs due to the legal ban on FGC, parents weigh their future opportunity costs and continue the practice in anticipation of future benefits. These findings align with Corno et al.'s (2020) research, which also demonstrates that drought-related income shocks contribute to increased child marriage. However, it is important to note that the current study's first-stage estimations only involve young girls who are unlikely to be considered marriageable in the near future. Thus, the results imply that parents are preparing their girls for marriage prematurely by engaging in FGC.

The significant impact of legal bans in reducing the prevalence of FGC necessitates the enforcement and strengthening of existing laws prohibiting the practice. This requires raising awareness about the legal consequences of FGC and ensuring the effective implementation of legislation. Further, comprehensive education and awareness programs should be developed and implemented to change societal attitudes and perceptions surrounding FGC. These programs should target individuals at risk of FGC and the broader community, emphasizing the negative health consequences and debunking prevalent myths. To address the prevalence of FGC, I propose a cash transfer program that offers a viable mechanism for reducing its occurrence. This program involves providing financial support to parents or guardians of young girls who are at risk of undergoing FGC during economic downturns. Through the provision of conditional cash transfers, this program could perhaps incentivize families to abandon the practice of FGC, improve economic conditions, and promote the well-being, education, and empowerment of girls.

Targeting families with girls aged 0-14 years, who are at risk of FGC based on community prevalence and cultural practices, the program would offer a monthly cash transfer amount that adequately addresses economic challenges and reduces the financial incentives for FGC. The specific amount would be determined based on local economic conditions and household needs to ensure its meaningful impact. By alleviating financial burdens and providing economic stability, cash transfers would contribute to reducing the economic incentives associated with practicing FGC. Furthermore, conditional cash transfers encourage girls' education by ensuring their enrollment and regular attendance in schools, thereby promoting improved educational outcomes and empowerment. By implementing these evidence-based policies and interventions, governments and stakeholders can make significant progress in considerably reducing the prevalence of FGC and advancing gender equality. It is crucial to approach this issue with sensitivity, cultural understanding, and a long-term perspective to ensure sustainable change.

Appendix A. Additional Tables

Table A1. Full Second Stage Results
Effects of Female Genital Cutting on Education: Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable

	Education: Extensive Margin
	(Model 4 of Table 13)
Had FGC	-0.050***
	(0.002)
Daughter year of birth	-0.001**
	(0.000)
Respondent's year of birth	0.001***
	(0.000)
Urban	0.033***
	(0.002)
Mother education	0.351***
	(0.002)
Mother married	-0.031***
	(0.006)
Muslim	-0.012**
	(0.004)
Partner education	0.057***
	(0.003)
age_1	-0.001
	(0.006)
age_2	-0.005
	(0.006)
age_3	0.003
	(0.005)
age_4	-0.003
	(0.005)
age_5	0.001
	(0.005)
age_6	-0.001
	(0.005)
age_7	-0.001
	(0.005)
age_8	-0.005
	(0.005)
age_9	-0.004
	(0.005)
age_10	-0.003
	(0.005)

Table A1. Full Second Stage Results
Effects of Female Genital Cutting on Education: Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable (continued)

	Education: Extensive Margin
	(Model 4 of Table 13)
age_11	-0.002
	(0.006)
age_12	-0.001
	(0.006)
age_13	-0.001
	(0.006)
y_1982	-0.007
	(0.010)
y_1983	0.005
	(0.012)
y_1984	-0.010
	(0.011)
y_1985	-0.001
	(0.011)
y_1986	-0.002
	(0.011)
y_1987	0.003
	(0.009)
y_1988	0.009
	(0.010)
y_1989	0.002
	(0.010)
y_1990	0.004
	(0.009)
y_1991	0.003
	(0.009)
y_1992	0.010
	(0.009)
y_1993	0.003
	(0.009)
y_1994	0.004
	(0.008)
y_1995	-0.001
	(0.008)
y_1996	0.009
	(0.008)
y_1997	0.006
	(0.008)

Table A1. Full Second Stage Results
Effects of Female Genital Cutting on Education: Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable (continued)

	Education: Extensive Margin
	(Model 4 of Table 13)
y_1998	0.005
	(0.008)
y_1999	0.001
	(0.008)
y_2000	-0.005
	(0.008)
y_2001	0.009
	(0.008)
y_2002	0.005
	(0.008)
y_2003	0.022**
	(0.008)
y_2004	0.009
	(0.007)
y_2005	0.007
	(0.008)
y_2006	0.021**
	(0.008)
y_2007	0.024**
	(0.008)
y_2008	0.014
	(0.008)
y_2009	0.013
	(0.008)
y_2010	0.016*
	(0.008)
y_2011	0.013
	(0.008)
y_2012	0.014
	(0.008)
y_2013	0.018*
	(0.008)
y_2014	0.022**
	(0.008)
y_2015	0.012
	(0.009)
y_2016	-0.004
	(0.009)

Table A1. Full Second Stage Results
Effects of Female Genital Cutting on Education: Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable (continued)

	Education: Extensive Margin
	(Model 4 of Table 13)
Poorest	-0.030***
	(0.002)
Poorer	-0.020***
	(0.002)
Richer	0.012***
	(0.003)
Richest	-0.018***
	(0.005)
Constant	0.110
	(0.716)
Region FE	Yes
Year FE	Yes
Survey FE	Yes
N	182,732

The table uses the girls sample and reports coefficients and standard errors from estimating equation 4 and reproduces column (4) results of table 13. The dependent variable capture the number of school years completed at the time of the survey. I define the probability of being cut from a baseline hazard model detailed in section 3. All models control variables are family background such as region, wealth, religion, education, and marital status. The excluded age and year are 14 and 2017. I also include $region \times year$ trend. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table A2. Full Second Stage Results
Effects of Female Genital Cutting on Years of Education: Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable

	Education: Intensive Margin
	(Model 4 of table 13)
Had FGC	-0.091***
	(0.006)
Respondent's year of birth	-0.003***
	(0.000)
Urban	0.063***
	(0.007)
Mother education	3.050***
	(0.007)
Mother married	-0.049*
	(0.021)
Muslim	-0.024
	(0.014)
parteduc	0.164***
	(0.010)
age_1	-0.021
	(0.018)
age_2	-0.029
	(0.018)
age_3	-0.005
	(0.017)
age_4	-0.042**
	(0.016)
age_5	-0.015
	(0.016)
age_6	-0.030*
	(0.015)
age_7	-0.007
	(0.015)
age_8	-0.021
	(0.015)
age_9	-0.000
	(0.015)
age_10	-0.012
	(0.017)
age_11	0.001
	(0.019)
age_12	0.003
	(0.020)

Table A2. Full Second Stage Results
Effects of Female Genital Cutting on Years of Education: Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable (continued)

Education: Intensive Margin	
	(Model 4 of Table 13)
age_13	0.016
	(0.020)
y_1982	-0.000
	(0.031)
y_1983	-0.021
	(0.036)
y_1984	-0.032
	(0.037)
y_1985	-0.009
	(0.035)
y_1986	-0.010
	(0.035)
y_1987	0.018
	(0.031)
y_1988	0.021
	(0.034)
y_1989	0.006
	(0.034)
y_1990	0.028
	(0.034)
y_1991	0.044
	(0.034)
y_1992	0.050
	(0.033)
y_1993	0.038
	(0.034)
y_1994	0.046
	(0.034)
y_1995	0.073*
	(0.035)
y_1996	0.084*
	(0.036)
y_1997	0.102**
	(0.035)
y_1998	0.074*
	(0.035)
y_1999	0.088*
	(0.036)

Table A2. Full Second Stage Results
Effects of Female Genital Cutting on Years of Education: Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable (continued)

	Education: Intensive Margin
	(Model 4 of Table 13)
y_2000	0.075*
	(0.035)
y_2001	0.143***
	(0.036)
y_2002	0.131***
	(0.037)
y_2003	0.154***
	(0.037)
y_2004	0.148***
	(0.036)
y_2005	0.119**
	(0.037)
y_2006	0.143***
	(0.037)
y_2007	0.165***
	(0.037)
y_2008	0.137***
	(0.037)
y_2009	0.197***
	(0.036)
y_2010	0.178***
	(0.036)
y_2011	0.185***
	(0.036)
y_2012	0.175***
	(0.036)
y_2013	0.203***
	(0.037)
y_2014	0.233***
	(0.038)
y_2015	0.226***
	(0.038)
y_2016	0.146***
	(0.039)
y_2017	0.183***
	(0.040)
Poorest	-0.013*
	(0.005)

Table A2. Full Second Stage Results
Effects of Female Genital Cutting on Years of Education: Using the Combined Estimates of the Exposure to the 1999 Law and the Income Shock as Instrumental Variable (continued)

	Education: Intensive Margin
	(Model 4 of Table 13)
Poorer	-0.008
	(0.006)
Richer	0.038***
	(0.009)
Richest	0.254***
	(0.016)
Constant	5.896***
	(0.798)
Region FE	Yes
Year FE	Yes
Survey FE	Yes
N	182,732

The table uses the girls sample and reports coefficients and standard errors from estimating equation 4 and reproduces column (4) results of table 13. The dependent variable capture school attendance. I define the probability of being cut from a baseline hazard model detailed in section 3. All models control variables are family background such as region, wealth, religion, education, and marital status. The excluded age and year are 14 and 1981. I also include in specifications (2 and 4) a $region \times year$ trend. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table A3. Full Second Stage Estimates
Effects of Female Genital Cutting on the Hazard of Age at First Marriage/Cohabitation

	(Model 1 of Table 14)
Had FGC	0.002*
	(0.001)
Respondent's current age	-0.001***
	(0.000)
Husband/partner's age	0.000***
	(0.000)
Muslim	0.002*
	(0.001)
Partner Works in Agricultural Sector	0.001***
	(0.000)
Respondent currently working	0.001**
	(0.000)
Respondent's year of birth=1947	-0.001
	(0.001)
Respondent's year of birth=1948	-0.003
	(0.002)
Respondent's year of birth=1949	-0.000
	(0.001)
Respondent's year of birth=1950	-0.003
	(0.001)
Respondent's year of birth=1951	-0.003
	(0.002)
respondent's year of birth=1952	-0.006**
	(0.002)
respondent's year of birth=1953	-0.005**
	(0.002)
respondent's year of birth=1954	-0.007***
	(0.001)
respondent's year of birth=1955	-0.006***
	(0.001)
respondent's year of birth=1956	-0.007**
	(0.002)
respondent's year of birth=1957	-0.005**
	(0.002)
respondent's year of birth=1958	-0.007**
	(0.002)
respondent's year of birth=1959	-0.007**
	(0.002)
respondent's year of birth=1960	-0.008***

Table A3. Full Second Stage Estimates
Effects of Female Genital Cutting on the Hazard of Age at First Marriage/Cohabitation (continued)

	(Model 1 of Table 14)
	(0.002)
respondent's year of birth=1961	-0.008***
	(0.002)
respondent's year of birth=1962	-0.008***
	(0.002)
respondent's year of birth=1963	-0.010***
	(0.002)
respondent's year of birth=1964	-0.010***
	(0.002)
respondent's year of birth=1965	-0.009***
	(0.002)
respondent's year of birth=1966	-0.010***
	(0.002)
respondent's year of birth=1967	-0.009***
	(0.002)
respondent's year of birth=1968	-0.010***
	(0.002)
respondent's year of birth=1969	-0.010***
	(0.002)
respondent's year of birth=1970	-0.011***
	(0.002)
respondent's year of birth=1971	-0.011***
	(0.002)
respondent's year of birth=1972	-0.011***
	(0.002)
respondent's year of birth=1973	-0.013***
	(0.002)
respondent's year of birth=1974	-0.012***
	(0.002)
respondent's year of birth=1975	-0.012***
	(0.002)
respondent's year of birth=1976	-0.013***
	(0.002)
respondent's year of birth=1977	-0.012***
	(0.002)
respondent's year of birth=1978	-0.012***
	(0.002)
respondent's year of birth=1979	-0.014***
	(0.002)
respondent's year of birth=1980	-0.014***

Table A3. Full Second Stage Estimates
Effects of Female Genital Cutting on the Hazard of Age at First Marriage/Cohabitation (continued)

	(Model 1 of Table 14)
	(0.002)
respondent's year of birth=1981	-0.013***
	(0.002)
respondent's year of birth=1982	-0.013***
	(0.002)
respondent's year of birth=1983	-0.014***
	(0.002)
respondent's year of birth=1984	-0.014***
	(0.002)
respondent's year of birth=1985	-0.014***
	(0.002)
respondent's year of birth=1986	-0.013***
	(0.002)
respondent's year of birth=1987	-0.013***
	(0.002)
respondent's year of birth=1988	-0.013***
	(0.002)
respondent's year of birth=1989	-0.014***
	(0.002)
respondent's year of birth=1990	-0.014***
	(0.002)
respondent's year of birth=1991	-0.013***
	(0.002)
respondent's year of birth=1992	-0.013***
	(0.002)
respondent's year of birth=1993	-0.013***
	(0.002)
respondent's year of birth=1994	-0.013***
	(0.002)
respondent's year of birth=1995	-0.012***
	(0.002)
respondent's year of birth=1996	-0.012***
	(0.002)
respondent's year of birth=1997	-0.011***
	(0.002)
respondent's year of birth=1998	-0.009***
	(0.002)
respondent's year of birth=1999	-0.007**
	(0.002)
respondent's year of birth=2000	-0.005*

Table A3. Full Second Stage Estimates
Effects of Female Genital Cutting on the Hazard of Age at First Marriage/Cohabitation (continued)

	(Model 1 of Table 14)
	(0.002)
respondent's year of birth=2001	-0.006*
	(0.003)
respondent's year of birth=2002	-0.005*
	(0.002)
respondent's year of birth=2003	0.011***
	(0.002)
Poorest	0.002**
	(0.001)
Poorer	0.001**
	(0.000)
Richer	-0.002***
	(0.000)
Richest	-0.005***
	(0.000)
Constant	0.076***
	(0.002)
Region FE	Yes
Year FE	Yes
Survey FE	Yes
N	992,934

The table uses the mothers sample and reports coefficients and standard errors from estimating equation 6. The sample is the duplicate observations of each mother. The dependent variables take the value of one if the woman reports marriage at a specific age, and zero for each age less than the age at marriage. I define the probability of being cut from a baseline hazard model detailed in section 2.5.3. All models control variables are background such as region, wealth, religion, and education. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table A4. Full Second Stage Estimates
Effects of Female Genital Cutting on the Hazard of Age at First Birth

	(Model 1 of Table 15)
Had FGC	0.001**
	(0.000)
Respondent's current age	-0.001***
	(0.000)
Husband/partner's occupation	-0.000
	(0.000)
Husband/partner's age	0.000***
	(0.000)
Christian	-0.002**
	(0.000)
respondent's year of birth=1947	0.001
	(0.001)
respondent's year of birth=1948	-0.000
	(0.002)
respondent's year of birth=1949	-0.000
	(0.002)
respondent's year of birth=1950	-0.001
	(0.001)
respondent's year of birth=1951	0.000
	(0.002)
respondent's year of birth=1952	-0.002
	(0.001)
respondent's year of birth=1953	-0.000
	(0.001)
respondent's year of birth=1954	-0.002
	(0.001)
respondent's year of birth=1955	-0.002
	(0.001)
respondent's year of birth=1956	-0.002
	(0.002)
respondent's year of birth=1957	-0.001
	(0.002)
respondent's year of birth=1958	-0.002
	(0.001)
respondent's year of birth=1959	-0.002
	(0.002)
respondent's year of birth=1960	-0.003
	(0.002)
respondent's year of birth=1961	-0.003
	(0.001)

Table A4. Full Second Stage Estimates
Effects of Female Genital Cutting on the Hazard of Age at First Birth (continued)

	(Model 1 of Table 15)
respondent's year of birth=1962	-0.002
	(0.001)
respondent's year of birth=1963	-0.003
	(0.001)
respondent's year of birth=1964	-0.004*
	(0.002)
respondent's year of birth=1965	-0.003*
	(0.001)
respondent's year of birth=1966	-0.004*
	(0.001)
respondent's year of birth=1967	-0.003*
	(0.001)
respondent's year of birth=1968	-0.003
	(0.001)
respondent's year of birth=1969	-0.004*
	(0.002)
respondent's year of birth=1970	-0.004*
	(0.002)
respondent's year of birth=1971	-0.004*
	(0.001)
respondent's year of birth=1972	-0.004**
	(0.001)
respondent's year of birth=1973	-0.005**
	(0.001)
respondent's year of birth=1974	-0.004**
	(0.001)
respondent's year of birth=1975	-0.005**
	(0.002)
respondent's year of birth=1976	-0.006**
	(0.002)
respondent's year of birth=1977	-0.005**
	(0.001)
respondent's year of birth=1978	-0.005**
	(0.002)
respondent's year of birth=1979	-0.006**
	(0.002)
respondent's year of birth=1980	-0.005**
	(0.001)
respondent's year of birth=1981	-0.005**
	(0.002)

Table A4. Full Second Stage Estimates
Effects of Female Genital Cutting on the Hazard of Age at First Birth (continued)

	(Model 1 of Table 15)
respondent's year of birth=1982	-0.006**
	(0.002)
respondent's year of birth=1983	-0.006**
	(0.002)
respondent's year of birth=1984	-0.006**
	(0.002)
respondent's year of birth=1985	-0.006**
	(0.001)
respondent's year of birth=1986	-0.006**
	(0.002)
respondent's year of birth=1987	-0.005**
	(0.001)
respondent's year of birth=1988	-0.005**
	(0.002)
respondent's year of birth=1989	-0.006**
	(0.002)
respondent's year of birth=1990	-0.005**
	(0.002)
respondent's year of birth=1991	-0.005*
	(0.002)
respondent's year of birth=1992	-0.005**
	(0.002)
respondent's year of birth=1993	-0.004*
	(0.002)
respondent's year of birth=1994	-0.005**
	(0.002)
respondent's year of birth=1995	-0.005**
	(0.002)
respondent's year of birth=1996	-0.003*
	(0.002)
respondent's year of birth=1997	-0.003*
	(0.002)
respondent's year of birth=1998	-0.002
	(0.001)
respondent's year of birth=1999	-0.000
	(0.002)
respondent's year of birth=2000	-0.002
	(0.002)
respondent's year of birth=2001	0.002
	(0.002)

Table A4. Full Second Stage Estimates
Effects of Female Genital Cutting on the Hazard of Age at First Birth (continued)

	(Model 1 of Table 15)
respondent's year of birth=2002	0.004
	(0.002)
respondent's year of birth=2003	0.005**
	(0.002)
Poorest	0.001*
	(0.001)
Poorer	0.001**
	(0.000)
Richer	-0.002***
	(0.000)
Richest	-0.004***
	(0.000)
Constant	0.067***
	(0.002)
Region FE	Yes
Year FE	Yes
Survey FE	Yes
N	1,159,851

The table uses the mothers sample and reports coefficients and standard errors from estimating equation 6. The sample is the duplicate observations of each mother. The dependent variables take the value of one if the woman reports first birth at a specific age, and zero for each age less than the age at marriage. I define the probability of being cut from a baseline hazard model detailed in section 2.5.3. All models control variables are background such as region, wealth, religion, and education. Standard errors are clustered at the region level and observations are weighted using survey-specific weights that are adjusted for comparability across time and country.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Appendix B. Discrete-Time Hazard Model

I use an estimation strategy based on conditional probability functions to approximate the density function of cutting prevalence for a girl, considering various explanatory variables. The variables in the model are defined as follows:

- A_i represents the waiting time (age) until girl i is cut in the calendar year y_i, with $A_i \in 0, 1, 2, ..., 14, ..., \infty$.
- $c_i^m(y_i)$ and $c_i^p(y_i)$ denote the characteristics of the mother and her partner, respectively, such as birth cohort, education, religion, and ethnicity for girl i in the calendar year y_i.
- The geographic and economic information for each girl is denoted as $g_i(y_i)$.
- The birth cohort of girl i is represented as $c_i = y_i - a$.

The hazard of being cut at each age ($a = 0, 1, 2, ..., 14$) is determined by factors such as the girl's age, social and demographic characteristics, parents' characteristics, and household specific factors. It captures the probability of cutting occurring at age A_i for girl i, given that she has not been cut at previous ages. Let $h(i, a)$ denote the hazard of a girl being cut at age a. The probability of a girl being cut at age A is given by:

$$f_i(A) = h(i, A) \times \prod_{a=0}^{A-1} (1 - h(i, A)) = h(i, A) \times S(i, A)$$

Here, $f_i(A)$ represents the probability density function (p.d.f) of the discrete random variable A, and $S(i, A)$ is the complement of the cumulative distribution function (c.d.f) or survival function. They respectively represent the probability of being cut at age A and the probability of not being cut before age A. In the model, it is assumed that if a girl is not cut by age 14, she will never be cut at any later age. Note that, after obtaining the probabilities for girls until age 14, it is possible to obtain the probability of cutting for girls older than 14 using the features of the model defined above.

I construct the probability of being cut at some age $a \leq A^*$, as the sum of the probabilities of surviving in every period prior to the cutting age times the probability of being cut at the cutting age.

$$Pr[i, A^*] = \sum_{a=0}^{A^*} Pr\{A = a | a > a - 1\} \tag{8}$$

To fit the model, I maximize an individual likelihood function using the age at cutting for the each girl in the sample. These distributions provide the elements to compute the hazard and survival rates and, ultimately, the probability of cutting. I assume that the cutting states are i.i.d. (identically and independently distributed), which allows deriving essential properties of estimators When a girl i is cut at age A, her contribution to the likelihood function is the density at that duration. If the exact age at cutting is not observed but only her approximate period of cutting or her age at the survey knowing that she was cut prior, the densities for each potential age of cutting are summed up either for the approximate period of each year leading up to the age at the survey. I sum up the likelihood functions of each girl in the sample to obtain the overall likelihood (LL) function of the model. I approximate the likelihood function using a logistic model and incorporate in the model all potential characteristics of girls defined above. The data allows us to observe the age at cutting for a vast majority of girls. However, in the sample, I only observe that some girls had been cut at some early ages and other at some point before their age at the time of the survey. I use the approach above to quantify their likelihoods. I translate the model using logistic regression with conditional odds of being cut at each age A such that:

$$\frac{h(a|X)}{[1 - h(a|X)]} = \ln\left(\frac{h(A_i, X)}{[1 - h(A_i, X)]}\right) = X\beta$$

where $h(a|X)$ is the conditional hazard of being cut at age a based on a set of covariates X which includes girl's age; parents' characteristics: birth cohort, education, religion, ethnicity, wealth index; and geographic/economic information. I estimate the impact of the exogenous law enacted in 1999 on FGC, I seek to compare the hazard for those in the treatment group to the hazard for those in the control group. I estimate the following model:

$$logit[h(A_m|X)_{i,t,g}] = \beta_1 + \beta_2\big[Post_t \times Senegal_{i,g}\big] + \Gamma X_{i,g,t} + \zeta_g + \tau_t + \tau_{A_m} \qquad (9)$$

$Senegal_{i,g}$ is an indicator variable $(= 1)$ for a daughter who lives in Senegal; $Post_t \times Senegal_{i,g}$ defines exposure by considering the date of birth and country of origin.

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VITA

Gaius Ahamide was born in Porto-Novo the capital of Benin in West Africa. His interest in Economics started somewhere during his last year in middle school at one of the most reputable institutions in the region. With his Maths skills, he obtained a Government scholarship to attend Ecole National d'Economie Appliquee to deepen his knowledge of Statistics and Economic principles. He earned a B.A. in December 2014. In the Fall of 2015, he decided to start his journey in graduate school by joining the African School of Economics. He pursued a master's degree in economics, mathematics, and economics in an environment that allowed him to foster a queen interest in research but also increase his knowledge of English.

Through the school, he worked as a research assistant with the affiliated and well-known Institute for Empirical Research in Political Economy. He acquired rich experience participating in round tables, shaping relevant information for questionnaires, and training, and supervising teams to collect adequate data. He contributed to many projects dealing with governance, education, public health, youth employment, and girls' introduction to STEM programs. He gained valuable experience in survey design and implementation, randomized control trials, and policy studies.

After graduating with his master's in December 2017, he was encouraged to join the Pre-doctoral program and prepare to reach his goal of getting more rigorous training in Health Economics and designing policy works. With the advisory of Dr. Leonard Wantchekon and the mentorship of Dr. Pierre Nguimkeu, he enrolled in August 2018, in a Ph.D. program in Economics at the Andrew Young School of Policy Studies at Georgia State University (GSU). During his training, Gaius has expanded his interest in health, education, development economics, and applied econometrics. During his graduate years at the Andrew Young School of Policy Studies, Gaius worked as a Graduate Research Assistant for Dr. Grace Eau and Dr. Pierre Nguimkeu. He continued his collaboration with Dr. Nguimkeu, focusing on developing sustainable and efficient policies to address development issues in the context of West Africa. His work has primarily centered around expanding economic knowledge pertaining to public health concerns faced by girls and women worldwide. Furthermore, he conducted research on the potential bias between informed and non-informed patients in the United States.

As Gaius embarks on his new career journey with the Center for Disease Control and Prevention, he remains committed to his mission of reshaping policies. He will join the Center for State, Tribal, Local, and Territorial Support, specifically the Office of Public Health Law Services, where he will work towards improving public health through interventions and initiatives aimed at enhancing the well-being of individuals.