Paid Work for Women and Domestic Violence: Evidence from the Rwandan Coffee Mills

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Abstract

Using the government-induced rapid expansion of the coffee mills in Rwanda in the 2000s, I first provide causal evidence that a mill opening increases women's paid employment, women's and their husbands' earnings and decreases domestic violence. Then I provide evidence which suggests that the decline in violence is driven by women's paid employment. The increase in husbands' earnings is not the dominant mechanism. The opening of a mill affects coffee farmers who reside in its catchment area, a buffer zone around the mill, during the harvest months. A mill opening enables women to transition from being unpaid family workers in their family plots to wage workers in the mills. Using a staggered difference-in-differences (DID) design, I show that upon a mill opening, women in the catchment areas are 18% more likely to work for cash and 26% less likely to self-report domestic violence in the past 12 months. Using novel monthly administrative records on the universe of hospitalizations for domestic violence and a DID event-study design, I also show that it is 20% less likely for the hospitals in the catchment areas to have a domestic violence patient in a harvest month compared to one month before the beginning of the harvest season. The decline in violence is present even among couples where husbands work in occupations with no change in earnings with a mill, non-agricultural manual jobs. An increase in women's outside options and their contribution to household earnings, not exposure reduction between couples, explain the results.

Keywords: Domestic violence, female labor supply, agriculture, Rwanda

JEL Codes: J12, J16, J21, J31, O12

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1 Introduction

Domestic violence is an extreme form of gender inequality, violation of human rights and a global health problem of epidemic proportions (WHO, 2013). About 1 in every 3 women worldwide have experienced either physical and/or sexual violence from their partners in their lifetime (World Bank, 2015). To address domestic violence, providing employment opportunities to women is discussed in the policy debate. The argument is that employment can decrease violence via an increase in women's outside options and bargaining power and/or a reduction in the financial stress in the household. Yet, causal evidence on the effects of increased job availability for women on domestic violence is limited. The domestic violence literature focuses on the effects of cash-transfers, unemployment, gender wage gap, education and dowry payments, which are different than having a job.[1] Moreover, evidence from cash transfers suggest that an increase in women's resources may increase as well as decrease violence due to husbands' incentives to extract the resources or male backlash (Angelucci 2008, Bobonis et al. 2013, Hidrobo et al. 2016, Haushofer et al. 2019). Does providing jobs to women make them less or more vulnerable to domestic violence?

This paper investigates whether providing employment opportunities to women decrease the violence they face from their partners using the government-induced rapid expansion of the coffee mills in Rwanda in the 2000s as a natural experiment. The expansion is an ideal setting to study the effects of increased job availability for women since a mill opening enables women to transition from being unpaid family workers in their family plots to wage workers in the mills for the same tasks as before. Thus, the results capture the effects of having a paid job and moreover are not influenced by learning a new skill.[2]

In 2002, the Rwandan government adopted the National Coffee Strategy that aimed to shift to mill-processed coffee production to participate in the international specialty coffee market (Boudreaux, 2011). In the early 2000s, a public-private partnership project helped farmers to establish cooperatives and build mills in their communities. After the project, farmers continued to build mills across the country. From 2002 to 2012, the number of mills increased from 5 to 213.[3]

A coffee mill is where coffee cherries, harvest of the coffee tree, are processed into coffee beans for export. The context provides two key features for identification. First, a mill opening enables women's transition to paid employment and creates a time-variation. Before a mill opening, women process coffee at home as a female-dominated task. Their husbands sell the home-

[1] See Section 2.

[2] Having a job is a combination of earning income and non-monetary benefits of employment including social network and psychosocial benefits (Hussam et al., 2021).

[3] In 2012, coffee accounted for nearly 20% of Rwanda's exports and 15% of its GDP (Macchiavello and Morjaria, 2020).

processed coffee in the local market as a male-dominated task and receive the income from coffee as their personal earnings. After a mill opening, husbands within the catchment area sell coffee cherries to the mill. The mill demands paid labor for the coffee processing tasks during the harvest months, March-July, within a year. Since the tasks are female-dominated, a mill provides the opportunity for women in the catchment areas to transition from unpaid family workers to daily wage workers in the mill and have personal earnings. Given that the husbands were already generating income, there is no change in their type of earnings. Yet, husbands earn a higher income from selling cherries to mills compared to selling home-processed coffee in the local market (Macchiavello and Morjaria, 2020). Second, the opening of a mill creates a spatial variation. A mill serves coffee farmers that reside within its catchment area, approximately a 4 km radius buffer zone around the mill.[4] It has a specific catchment area since cherries will rot if coffee farmers do not transport their cherries to a mill within few hours of harvest.

To causally identify the impact of a mill opening, I first use a staggered DID design exploiting the spatial variation, within-outside of the catchment area, and the yearly time variation, before-after a mill opening. For this strategy, I use data on self-reported domestic violence and labor market outcomes. Then I complement this analysis using novel monthly administrative records, the universe of hospitalizations for domestic violence, during the end of the expansion where the number of mills is fixed. I use a DID event study design exploiting the same spatial variation as before and monthly time variation within a year. I use the beginning of the harvest season, March, as the event where the mills start to operate.

Rwandan Demographic Health Surveys (DHS) provide information on couples' self-reported labor market outcomes and women's domestic violence for the past 12 months. Hospital Management Information System (HMIS) data provides the universe of monthly hospitalizations due to domestic violence. I combine data on the universe of mills using Rwanda GeoPortal and Macchiavello and Morjaria (2020). All aforementioned datasets are geocoded that enables me to link the couples and hospitals with the mills based on the GPS coordinates. I also use an additional household survey that provides couples' individual earnings.

Upon a mill opening, being exposed to a mill increases the probability of working for cash in the past 12 months by 18% with respect to the sample mean (0.40). The probability of working in the past 12 months remains unchanged. Importantly, being exposed to a mill decreases the probability of self-reporting a domestic violence experience in the past 12 months by 26% with respect to the sample mean (0.35). There is no statistically significant change in husbands' probability of working and type of earnings being cash in the past 12 months. The occupation for each spouse remains unchanged. To establish these results, I use couples who reside outside of the catchment

[4] Farmers outside of the catchment areas continue to process coffee at home after a mill opening.

area but are located within the same district with the mills as the control group. The results are robust to using another control group, the couples who reside within the donut area between 4 and 8 km from the mills. Using the additional household survey data, I also show that upon a mill opening, mill exposure increases both women's and their husbands' last daily earnings.

Next, using monthly hospitalizations data in a DID event study design, I test for an effect during the harvest months, the only period mills operate within a year. Within the harvest months, May-July is the peak of the harvest where majority of the community around the mills work in the mills. I show that it is 18% and 20% less likely for hospitals in the catchment areas to a have a domestic violence patient in June and July respectively compared to one month before the mills' month of operation, February. There are no statistically significant changes both for January, two months before mills' month of operation, as well as for the post-harvest months when mills do not operate and thus women do not work for pay. As a placebo test, I present results for women's hospitalizations other than domestic violence. I find no changes. This rules out the concern that women go to a hospital less during the harvest season due to increased opportunity cost of time. Moreover, finding a decline in domestic violence both with administrative and self-reported data suggests that the results are not subject to reporting bias.

In the second part of the paper, I investigate the mechanisms behind the decline in domestic violence. I first present a conceptual framework. The husband decides whether to inflict violence and the wife decides whether to separate. The level of satisfaction with the marriage is private information for each spouse. A mill opening affects violence in three ways. First, as the wife transitions to paid work, her outside option, the utility of being separated, improves. This increases the probability of her initiating separation. Opposingly, the husband is incentivized to choose violence to extract the newly acquired resources from the wife. Third, as the household earnings increases either via an increase in his or the wife's earnings, husband's marginal non-monetary benefit from violence (e.g. financial stress relief) decreases. When the wife's outside option due to her job is good enough, the husband's extraction rate and his non-monetary utility from violence based on household earnings is small enough, violence decreases.

To uncover the mechanisms behind the decline in violence empirically, I first show that upon a mill opening, women in the catchment areas are more likely to make household decisions jointly with their partners including large household purchases and contraception usage. This suggests that a mill opening improves women's outside options and increases their bargaining power in the household. Second, I show that the decline in domestic violence is observed even among couples where husbands work in occupations with no change in earnings with a mill, non-agricultural manual job.[5] The magnitude of the decline in violence is also similar to the result based on the

[5] Plumber, construction worker etc. Occupations do not change with a mill opening.

whole sample. This suggests that the increase in husbands' earnings is not the dominant mechanism behind my results. The increase in women's outside options and decrease in husbands' non-monetary benefit from violence (e.g. financial stress relief) due to women's contribution to household earnings are plausible mechanisms. Moreover, unlike farmer couples, these couples do not work together. A mill opening is not a shock to the time they are exposed to each other during work hours. Thus, exposure reduction between couples is also ruled out as the dominant mechanism.[6]

All plausible channels are due to women's paid employment. Thus, the paper suggests that women's paid employment is the driver behind the decline in domestic violence. The seasonality of the decline in hospitalizations supports this and also speaks to the mechanisms. The result suggests that in a context where wages and household resources are low, access to credit markets and saving technologies are limited, women having better outside options and husbands having less non-monetary benefit from violence based on household earnings is concentrated when women have the jobs.

I also investigate the dynamic impact of a mill opening using a DID event study specification exploiting the number of years couples are exposed to a mill opening. Dynamic estimates show that the effects on domestic violence persists for 4 years. After 4 years, there is no decline in domestic violence although women continue to work for pay. This suggests that the effects of women's paid employment in low-paid jobs may not persist for long years. For the years before a mill opening, the coefficients are close to zero and statistically insignificant for all variables.

Recent econometric literature on DID estimators that use variation in treatment timing raises concerns about the validity of estimation results in the presence of treatment effect heterogeneity. My results are robust to using estimators proposed in de Chaisemartin and D'Haultfœuille (2020) and Sun and Abraham (2020) that gives valid results even if the treatment effect is heterogeneous over time and across groups. I also perform robustness checks related to catchment area measurement. I use different catchment area sizes, 5 and 10 km. I show that as the buffer radius increases, the more untreated couples are counted as treated, the effects of mill exposure fade out for all of my main outcome variables. This rules out the concern that the couples residing right outside of the catchment area are sorting themselves into the treatment group.

The organization of the paper is as follows. Section 2 reviews the related literature and highlight the contributions of the paper. Section 3 provides background information on the Rwandan coffee industry, rapid expansion of coffee mills and women's paid employment in the coffee value

[6]Exposure reduction mechanism argues that there is less violence when the wife work in the mills simply because the couple interact less frequently. I do not model it in my conceptual framework, however, it is documented as a channel in the literature.

chain. Section 4 introduces the conceptual framework that guides the empirical analysis. Section 5 introduces all data sources. Section 6 outlines the identifying assumptions, threats to identification and propose the identification strategy. Section 7 present the empirical results and investigate the mechanisms. Section 8 provides robustness checks. Section 9 concludes.

2 Related Literature

This paper contributes to several strands of the literature. First, it contributes to the literature on women's income and domestic violence. The literature provides evidence for both a positive and negative relationship. The negative relationship between the two is explained with the theory on the increase in the outside option, the decline in financial stress and exposure reduction. The positive relationship is explained with instrumental/extractive theory of domestic violence and male backlash. In the theory on the increase in the outside option, decline in financial stress and the instrumental theory of domestic violence, violence is incorporated into household bargaining models via men's motives.[7] If a man is violent because it contributes to his utility directly, via a release of stress or frustration, then the violence is *expressive* (Gelles 1974, Tauchen et al. 1991). If a man is violent to extract resources from his wife to increase his consumption of goods or to control the wife's behavior, then the violence is *instrumental* (Gelles 1974, Tauchen et al. 1991). I briefly review the theories and the literature on the relationship between women's income and domestic violence below.

I. Increase in the Outside Option. An economic theory of household bargaining that incorporates only expressive violence (Farmer and Tiefenthaler 1997, Aizer 2010, Anderberg et al. 2016, Hidrobo et al. 2016) or expressive and instrumental violence combined (Tauchen et al. 1991, Haushofer et al. 2019), suggests that an increase in women's income decreases domestic violence by improving her outside option and thus her bargaining power. For the choice of outside options, the models use either value of being divorced as in the divorce threat model (Manser and Brown 1980. McElroy and Horney 1981) or noncooperative equilibrium within the marriage as in the separate spheres model (Lundberg and Pollak, 1993)

II. Expressive Violence (Effect of Income). In the literature, expressive violence is used to study the effect of income on domestic violence. Tauchen et al. (1991) highlights that expressive violence does not necessarily need to be sadistic but may allow the husband to release economic stress. Similarly, Angelucci (2008) argues that an increase in spousal income may reduce the husband's economic stress and decrease domestic violence. Haushofer et al. (2019) incorporates expressive

[7] See Chiappori and Mazzocco (2017) for a detailed review of household decisions.

violence into their model to analyze the relationship between economic stress and domestic violence. The paper highlights that if violence and the husband's wealth are substitutes in his utility's expressive component, then they are also substitutes in his total utility. Thus, an increase in the husband's income decreases the violence he inflicts on his wife. The theory is in line with evidence from behavioral neuroscience that finds a link between stress and aggressive behavior (Kruk et al., 2004).

III. Exposure Reduction. Criminologists develop the theory of exposure reduction to argue that an increase in female employment may reduce domestic violence due to the decline in the time couples spent together (Dugan et al., 1999).

IV. Instrumental Violence (Resource Extraction). There also exists theories which suggest that there is a positive relationship between women's resources and domestic violence. Bloch and Rao (2002), Eswaran and Malhotra (2011), Bobonis et al. (2013), Anderson and Genicot (2015) and Calvi and Keskar (2021) present bargaining models that incorporates instrumental violence where the husband uses violence or threats of violence as a bargaining tool to extract resources from his wife or to enhance his bargaining power. These models argue that violence is an instrument in household bargaining for men and an increase in women's resources also increases the domestic violence they face.

V. Male Backlash. Theory of male backlash proposed by sociologists also argues that an increase in women's income may indeed increase domestic violence. According to the theory, female employment challenges the husband being the "breadwinner" and thus, he inflicts violence on his wife to reinstate his traditional gender role (Macmillan and Gartner, 1999). Although both instrumental violence and male backlash theory suggest a positive relationship between female employment and domestic violence, male backlash theory do not necessarily argue that the husband's motive to inflict violence is to extract resources from the wife. The theory focuses on the husband perceiving the wife's employment as a status threat in the household due to entrenched social norms.

A growing empirical literature on domestic violence provide evidence for the theory on the increase in women's outside options (Aizer 2010, Anderberg et al. 2016, Hidrobo et al. 2016, Haushofer et al. 2019), reduction in financial stress (Angelucci 2008, Bhalotra et al. 2019, Heath et al. 2020, Arenas-Arroyo et al. 2021, Bhalotra et al. 2021), exposure reduction (Chin, 2011), instrumental violence (Bloch and Rao 2002, Eswaran and Malhotra 2011, Bobonis et al. 2013, Heath 2014, Anderson and Genicot 2015, Erten and Keskin 2018, Bhalotra et al. 2019, Erten and Keskin 2018, Erten and Keskin 2020, Calvi and Keskar 2021 Erten and Keskin 2021) and male backlash (Angelucci 2008, Luke and Munshi 2011, Tur-Prats 2021, Alesina et al. 2020, Guarnieri and Rainer 2021). It is worth mentioning that within the empirical literature on domestic violence, La Mattina (2017), Rogall (2021) and Sanin (2021) focus on domestic violence in the Rwandan context, yet they do not investigate the relationship between women's resources and domestic violence. They focus on the long-run impact of the Rwandan Genocide, female political participation and the effects of domestic violence laws on domestic violence in Rwanda respectively.

This paper also contributes to the literature on female labor force participation (FLFP) in developing countries. Since FLFP is strikingly low in the developing world (non Sub-Saharan African countries), the literature focuses on the drivers of FLFP and the effects of interventions that can foster FLFP. These include cultural practices, trade liberalization, residence patterns, microcredit, education, cash-transfers, correcting husbands' beliefs, laws, opening bank accounts for women and psychosocial interventions (Alesina et al. 2013, AlAzzawi 2014, Gaddis and Pieters 2017, Khanna and Pandey 2020, Angelucci et al. 2015, Banerjee et al. 2015, Keats 2018, Baird et al. 2019, Bursztyn et al. 2020, Hyland et al. 2020, Field et al. 2021, McKelway 2021). In this paper, I focus on the consequences of women's employment, specifically paid employment. Heath and Jayachandran (2017) reviews the litearature on FLFP in the developing countries and highlights that increased job availability for women is found to affect women's marriage, fertility and education decisions (Jensen 2012, Sivasankaran 2014, Heath and Mobarak 2015), children's health (Qian, 2008) and bargaining power (Anderson and Eswaran 2009, Majlesi 2016). My results suggest that the interventions that increase female paid employment have the potential to benefit women beyond their labor supply and decrease the violence they face from their partners.

3 Institutional Context

In this section, I provide background information on the coffee industry in Rwanda, rapid expansion of the mills following the agricultural reforms in the early 2000s and women's work opportunities in the mills.

3.1 The Coffee Industry in Rwanda

Coffee production and processing. The first two stages of the coffee value chain, cultivation and processing are the stages of interest throughout the paper. Both stages includes labor intensive processes which affect the quality of the end product.

A coffee tree produces coffee cherries that contains coffee beans. It takes at least three to five years for a coffee tree to produce cherries after it is planted. When the cherries ripen, they should be harvested (picked) by hand. The cherries do not ripen all at once which makes harvesting a labor-intensive process. The harvest season lasts for approximately four to five months. It lasts from March to July in Rwanda and the peak of the harvest is from May to July.

After harvest, coffee needs to be processed. Processing is made up of three main tasks. The first task is cleaning, which is removing the outer layer (pulp) of the coffee beans. In the second task, the coffee beans are dried under the sun on flat surfaces.[8] In the third task, the defective dried coffee beans are sorted out by hand based on their color and size, which is a very labor-intensive process like harvesting.

There are two possible methods to process the coffee cherries: dry processing and wet processing. In the dry processing, which is also known as the traditional method due to being the oldest coffee processing method, all tasks are done by farmers at their homes without any machinery.[9] The outcome of this process yields a low quality product which is sold in the local market for a very low price.

In the wet processing method, farmers sell their coffee cherries to coffee mills (called washing stations in Rwanda). A mill can be thought as a large firm for developing country standards where coffee is wet-processed. In the mills, cleaning is done with specific machinery which uses plenty of water. That is why the method is called wet processing. Drying and sorting tasks are done by hand as in dry processing. Mills demand seasonal wage labor from the neighboring community for these tasks. The method yields a high quality product which is sold in the international market for a high price to international buyers.[10] Multinational companies like Starbucks is an example of an international buyer of Rwandan wet-processed coffee.

3.2 Rapid expansion of the mills

Agricultural Reforms. In 2000, Paul Kagame came into power and prioritized economic growth to rebuild the country in the aftermath of the Rwandan Genocide (1994). He launched the Vision 2020 program in 2000 (Boudreaux, 2011). The program outlined a list of goals which the government aimed to achieve by 2020. One of the main goals was to transform agriculture into a high value sector. In light of this goal, the government adopted the National Coffee Strategy in 2002 which aimed to shift to high quality, wet-processed coffee production to participate in the international specialty coffee market (Boudreaux, 2011). At the time, 90% of the Rwandan coffee was dry-processed and thus classified as low-quality (MINAGRI and MINICOM, 2008). The government also liberalized the coffee industry and removed barriers to trade (Boudreaux, 2011).

[8] The dried beans are called parchment coffee.

[9] Farmers clean cherries using rocks and then dry the beans on mats (Macchiavello and Morjaria, 2020).

[10] In 2012, wet-processed (also called as fully washed) coffee export gate prices are roughly 40% higher than for dry-processed coffee in Rwanda (Macchiavello and Morjaria, 2020).

The reforms in the coffee industry changed the incentives of individuals in the coffee value chain. First and foremost, farmers started to have the incentive to use wet-processing rather than dry-processing since it yields a higher income (Boudreaux, 2011). Exporters compete to sell the wet-processed coffee to foreign buyers. Foreign buyers are interested in buying the Rwandan coffee since the quality increased as the coffee is now wet-processed.

Expansion of the Mills. Between 2000-2006, governmental institutions collaborated with USAID, universities in Rwanda and U.S., and private sector partners under the Partnership to Enhance Agriculture in Rwanda through Linkages (PEARL) project. The project helped farmers to establish cooperatives, find loans and build mills in their communities in few locations. After 2006, farmers continue to establish cooperatives and build mills in their communities across the country. The number of mills expanded rapidly between 2005-2011. Figure 1 shows the expansion of the mills in Rwanda over the last decades. In 2005, the total number of mills was 49. In 2011, the number quadrupled to 197.

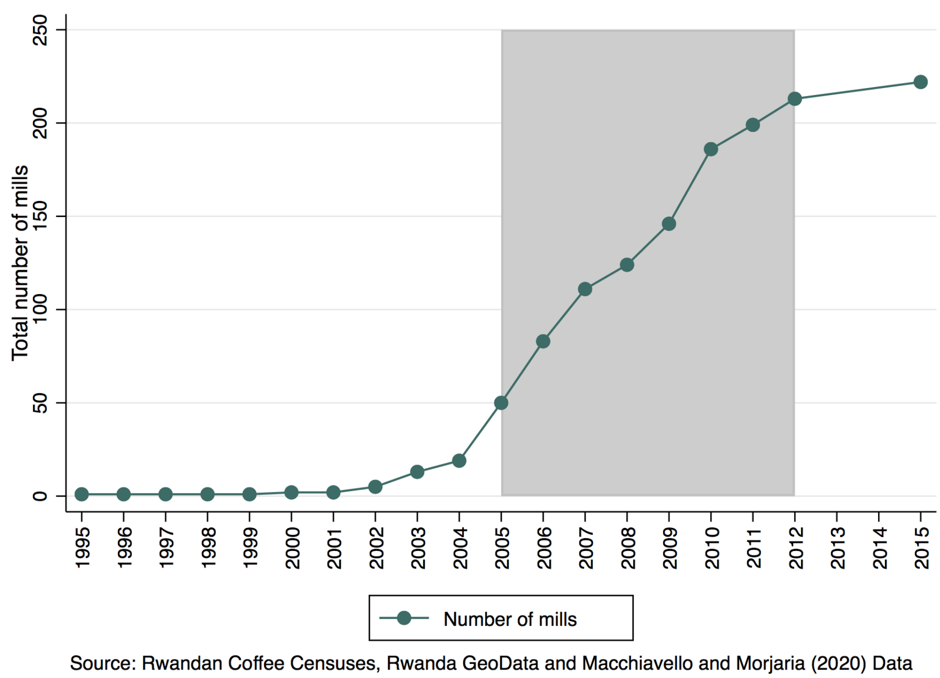


Figure 1: Mill Expansion in Rwanda

Mill Suitability. There is geographical variation in mill locations. Figure 2 visualizes the spatial variation. The expansion of the mills are mostly concentrated in the areas that had a high number of coffee trees in 1999, before the adoption of National Coffee Strategy in 2002.

The number one condition for mill suitability is the area having a sufficient amount of coffee trees (Schilling and McConnell, 2004). This is mainly because the harvested coffee cherries should

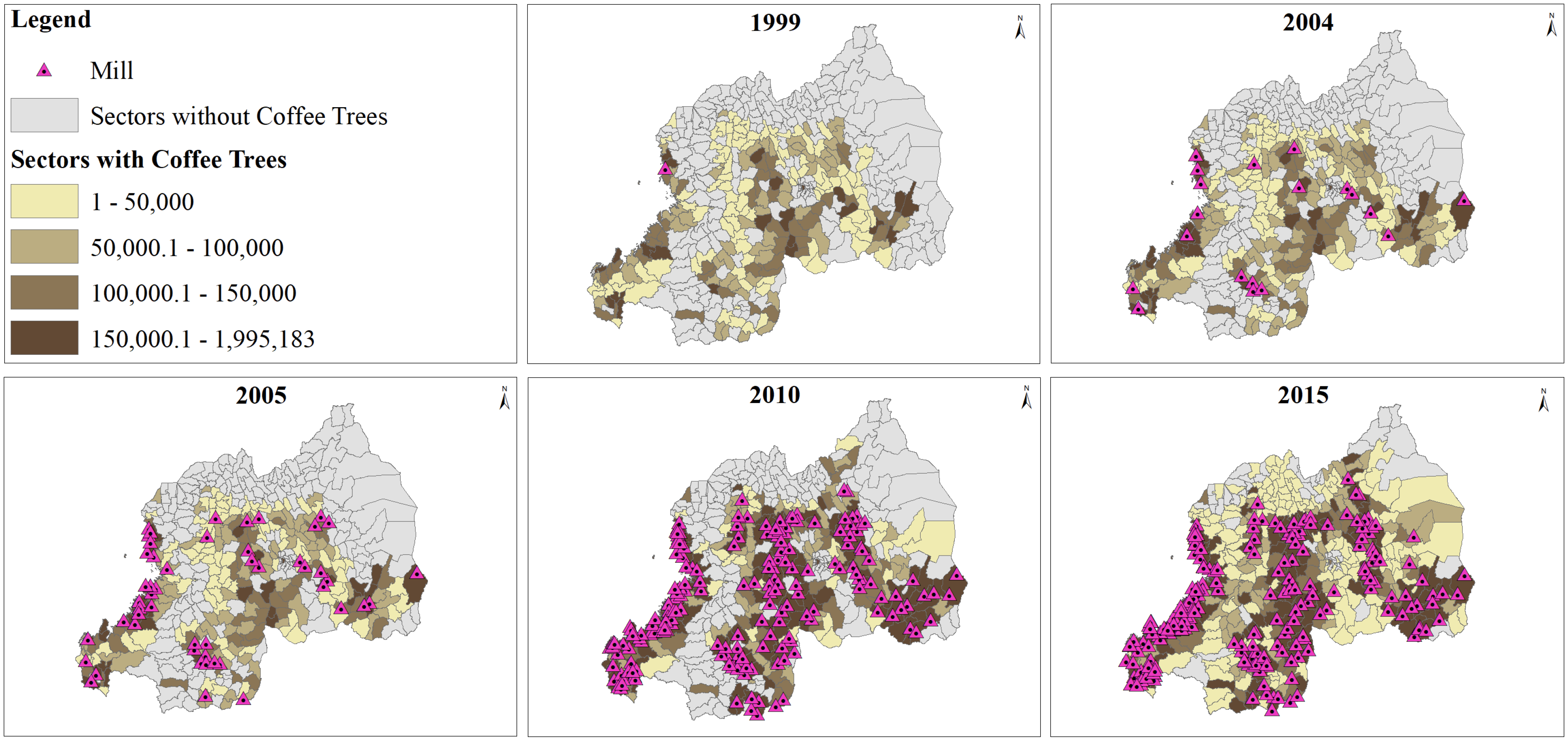


Figure 2: Expansion of Mills in Rwanda

Note: The maps are constructed by combining data on mills, The Rwandan Coffee Census 1999, 2003, 2009 and 2015, The Rwandan GeoPortal spatial data on sector boundries.

be transported to the mills within two hours of harvest. Otherwise they will rot (Schilling and McConnell 2004, Macchiavello and Morjaria 2020).[11] An overwhelming majority of the country is suitable for coffee cultivation.[12] Figure A.1 visualizes FAO-GAEZ coffee suitability index and confirms that the country is suitable for coffee production. Arabica coffee, the dominant plant type in Rwanda, grows best at an altitude over 1,000 meters (3,000 and 6,000 feet) and at an average temperature between 15 and 24 °C (59 and 75 °F). Nicknamed as "The Land of the Thousand Hills", Rwanda's hillsides provide the ideal conditions to cultivate coffee.

Figure 2 and Figure A.1 show that over time, the number of coffee trees increased also in the coffee suitable areas that did not have coffee trees in 1999. However, specifically the rapid expansion between 2005 and 2010 is concentrated in the areas where there were already coffee trees back in 1999. This is mainly because it takes at least 3-5 years for a newly planted coffee tree to produce coffee beans. Thus, a newly planted coffee tree that is planted the day the National Coffee Strategy is adopted will start to produce coffee cherries between 2005-2007.

In Section 6.1, I investigate the determinants of a mill opening and present supporting evidence that conditional on agricultural conditions related to mill suitability, the timing and location of a mill opening is random.

3.3 Women's paid employment in the mills

The division of labor in the coffee value chain is gendered. This holds true not just for Rwanda but in coffee producing countries in the world in general. According to International Trade Forum's (ITC) survey that was conducted in 15 coffee producing ITC member countries -most of them are developing countries and Rwanda is one of them- women mostly take place in the earlier labor intensive steps in the value chain compared to the latter steps. Survey results is reported in Table 1. Women constitute 70% of the workforce in harvesting and processing. Only 10% of them are doing sale activities like in-country trading or exporting (Scholer, 2008). Drying and sorting are female-dominated tasks and marketing and selling the product are male-dominated. As coffee transforms from a commodity into a value-added product tasks in the coffee value chain become male-dominated (SCAA Sustainability Council, 2015).

Before the expansion, the gendered division of labor generated a disparity in generating labor income in Rwanda. Although women worked in labor intensive stages, men receive and control the income. Women do not have their personal income and they depend on their husbands financially.

[11] Most farmers carry their product to mills by walking.

[12] Coffee plants (*coffea*) is found in the tropical areas of Africa, South America and Asia, which is termed as "the coffee/bean belt". The belt provides the necessary conditions for the coffee plants to grow. Such conditions include specific ranges of temperature, rainfall, altitude and soil characteristics.

Tasks in the value chain	Participation Variation (Min-Max)	Typical Participation
Fieldwork	10-90%	70%
Harvest	20-80%	70%
Sorting	20-95%	75%
In-country trading	5-50%	10%
Export	0-40%	10%
Other (certification, laboratories)	5-35%	20%

Source: International Trade Forum, 2008

Table 1: Women's Participation in the Coffee Value Chain in Coffee Producing Countries

With the expansion, mills demand seasonal wage labor for drying and sorting tasks.[13] Women transition from being unpaid family workers to wage workers in the mills. What is unique about the context is that women are doing the exact same tasks as before the expansion, drying and sorting, but now they are paid for their labor by the mills and generate personal income. Since men were already generating income from their labor (selling the product), there is no change in their type of earnings. However, I will show that they generate a higher income from selling their product. Before the expansion, men sell dry-processed coffee beans to middlemen in the domestic market for a very low price. With the expansion, they sell their cherries to mills for a higher price.[14]

In 2012, authors of Macchiavello and Morjaria (2020) surveyed the coffee farmers who sell cherries to a coffee mill in Rwanda where the survey results confirm that a mill opening affects women and men differently. On average, a mill buys cherries from 400 farmers. 71% of the survey respondents are men, which confirms that selling cherries is a male dominated task.[15] Moreover, 55% of the farmers that answered the survey are coffee cooperative members. 50% of the mills are owned/run by coffee farmer cooperatives. If a mill is owned/run by a cooperative, it means that the coffee farmers in a region gather together, establish a cooperative and build a mill. Based on the numbers, typically, the cooperative member farmer husband sells coffee cherries to a mill and his wife works in the mills during the harvest season, March-July.[16]

[13]Within the harvest months, in a given day, multiple farmers bring their cherries to a mill. The cherries are combined together and washed with the machinery in the mills. In the following days, mills demand paid labor for the female-dominated drying and sorting tasks where women can work for.

[14]Macchiavello and Morjaria (2020) surveys the coffee farmers in Rwanda in 2019. The survey asks the relative profitability of the two processing methods. 98% of the farmers reported that selling cherries to mills are more profitable than home processing.

[15]Based on my data, the remaining percent is in line with the share of farmer women who are married to non-farmer husbands or are widows.

[16]It has also been documented that the farmers (husbands) who sell to the mill may receive a second-payment from the mills after the harvest, around November. This is when export contracts are realized and mills receive a premium/payment from the countries that the processed coffee is exported (Macchiavello and Morjaria 2020, Church 2018). Although 80% of the survey respondents expressed that they received a second payment in the past, the amount of the payment is not big. Amounts typically are 5%–10% of total payments during the harvest season (Macchiavello

In summary, being exposed to a mill upon a mill opening is a plausibly exogenous increase in both women's paid employment and women's and their husbands' earnings. In the next section, I conceptualize the impact of an increase in women's and their husband's earnings on domestic violence in a simple theoretical framework to guide my empirical analysis.

4 Conceptual Framework

My conceptual framework below summarizes the main effects discussed in the literature (See 2) and shows how changes in women and their husband's earnings affect domestic violence.

4.1 Setup

Preferences. The household consists of a wife and husband, $j \in \{w, h\}$. I assume that the preferences can be represented by the utility functions

$$U_h = yI_h + (1 - x + t\tau)I_w + t\alpha_h(I_h + I_w) + \theta_h \quad \textit{and} \quad U_w = (1 - y)I_h + (x - t\tau)I_w + \theta_w - tv_w \quad (1)$$

where I_j for $j \in \{w, h\}$ indicates personal earnings for the wife and husband. $I_h > I_w$, the husband earns more than the wife as in my data. According to Rwandan social norms, the husband controls household income and household decision-making (ICRW 2011, Bayisenge 2010, Ya-Bititi et al. 2019). The husband keeps yI_h of his personal income, $y \in (0, 1)$, and gives $(1 - y)I_h$ of it to the wife for her expenses. The wife keeps xI_w of her personal income, $x \in (0, 1)$, and turns $(1 - x)I_h$ of it to the husband. In my data, 65% of women decide how to spend their earnings jointly with their husband, not by themselves, which provides support for the model. x and y are predetermined in the beginning of the marriage. The main difference between the husband and the wife is that the husband can extract more money than his spouse turns over to him (based on the predetermined x value) by inflicting violence. Mainly, the husband can use violence to get a bigger share of her earnings and maximize his utility from marriage. Violence is parametrized by $t \in \{0, 1\}$. $\tau \in (0, x]$ is the extraction rate. If the husband chooses to inflict violence on his wife, $t = 1$. If he chooses not to be violent, $t = 0$. τ captures *instrumental* violence and shows that violence is used as a tool by the husband to extract resources from his wife.

$\alpha_h(I_h + I_w)$ denotes husband's non-monetary utility from inflicting violence and captures *expressive* violence in the framework. With the parameter, the benefit from domestic violence enters to the husband's utility directly, not in an instrumental way. The parameter can be seen as the

and Morjaria, 2020).

husband's taste for violence. It allows to study the effect of income on violence when it is not instrumental. As an example, the husband's taste for violence can be decreasing in his and/or his wife's earnings which in turn affects violence in the household. It is possible that when there is a higher level of resources in the household, the husband enjoys consuming a richer consumption bundle compared to before and his taste for violence decreases. This resembles an income effect on husband's taste for violence and thus the actual violence. $\alpha_h(I_h + I_w)$ can also capture the effect of financial stress on violence in the household. The husband can dislike financial stress and $\alpha_h(I_h + I_w)$ can capture stress relief from violence. In such a case, when there are more resources in the household, there is less financial stress and marginal utility from stress relief is lower. Thus violence decreases. Both scenarios are plausible and allows to conceptualize the effect of an increase in household earnings (either via the wife's or the husband's) on violence in a non-extractive way. In order to capture the aforementioned scenarios, I assume that $\alpha_h(I_h + I_w)$ is decreasing in both the husband's and wife's income, $\frac{\partial \alpha_h}{\partial I_h} < 0$ and $\frac{\partial \alpha_h}{\partial I_w} < 0$.

θ_j for $j \in \{w, h\}$ indicates the private level of satisfaction with the marriage for the wife and husband. As a key assumption of the model, the level of satisfaction with the marriage remains private information for each spouse. θ_j follows distribution F_j with support $[\underline{\theta_j}, \overline{\theta_j}]$. $\underline{\theta_j}$ is high enough for the marriage to be intact. v_w is the disutility from violence for the wife where $v_w > 0$. U_w is decreasing in domestic violence and increasing in her and the husband's earnings and her private level of satisfaction with the marriage. U_h is increasing in his and his wife's earnings and his private level of satisfaction with the marriage.

I assume that their outside options can be represented by the utility functions

$$S_h = I_h \quad and \quad S_w = I_w. \tag{2}$$

Each spouse only enjoys her/his personal earnings as an outside option. I define the outside option as the utility of being separated. Due to paid employment, the wife has personal earnings to support herself financially if she initiates separation. I conceptualize the utility of being separated with personal earnings only as a simplification. Having a paid job also has non-monetary benefits that can constitute a part of the wife's outside option. As an example, due to having a job, the wife has a social network that can provide her a place to stay during the time she is separated.

Timing. The husband keeps a portion of his personal income to himself and gives the remaining portion to the wife for her expenses. The wife keeps a portion of her personal income and turns the rest to her husband. The husband observes the resources he receives from his wife, $(1-x)I_w$, and either chooses to inflict violence to extract more resources from the wife, τI_w, or he chooses not to be violent and remains with $(1-x)I_w$. If he chooses to inflict violence, his utility becomes

$U_h = yI_h + (1-x+\tau)I_w + \alpha_h(I_h+I_w) + \theta_h$. If he chooses not to, then $U_h = yI_h + (1-x)I_w + \theta_h$. Then, the wife either chooses to separate from the husband or not. If the husband chooses to inflict violence and wife does not separate, her utility becomes $U_w = (1-y)I_h + (x-\tau)I_w + \theta_w - v_w$ where $v_w > 0$. In the absence of violence, her utility becomes $U_w = (1-y)I_h + xI_w + \theta_w$ and she stays with/does not separate from the husband assuming $(1-y)I_h + xI_w + \theta_w > S_w$. The husband's utility is high enough to stay with the wife in the absence of violence as well. When they are separated, the wife and the husband receive S_w and S_h respectively, their individual labor market potential. To highlight again, the level of satisfaction with the marriage remains private information for each spouse throughout the marriage.

Decisions. The solution of the game between the husband and wife can be found via backward induction. The wife chooses between staying in the marriage and separating from the husband given the husband's decision to choose violence. She will separate from her husband if her utility of staying in a violent marriage is smaller than the utility of being separated as in

$$\underbrace{(1-y)I_h + (x-\tau)I_w + \theta_w - v_w}_{\text{Utility of being in a violent marriage}} \leq \underbrace{I_w}_{\text{Utility of being separated}}. \tag{3}$$

Based on equation 3, there is a threshold value of the wife's private level of satisfaction with the marriage, $\overline{\theta_w}$, that makes her indifferent between remaining together with and being separated from her husband. The value of $\overline{\theta_w}$ is

$$\overline{\theta_w} = (1-x+\tau)I_w - (1-y)I_h + v_w. \tag{4}$$

Recall that the cumulative distribution function of θ_w is given by F_w. Therefore, the probability of the wife separating from her husband is $P(\theta_w \leq \overline{\theta_w}) = F_w(\overline{\theta_w})$. Observe that as I_w increases, the probability of separation increases. This is due to the fact that an increase in wife's personal income is improving her outside option. Also, when I_h increases, the probability of separation decreases. This is because the wife enjoys a portion of the husband's personal income if she remains married.

Since the level of satisfaction with the marriage is private information, the husband chooses to inflict violence only knowing the probability that she will initiate separation if her utility of staying together is less than her utility of being separated. He compares the expected utility of choosing violence, EU_h, with utility of not choosing to be violent. His expected utility of inflicting violence on his wife is

$$EU_h = F_w(\overline{\theta_w})I_h + [1 - F_w(\overline{\theta_w})][yI_h + (1-x+\tau)I_w + \alpha_h(I_h+I_w) + \theta_h]. \tag{5}$$

The husband chooses to be violent if

$$\underbrace{EU_h}_{\text{Expected utility of inflicting violence}} \geq \underbrace{yI_h + (1-x)I_w + \theta_h}_{\text{Utility from not inflicting violence}}. \tag{6}$$

Based on equation 6, there is a threshold value of the husband's private level of satisfaction with the marriage, $\overline{\theta_h}$, that makes the husband indifferent between choosing violence (to extract a portion of the wife's resources) and not being violent. The value of $\overline{\theta_h}$ is determined by

$$\overline{\theta_h} = (1-y)I_h - (1-x+\tau)I_w - \alpha_h(I_h, I_w) + \frac{\tau I_w + \alpha_h(I_h + I_w)}{F_w(\overline{\theta_w})}. \tag{7}$$

Therefore, the probability of the husband choosing violence is $P(\theta_h < \overline{\theta_h}) = F_h(\overline{\theta_h})$.

4.2 Effect of a Mill Opening on Domestic Violence

For the couples who are exposed to a mill, the mill provides paid employment opportunities to the wife who was working as unpaid family workers. Thus, I_w increases. Since the husband receives higher earnings from selling cherries to the mill compared to selling home-processed coffee to middlemen in the domestic market, there is also an increase in I_h. I present the main channels that affect domestic violence below.

Increase in Outside Option. As the wife's earnings increases, her outside option improves. This increases the probability of her initiating separation and makes it less likely for the husband to inflict violence on her.

Increased Incentives for Extractive Violence. As the wife's earnings increases, the husband is incentivized to choose violence to extract the newly acquired resources from the wife.

Increase in Household Earnings. As the husband's or women's earnings increase, the husband would receive less non-monetary benefit from using violence. Thus he is less likely to inflict violence.

Differentiating the husband's probability of choosing violence, $F_h(\overline{\theta_h})$, with respect to the wife's earnings, $\frac{\partial F_h(\overline{\theta_h})}{\partial I_w}$, highlights the impact of providing paid employment opportunities to women on domestic violence. Differentiating it with respect to the husband's earnings, $\frac{\partial F_h(\overline{\theta_h})}{\partial I_h}$, highlights the impact of an increase in husband's earnings on him inflicting violence. Both, impact of an increase in I_w and I_h on $F_h(\overline{\theta_h})$, are ambiguous.[17] Under certain conditions, the effects may

[17]The effects still exist if decreasing marginal utility of consumption is assumed such as $U_h = \log(.) + \theta_h$ and $U_w = \log(.) + \theta_w - v_w$. Results are available upon request.

lead to a decline in violence.

Proposition. *The effect of providing job opportunities to women on domestic violence,* $\frac{\partial F_h(\overline{\theta_h})}{\partial I_w}$*, is negative when* I_w *and* $|\frac{\partial \alpha_h(I_h+I_w)}{\partial I_w}|$ *are large enough and* τ *is small enough. The larger the* I_w *and* $|\frac{\partial \alpha_h(I_h+I_w)}{\partial I_w}|$ *and the smaller the* τ *, the larger the effect is in magnitude. The effect of an increase in husband's earnings on violence,* $\frac{\partial F_h(\overline{\theta_h})}{\partial I_h}$*, is also negative when* $|\frac{\partial \alpha_h(I_h+I_h)}{\partial I_h}|$ *is large enough. The larger the* $|\frac{\partial \alpha_h(I_h+I_w)}{\partial I_h}|$*, the larger the effect is in magnitude. If* $\frac{\partial \alpha_h(I_h+I_w)}{\partial I_h}$ *is zero,* $\frac{\partial F_h(\overline{\theta_h})}{\partial I_h}$ *is positive.*

Proof. See Appendix B.

The proposition highlights how the wife's job opportunities may decrease domestic violence. When the wife's outside option due to her job is good enough, the husband's extraction rate is small enough and he receives less non-monetary benefit from violence with the wife's contribution to household earnings, violence decreases. The proposition also highlights that keeping the wife's earnings constant, an increase in the husband's earnings may also decrease violence. This happens when the increase in his earnings (also an increase in household earnings), decrease his non-monetary benefit from inflicting violence. If such an increase in his earnings does not have any effect on his non-monetary benefit from violence, the violence increases. Intuitively, this is because an increase in his earnings increases the benefit of marriage for the wife. Thus, she will less likely to leave when she experiences domestic violence. This makes the husband more likely to inflict violence on his wife.

In the rest of the paper, using data, I first show that a mill opening decreases women's likelihood of experiencing domestic violence. Then I provide evidence that the result is plausibly driven by channels due to women's paid employment, increase in women's outside options and their contribution to household earnings. The increase in husbands' earnings is not the dominant mechanism.

5 Data

5.1 Panel of Mills

I combine multiple data sources to create a panel of mills.

Mills Data. The Rwanda GeoPortal provides data on the universe of mills as of 2014 in Rwanda. The data is geocoded and includes information on the characteristics of the mills like owner, number of drying tables etc. I combine the data with Macchiavello and Morjaria (2020)'s data that includes the year of operation for each mill between 1995-2012.[18] By combining the datasets, I create a panel of mills that has information on GPS coordinates, year of operation and characteristics of every mill in Rwanda.

Spatial Data, Coffee Census and FAO-GAEZ Suitability Index. I spatially match the mills data with the maps of different geographical boundaries to find the sector, district and province a mill is located in. Then I match the data with several rounds (1999, 2003, 2009 and 2015) of Rwandan Coffee Census. The coffee censuses provide information on the universe of coffee trees in Rwanda at the sector level. I also match the mills panel with FAO's Global Agro-Ecological Zones (FAO-GAEZ) coffee suitability index for 1980-2010. The index provides a coffee suitability score for Rwanda at 9 km^2 resolution. I aggregated the index at the sector level. More details on the data and summary statistics are available in Appendix C.1.

5.2 Individual and Household Level Data

Rwandan Demographic Health Surveys. As a first step of my analysis, I show the impact of the expansion of the mills on paid employment using the Rwandan Demographic Health Surveys (DHS). DHS are nationally representative, cross-section individual and household level surveys that are conducted in developing countries every 5 years. I use 2005, 2010/11 and 2014/15 cycles for my analysis. The surveys collect demographic and health information from women aged 15-49 and men aged 18-59. The data also provide household member information, which enable me to link couples to each other for my analysis.

The information on individuals' employment and type of earnings is collected retrospectively during the individuals' interview: individuals are asked to answer whether they are employed for the last 12 months and if so, whether they worked for cash.[19] I create a binary variable which takes the value one if an individual worked for cash in the last 12 months. Nationally, 88% of women worked in the past 12 months, where only 39% of them worked for cash. I also use other labor market outcomes including occupation.

Domestic violence categories (physical, sexual and emotional) are classified by DHS with respect to World Health Organization (WHO) guidelines. I create a binary variable which takes the value one if a partnered woman experienced physical or sexual domestic violence in the last 12 months. 34% of women self reported experiencing domestic violence in the past 12 months.

The surveys also collect GPS coordinates for every cluster of households. Using the GPS

[18] The number of mills opened between 2012-2014 is very small. I coded those mills' year of operation as 2013.

[19] Due to retrospective questions, DHS data enables me to observe four harvest years in total, 2004, 2005, 2010 and 2014.

coordinates, I spatially merge the DHS data with the mills data. Due to the random displacement (to main confidentiality of respondents), rural clusters contain a minimum of 0 and a maximum of 5 kilometers of positional error. Thus, GPS displacement may lead to measurement error and can bias the results (Perez-Heydrich et al., 2013). In order to reduce distance measurement error, I follow Perez-Heydrich et al. (2013), which suggests using a buffer distance rather than a closest distance when using a distance measure. All the distances calculated in the paper are based on a buffer distance measure. I revisit this issue in the robustness checks section.

I restrict the sample to women who are partnered (civil marriage and those who are living together) before the expansion of the mills to avoid changes in the marriage market matching.

Integrated Household Living Conditions Surveys. I complement my analysis using Integrated Household Living Conditions Survey (EICV). EICV is nationally representative, cross-section individual and household level survey that is conducted in Rwanda. I use 2005, 2011 and 2013/14 cycles for my analysis. The surveys collect demographic and socioeconomic information from households. I use last daily labor income amount (cash) to further investigate the impact of the mill expansion on the labor market and uncover the mechanisms behind the effects on domestic violence. On average women earn less daily labor income compared to their husbands.

The surveys collect district of residence as the smallest geographical unit for each individual/household. There are in total 30 districts in Rwanda. I aggregate the panel of mills at the district level and merge it with individual and household level variables for my analysis. I again restrict the sample to women who are partnered (civil marriage and those who are living together). More details on EICV and DHS data and summary statistics are available in Appendix C.2.

5.3 Administrative Hospital Level Domestic Violence Data

In order to investigate the impact of providing employment opportunities to women on domestic violence, I also use confidential, administrative, geocoded data on the universe of public/district hospitals from the Rwandan Ministry of Health (MOH). Rwandan Health Management Information System (HMIS) data is a monthly district hospital level data on hospitalizations between January 2012 to December 2020. I focus on the years between 2012-2014 for my analysis.

There are in total 42 district hospitals in Rwanda. Due to the institutional structure of the hospitals, the data is on the universe of official domestic violence reports in Rwanda. It collects information on the number of individuals (both women and men) who show symptoms of physical and sexual violence for different age groups (10-18, older than 18). Unfortunately the data does not provide information on the marital status of the patient. In order to create a measure of domestic violence, I focus on the gender based violence reports of individuals who are older than 18 years old. This is because 70% of women over 18 are married in Rwanda.

I construct a binary variable coded as 1 if a hospital had hospitalizations due to physical or sexual violence for women older than 18 in a month and 0 otherwise. This creates a non self-reported measure of domestic violence. 79% of the hospitals have hosted at least a domestic violence patient (GBV patient older than 18) in a given month. Geocoded nature of the data enable me to match this measure of domestic violence with the panel of mills. More details on the data and summary statistics are available in Appendix C.3

5.4 Measuring Exposure to Mills: Treatment and Control Groups

Throughout the paper, the treatment group consists of entities (woman/husband/hospital) who are exposed to the mills where the control group consists of the entities who are not. I construct two measures of exposure to the mills, being in the catchment area of a mill and mills per capita in a district. I also construct multiple control groups with respect to the measures I create.

The first mill exposure measure, being in the catchment area of a mill, is used when the outcome variables are created with geo-coded datasets (DHS and HMIS). The measure uses the GPS coordinates of the mills and DHS clusters/hospitals and calculates whether the clusters/hospitals are within the catchment area of a mill. In most cases, mills are located within a radius of 3–5 km away from the farmers (AgriLogic, 2018). On average, managers of the mills in Rwanda report that the catchment areas have a radius of approximately 4.5 km (Macchiavello and Morjaria, 2020). I create a buffer with 4 km radius centered around the mills to construct the catchment area (treatment group). I define a DHS cluster/hospital within the catchment area of a mill, if the GPS coordinate of the DHS cluster/hospital falls inside the buffer around a mill.

When using DHS data, I consider 2 potential control groups in my analysis. The first control group consists of the DHS clusters that are outside of the catchment area of the mills (4 km buffer) but are located within the same district with the mills. I define using this control group as the "within district approach". An alternative control group consists of only the DHS clusters that are within the donut area between 4 and 8 km from the mills. Since I restrict the control group only to DHS clusters that are within the surface area of a donut, I define using this control group as the "donut approach". Figure 3 shows a visual representation of the treatment and the 2 control groups using a mill in Nyarugenge district and DHS clusters. In both maps, the circular area (buffer around the triangle/mill) is the treatment group. In the top map, which visualizes the within district approach, everywhere outside the buffer characterizes the control group. In the bottom map, which visualizes the donut approach, only the donut area constitutes the control group.

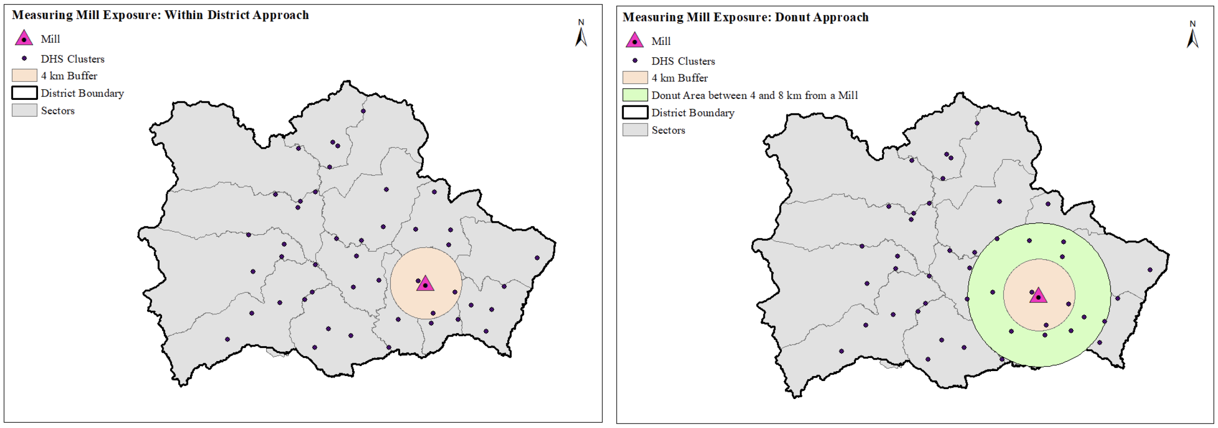


Figure 3: Visualization of the Treatment and Control Groups using Nyarugenge District: Within District and Donut Approach

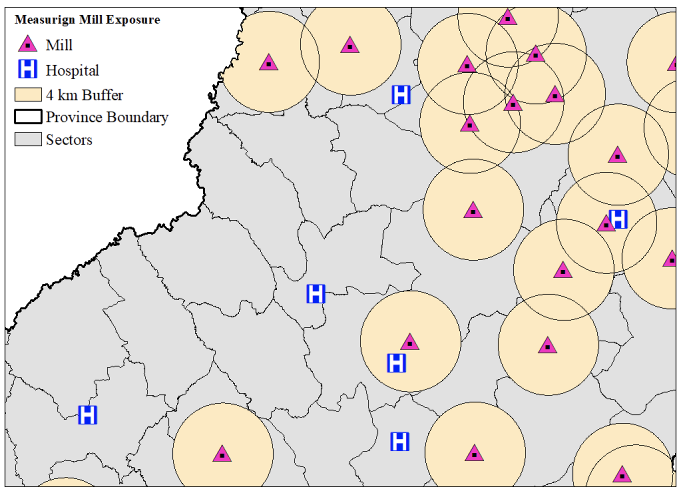


Figure 4: Visualization of the Treated and Control Hospitals

For HMIS (hospital) data, the control group consists of the hospitals that are outside of the catchment area of the mills but are located within the same province with the mills.This choice is due to the sample size and locations of the hospitals. There are only 42 hospitals in the country and majority of the hospitals who are not in the catchment area of a mill are located outside of the same district with the mill as well as the donut area between 4 and 8 km from the mill. Figure 4 shows a visual representation of the treated and control hospitals. The ones in the catchment areas are treated hospitals where the ones outside (within the same province) are control hospitals.

The underlying assumption I make in the hospital specification is that households within (outside of) the catchment area visit a hospital inside (outside) of the catchment area rather than the one outside (inside) due to the hospital's proximity. This is a plausible assumption since the cost of visiting a hospital far away in case of a health problem is more costly compared to visiting the one that is closer (within the catchment area). I create 4 km buffers around the hospitals to check what percent of the buffers around the control hospitals do not intersect with mill buffers. The logic here is that if the rate of no intersection is high, then most of the control hospitals are far enough from the households within the catchment areas. Thus, those households who are within the catchment areas plausibly go the hospitals within the catchment areas and the households outside of the catchment areas go to the ones outside due to proximity. I find that 70% of the control hospital buffers do not intersect with mill buffers. In any case, if a household within the catchment area of a mill visit a hospital outside of the catchment area, this suggests that my results constitute a lower bound.

The second mill exposure measure, log of mills per capita, is used when the outcome variables are created with a dataset that is not geo-coded (earnings data, EICV). The measure is the log of total number of mills in a district in a given year divided by the number of working age individuals living in the district in that year.[20]

6 Empirical Specification

This section proposes the identification strategy to estimate the causal impact of a mill opening on women's labor market outcomes and domestic violence. I use a difference-in-differences strategy that uses the differential timing of and spatial variation in a mill opening.

6.1 Identifying Assumptions and Threats to Identification

The key identifying assumption of the empirical strategy is that the average outcomes for the treatment and control groups would have parallel trends in the absence of treatment, a mill placement. A mill opening at a specific location in a given year is assumed to be uncorrelated with other determinants of changes in the outcome variables (women's labor market outcomes and domestic violence) over time (the treatment is not endogenous). If a mill placement is endogenous, then the parallel trends assumption is violated. This is because in counterfactual, the areas who are exposed to the mill would have diverged anyway, regardless of the mill.

To provide suggestive evidence in favor of my identifying assumption, I estimate, at the sector level, the determinants of having the first mill during the period when mills expanded rapidly, between 2005-2011, and having a mill by the end of my sample, 2014. Firstly, I focus on the variables that are related to coffee cultivation including the historical number of coffee trees and

[20]Individuals who are aged 19-59 are selected in EICV to match the age profile in the DHS sample.

FAO-GAEZ coffee suitability index. I also include the shares of women who are unpaid family workers, self-employed and completed primary school at the sector level before the expansion of the mills as well as the share of men who completed primary school in the regression. This is to confirm that mill placement is uncorrelated with factors that can affect the evolution of female paid employment and domestic violence rates in Rwanda. I use the Rwanda Population and Housing Census 2002 to create the variables. I also included total population and female population at the sector level. Unfortunately, I am unable to include domestic violence rates before the expansion in the regression, since domestic violence data started to be collected in 2005, after the expansion started. However, since education (women and men's) are correlated with the probability of experiencing domestic violence, including them in the regression constitutes a test on whether the placement of the mills is correlated with the evolution of domestic violence rates in Rwanda.

I also include other variables related to promoting female empowerment including share of women in a consensual union, polygamous marriage, without assets and number of daughters per woman. If these variables are uncorrelated with mill placement, then, it provides supporting evidence that the mills are not placed to promote female empowerment and hence mill placement is not endogenous. Moreover, I include genocide intensity since it is also a variable that is found to impact the probability of experiencing domestic violence in Rwanda (La Mattina, 2017). It is also possible that the government or NGOs are more likely to financially support the opening of a mill in genocide intense areas to promote female empowerment that can make the opening of a mill endogenous. District fixed effects are included in all specifications.

I report the results in Table 2. The results provide support for the evidence that variables related to coffee, the number of coffee trees in 1999 and FAO-GAEZ coffee suitability predicts mills placement. Specifically, sectors that have a higher number of coffee trees in 1999 are more likely to have their first mill between 2005-2010. Those areas are also more likely to have a mill by 2014. Similarly, sectors with a higher FAO-GAEZ coffee suitability index are more likely to have their first mill between 2005-2010. Based on results, historical number of coffee trees are more likely to be correlated with the rapid expansion of the mill compared to FAO-GAEZ coffee suitability index. This is not surprising. Before the expansion, not every coffee suitable area in Rwanda had coffee trees and it takes minimum 3-5 years for a coffee tree to produce coffee cherries. Thus, it is likely to observe the rapid expansion of the mills between 2005-2010 in the areas that already have coffee trees before the expansion, like 1999.

All variables other than the number of coffee trees in 1999 and FAO-GAEZ coffee suitability index are statistically insignificant. Specifically, pre-expansion female unpaid employment and female, male primary education rates do not predict mill placement. None of the variables related to female empowerment is statistically significant. Genocide-intensity does not have a statistically significant impact on mill expansion. I also test the joint significance of the relationship between a mill opening and non-coffee variables. For both regressions, I cannot reject the null hypothesis (p-value=0.4954 and p-value=0.6026). These results suggest that mills are not placed to promote female empowerment. They are uncorrelated to the factors that can have an impact on the evolution of female paid employment and domestic violence over time. Thus, conditional on mill suitability based on coffee related variables, opening of a mill is assumed to be random. I control for historical number of coffee trees and FAO-GAEZ coffee suitability index in all of my specifications in the paper.

In Section 8, I also perform an event-study analysis for all of my main outcome variables that exploits the variation in the number of years couples are exposed to a mill. There is no pre-trends in outcomes.

6.2 Paid Work and Self-Reported Domestic Violence

In order to investigate the impact of a mill opening on women's and their husbands' outcomes, I estimate the specification below:

$$Y_{ist} = \beta_0 + \beta_1 Mill_{ist} + \mathbf{X_{ist}}\phi + \lambda_c + \omega_m + \alpha_s + \gamma_{dt} + (\mathbf{X_s} \times t)\theta + \varepsilon_{ist}. \tag{8}$$

The dependent variable Y_{ist} is the outcome of interest of woman i (or the husband of woman i), in sector s and at year t. $Mills_{ist}$ is a binary variable coded as 1 if woman/husband i at year t resides within the catchment area of a mill and zero otherwise. I have a rich set of individual controls, $\mathbf{X_{ist}}$, that includes information on women's/husbands' occupation, education, religion, number of children, marital status, age and duration of marriage, residence (rural/urban) and household wealth. I also control for partner characteristics like partner's age, occupation and education. λ_c is the cohort fixed effects and controls for factors that vary across cohorts. As an example, compared to younger cohorts, older cohorts grew up during a period when Rwanda did not have pro-women laws which may affect their labor market participation and acceptance of domestic violence. ω_m is the year of marriage fixed effects. It controls for time-variant shocks to the marriage market such as the Rwandan Genocide that is documented to affect marriage quality in Rwanda (La Mattina 2017, Sanin 2021).[21] α_s is the sector fixed effects and controls for time-invariant local observable

[21] La Mattina (2017) shows that the timing of marriage (before or after the genocide) has an impact on probability of experiencing domestic violence in Rwanda. Sanin (2021) investigates the impact of the adoption of the domestic violence legislation in Rwanda in 2008, which allows women to unilaterally divorce their husbands if their husbands are violent towards them. After the law, among the women who married after the genocide, the divorce rates increase more and sexual domestic violence rates increase less in the formerly genocide-intense areas, where women are more likely to be in violent marriages. No effect is observed for women who married right before the genocide.

Table 2: Sector Level Baseline Characteristics that Predict Mill Opening

	(1) First Mill in 2005-2010	(2) Mill by 2014
Log Coffee Trees in 1999	0.03***	0.04***
	(0.01)	(0.01)
FAO-GAEZ Coffee Suitability Index	0.07	0.03
	(0.04)	(0.04)
Log Population in 2002	-0.95	-0.67
	(0.74)	(0.75)
Log Female Population in 2002	0.91	0.73
	(0.73)	(0.74)
Share of Self-Employed Women in 2002	0.43	0.65
	(0.55)	(0.55)
Share of Unpaid Worker Women in 2002	0.36	0.87
	(0.58)	(0.59)
Share of Primary-Educated Women in 2002	1.75	1.32
	(1.12)	(1.14)
Share of Primary-Educated Men in 2002	-1.00	-1.10
	(1.21)	(1.22)
Number of daughters per Woman in 2002	-0.18	-0.13
	(0.22)	(0.22)
Share of Women in a Consensual Union in 2002	-1.06	-0.57
	(0.77)	(0.78)
Share of Women in a Polygamous Marriage in 2002	-0.02	-1.08
	(1.94)	(1.96)
Share of Women without Assets in 2002	0.41	-0.32
	(0.60)	(0.60)
Age at Genocide among Women in 2002	-0.08	-0.06
	(0.05)	(0.05)
Genocide Intensity Index at the Commune Level	0.00	-0.03
	(0.04)	(0.04)
District FE	✓	✓
Number of Observations	348	348
Dependent variable mean	0.28	0.33
Adjusted R^2	0.27	0.33

Note: FAO-GAEZ coffee suitability and genocide intensity index are both standardized. The data is at the sector level. FAO-GAEZ index is originally defined at the 9 km^2 resolution. I aggregated the index at the sector level (on average 50 km^2 area) for analysis. *** p<.01, ** p<.05, * p<.1

and unobservable characteristics, such as social norms related to women's employment, domestic violence and gender roles.

γ_{dt} is the district-by-year fixed effects. This is to control for factors that change over time and across districts and may determine both a mill opening and female empowerment such as female political participation. As of 2008, Rwanda is the first country in the world with a female majority in parliament. The share of women in local government varies across districts and increases over time. Districts (akarere) are the geographical units with the highest tier in local government. District councils decide on local development programs within districts. As a possible concern, after an increase in the female political representation in a district council, the local government may financially support cooperatives who want to open mills to promote female paid employment. District-by-year fixed effects control for such scenario. $\mathbf{X_s}$ is a vector of baseline geographical variables at the sector level such as the historical number of coffee trees in 1991 and FAO-GAEZ coffee suitability index. I interact these initial conditions with linear time trends to allow their impact vary over time. The interaction mitigates potential omitted variable bias. This is because coffee tree presence in 1999 is correlated with mill openings after 2002 and it may also effect the evolution of female paid employment over time. I cluster standard errors at the sector level.

The main dependent variables for this specification are being employed, working for cash and experiencing domestic violence in the past 12 months. All outcomes are indicator variables. As an example, working for cash in the past 12 months variable takes the value one if the respondent worked for cash in the past 12 months and 0 otherwise. Domestic violence in the past 12 months variable is a combination of physical and sexual domestic violence. It takes the value one if a partnered woman experienced physical or sexual domestic violence in the past 12 months and 0 otherwise. I also use dependent variables like occupations (manager, sales, agricultural self-employed, agricultural employee, skilled manual, unskilled manual) and household decision-making (whether large household purchases are decided by women alone or jointly with husband compared to husband alone).

The coefficient of interest is β_1, which identifies the impact of a mill opening on the outcome variables. The treated group consists of woman/husband who reside in the catchment area of a mill. The control group either consists of woman/husband who do not reside in the catchment area of a mill within the same district (within district approach) or woman/husband who reside within the donut area between 4 and 8 km from a mill (donut approach). Tables A.11 and A.12 examine whether predetermined covariates including women's agricultural occupation, education, religion, marriage type, age at first marriage, partner characteristics and living conditions (electricity, cement floor in the household) are balanced across treatment and control groups. I perform the test by estimating the specification given in equation 8 using each of the predetermined covariates as the dependent variable. None of the estimates are statistically significant which suggests that the baseline characteristics are balanced across the treatment and each control group.

I also perform a placebo test to show that outcome variables are balanced across treatment and control groups before a mill opening. For this test, I drop the women who reside within the catchment area of a mill in a given year (2004, 2005, 2010 and 2014) from the sample. I construct the treatment group as women who live in the areas that do not have a mill yet. The areas will receive a mill and become catchment areas in the upcoming years. Thus, I am *falsely assuming* that the women who reside in those areas are exposed to a mill and in the treatment group. The control group consists of women who live in the areas outside of the future catchment areas. I again use both the within district and donut approaches. Women in both groups self-report their labor market outcomes and domestic violence experience for a given year before a mill opening. Since both groups are not exposed to a mill, I expect to see no statistical differences between them. I perform the placebo test by estimating the specification given in equation 8 using the aforementioned treatment and control groups. None of the estimates are statistically significant which suggests that the outcome variables are balanced across treatment and control groups before a mill opening.

Table 3: Placebo Test: Outcome Variables Before a Mill Opening

	Within District			Donut		
	(1) Work	(2) Cash	(3) Violence	(4) Work	(5) Cash	(6) Violence
Mill	0.01	-0.02	-0.00	0.00	-0.03	0.01
	(0.01)	(0.04)	(0.07)	(0.01)	(0.04)	(0.07)
Observations	6472	6475	2717	3105	3106	1348
Dependent variable mean	0.99	0.36	0.35	0.98	0.36	0.34

Note: Robust standard errors clustered at the sector level are in parentheses. 4 km catchment area is used for the treatment group. The estimates are based on DHS data and estimated with the main specification presented in Section 5.2.1 *** p<.01, ** p<.05, * p<.1

6.3 Earnings

I also test the impact of a mill on earnings (women and their partners' each).[22] Unfortunately the data on these variables is not geo-coded and the smallest geographical unit in the data is the district. Thus, in order to estimate the impact of the mills on those variables, I employ the empirical

[22]I use earnings and labor income interchangeably.

specification below:

$$Y_{idt} = \beta_0 + \beta_1 Mill_{idt} + \mathbf{X_{idt}}\phi + \lambda_c + \gamma_{dt} + (\mathbf{X_d} \times t)\theta + \varepsilon_{idt}. \tag{9}$$

The dependent variable Y_{idt}, is the logarithm of last daily labor income of partnered woman/husband i, in district d and at year t for estimating the impact on earnings. $Mills_{idt}$ is the logarithm of the total number of mills per capita in the district of residence of a woman/husband i at year t. $\mathbf{X_{idt}}$ is the same set of controls in the main specification. λ_c is the cohort fixed effects.[23] γ_{dt} is the district-by-year fixed effects. $\mathbf{X_d}$ is a vector of baseline geographical variables at the district level including the historical number of coffee trees in 1999 and FAO-GAEZ coffee suitability index. I interact these initial conditions with linear time trends, to allow their impact vary over time. I cluster standard errors at the district level.

The coefficient of interest is β_1, which identifies the impact of an increase in log mill per capita on the outcome variables.

6.4 Monthly Hospitalizations due to Domestic Violence

A unique feature of this paper is that I investigate the relationship between paid work opportunities and domestic violence using both annual self-reported and monthly administrative data. Using the universe of monthly hospitalizations due to domestic violence in Rwanda, I test whether a mill affects domestic violence when it is in operation. This variation is due to the fact that a mill is operating only during the harvest period: March-July. I use a specification at the hospital level. To estimate the impact of a mill on hospitalizations due to domestic violence, I estimate the empirical specification below:

$$Y_{hdtm} = \beta_0 + \sum_{m=1}^{12} Mill_{hd} \times \beta_m \mathbb{1}[\tau = m] + \mathbf{X_{ht}}\phi + \lambda_h + \alpha_d + \sigma_m + \gamma_{pt} + (\mathbf{X_d} \times t)\theta + \varepsilon_{hdtm}. \tag{10}$$

The dependent variable Y_{hdtm} is the monthly hospitalization outcome due to domestic violence in hospital h, in district d, in year t and at event-time m. $Mills_{hd}$ is a binary variable coded as 1, if hospital h is within the catchment area of a mill and zero otherwise during the sample period, 2012-2014. Being in the catchment area of a mill did not change between 2012-2014 for the hospitals. Thus, $Mill_{hd}$ is a time-invariant characteristic. It is interacted with event-month dummies, $\mathbb{1}[\tau = m]$, to investigate the dynamic impact of a mill during the harvest period (March-July), the months mills operate. τ denotes the event-month. $\tau = 3$, March, represents the month

[23] I am unable to control for year of marriage fixed effects since the data does not have such information. However, I am controlling for cohort fixed effects.

harvest period begins and mills start to operate. For $3 \leq m \leq 7$, March-July, $\tau = m$ represents the months mills are operating. For $m < 3$, $\tau = m$ represents the months before a mill's month of operation. The omitted category is $\tau = -1$, February, which means that the dynamic impact of being exposed to a mill is estimated with respect to one month prior to a mill's month of operation.

$\mathbf{X_{ist}}$ is the set of hospital level time-varying controls related to gender based violence specific hospital quality. It includes information on whether gender based violence patients are referred for care to a health facility with higher level of resources. It is a proxy for poor hospital quality. $\mathbf{X_{ist}}$ also includes information on whether gender based violence victims are referred to the hospital by the police and community health workers. They are proxies for high hospital quality.[24] λ_h is the hospital fixed effects which controls for any hospital specific characteristic that is fixed over time like its location. α_d is the district fixed effects. District is chosen for the level of geographical unit since the unit of observation is a district hospital. σ_m is the month fixed effects and controls for month specific trends. γ_{dt} is the province-by-year fixed effects. I allow year fixed effects to differ by province, one unit higher than the district.[25] This way, I am comparing the hospitals who are in the catchment area of a mill to the ones that are not, within the same province. Hospitals who are not within the catchment area of a mill within the same province constitutes a more accurate control group. $\mathbf{X_d}$ is the vector of baseline geographical variables at the district level interacted with linear time trends. I cluster standard errors at the district level.

The main dependent variables for this specification are whether the hospital had hospitalizations and deaths due to gender based violence for women/men older than 18 and aged 10-18. Variables that focus on individuals older than 18 capture domestic violence. This is because according to DHS and census data, majority of the individuals who are older than 18 are married in Rwanda. Variables that focus on individuals aged 10-18 capture gender based violence not due to a partner. Moreover, that age group do not work in the mills. Such variables are used as placebo outcomes as a robustness check.

All (violence) outcomes are indicator variables. As an example, monthly hospitalizations due to gender based violence for women older than 18 variable takes the value 1 if a hospital had a hospitalization due to gender based violence for a female victim older than 18 in a given month and 0 otherwise. Dummy variables rather than the logarithm of hospitalizations are used since the number of hospitalizations for gender based violence is low in a month (close to 1). Only when I

[24]Being a hospital that is referred to a gender based violence victim by the police and community health workers may show that the hospital is known for the resources and knowledge related to gender based violence cases. Moreover, referrals may also show that the hospital is in collaboration with the police and community health workers.

[25]Unfortunately there is not enough observations/hospitals to have district-by-year fixed effects. Adding district-by-year fixed effects mean comparing the hospitals who are in the catchment area of a mill to the ones that are not within the same district. Most of the districts have only one district hospital.

am performing the placebo test, when the dependent variable is hospitalizations for bone and joint disorders other than fractures, I use the logarithm of hospitalizations. This is due to the fact that mean hospitalizations for such diseases is way bigger than one, 46.

The coefficients of interest are β_m's when $3 \leq m \leq 7$ (March-July). For $3 \leq m \leq 7$ and aged older than 18 category, each β_m provides the change in hospitalizations due to domestic violence within the cathment area of a mill relative to the hospitalizations that are not, within the same province, during a mill's month of operation, relative to one month before the operation. The harvest season is at peak during $5 \leq m \leq 7$, May-July, where majority of the farmers work in the mills. Thus, I specifically expect to see statistically significant estimates during those months. Since $m = 1$ (January) and $8 \leq m \leq 12$ (August-December) respectively represent the months before and after the harvest season when the mills do not operate, I expect to see small and statistically insignificant estimates for those months.

7 Results

7.1 Employment and Self-Reported Domestic Violence

I first estimate the impact of mill exposure on women's employment, type of earnings and self-reported domestic violence using equation 8. I show that a mill opening increases women's paid employment and decreases women's likelihood of experiencing domestic violence in the past 12 months.

Table 4 presents the results of estimating the impact of exposure to a mill on women's probability of working in the past 12 months, her type of earnings being cash in the past 12 months and self-reporting domestic violence in the past 12 months using different control groups. To measure mill exposure 4 km catchment area is used. The first three columns represents estimating equation 8 when the control group is defined as DHS clusters that are outside of a mill's catchment area but within the same district the mill is located (within district approach). Columns 4-6 represents estimating equation 8 when the control group consists of DHS clusters that are within the donut area between 4 and 8 km from a mill (donut approach). All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills.

When within district approach is used for the control group, upon a mill opening, being exposed to a mill increases the probability of working for cash in the past 12 months by 7 percentage points (p-value= 0.001) where the probability of working in the past 12 months remain unchanged. The estimated impact represents an increase of 18% with respect to the sample mean (0.40). Moreover, being exposed to a mill decreases the probability of experiencing domestic violence in the past 12 months by 9 percentage points (p-value= 0.01). The estimated impact represents a decrease of 26% with respect to the sample mean (0.35).

When using the donut approach, upon a mill opening, being exposed to a mill increases the probability of working for cash in the past 12 months again by 7 percentage points (p-value= 0.003) where the probability of working in the past 12 months remain unchanged. The estimated impact represents an increase of 16% with respect to the sample mean (0.45). Moreover, being exposed to a mill decreases the probability of experiencing domestic violence in the past 12 months by 8 percentage points (p-value= 0.06). The estimated impact represents a decrease of 22% with respect to the sample mean (0.37). In summary, results continue to be statistically significant and very similar even when the control group is restricted only to the clusters within the donut area between 4 and 8 km from a mill. There is a statistically significant increase in the probability of working for cash and a decline in the probability of experiencing domestic violence for women.[26]

Table 4: Effect of Mill Exposure on Women's Employment, Type of Earnings and Self-Reported Domestic Violence in the Past 12 Months

	Within District			Donut		
	(1) Work	(2) Cash	(3) Violence	(4) Work	(5) Cash	(6) Violence
Mill	-0.00	0.07***	-0.09***	-0.00	0.07***	-0.08**
	(0.01)	(0.02)	(0.03)	(0.01)	(0.02)	(0.04)
Observations	9823	8766	3583	4900	4415	1658
Dependent variable mean	0.88	0.40	0.35	0.88	0.45	0.37

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All dependent variables are measured for the past 12 months. The catchment areas is constructed by buffers around the mills with a 4 km radius. *** p<.01, ** p<.05, * p<.1

Table 5 presents the results of estimating the impact of exposure to a mill on women's husbands' probability of working in the past 12 months and their type of earnings being cash in the

[26] I also check alcohol consumption among husbands. DHS 2005 and 2014 ask for such information. 61% of husbands in my sample (based on DHS 2005, 2014) gets drunk sometimes and 20% gets drunk very often (rest is never drunk). The means are similar across within and outside of the catchment area. There is no change in drinking behavior based on DID using 2005 and 2014.

Table 5: Effect of Mill Exposure on Husband's Employment and Type of Earnings in the Past 12 Months

	Within District		Donut	
	(1) Work	(2) Cash	(3) Work	(4) Cash
Mill	-0.00	0.03	-0.01	0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Observations	4099	3548	2168	1961
Dependent variable mean	0.87	0.81	0.90	0.82

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of the husbands of the women in the sample. All dependent variables are measured for the past 12 months. The catchment areas is constructed by buffers around the mills with a 4 km radius. *** p<.01, ** p<.05, * p<.1

past 12 months for both control group approaches. There is no statistically significant change in those variables. I also estimated the impact of mill exposure on women's and their husbands' occupation. It is possible that a mill opening can induce individuals to sort into the agricultural sector. Results are reported in Tables A.13, A.14, A.15 and A.16. The first two tables use the within district approach and the last two use the donut approach. Each column represents one occupation where the occupations are managers, sales, agricultural self-employed, agricultural employee and skilled and unskilled manual. For women, exposure to a mill do not induce a change in occupations. The dominant occupation is the agricultural self-employed category where 80% of women have such occupation. Being a farmer constitutes an example of working as self-employed in agriculture. For husbands, there is a statistically significant increase in the sales category. However, there is not a statistically significant impact of mill exposure on husbands being self-employed in the agricultural sector. Being self-employed in the agricultural sector is also the dominant occupation for husbands where 66% of the husbands have such occupation. Overall, individuals who are exposed to a mill do not sort into being self-employed in agriculture (become farmers).

According to the results, women and their husbands were already self-employed in the agricultural sector (farmers). They were already working in the past 12 months. Being exposed to a mill, did not induce a shift on these variables. However, exposure to a mill changed the type of earnings of women. Women start to be paid cash for their labor in agriculture. Their husbands were already working for cash and being exposed to a mill did not change their type of earnings.

7.2 Earnings

I also estimate the impact of a mill opening on women's and their husbands' earnings using equation 9. Using earnings data, I show that a mill opening increases both women's and their husbands' last daily earnings.

Table 6 presents the results of estimating the impact of a mill opening on women's and their husbands' log of last daily earnings.[27] Since EICV data is not geocoded, mill exposure is defined as the logarithm of mills per capita in a district. Columns 1-2 present the results for the whole sample. Columns 3-4 present the results among couples working in agriculture. Among all sample, 1% increase in mills per capita increases women's and their husbands' last daily earnings by 1.8% and 2.3% respectively. Among couples working in agriculture, an increase in mills per capita also increases the log of last daily earnings for each spouse. These results show that being exposed to a mill upon a mill opening increases women's and their husbands' earnings.

Table 6: Effect of Mill Exposure on Log of Last Daily Earnings

	All Sample		Occupation: Agriculture	
	(1) Woman: Log of Last Daily Earnings	(2) Husband: Log of Last Daily Earnings	(3) Women: Log of Last Daily Earnings	(4) Husband: Log of Last Daily Earnings
Log of Mills per capita in the District	1.80***	2.37***	2.10***	2.62***
	(0.18)	(0.20)	(0.13)	(0.14)
Observations	5205	8304	4148	3498
Dependent variable mean	6.39	6.84	6.16	6.27

Note: Robust standard errors clustered at the district level are in parentheses. All estimations include individual controls, cohort fixed effects, district-by-year fixed effects, linear time trends interacted with baseline district level characteristics. Sample consists of partnered women (and their husbands) who married before the expansion of the mills. Since EICV is not geocoded, the mill variable is log of mills per capita in a district in a given year. In Columns 3-4, the sample consists of women and their husbands who reported their occupation as agricultural. *** p<.01, ** p<.05, * p<.1

It should be noted that the results are based on data where I observe the labor income of women who work for pay (positive, not missing labor income). The missing labor income observations belong to women who do not work or do not work for pay. Their labor income is zero either way. As a first robustness check for my results on earnings, I code the missing values as zero and

[27] Majority of the earnings is received on a daily basis in this context due to the dominant occupation is being agricultural. Thus, I use last daily earnings as my dependent variable.

transform the dependent variables by using an inverse hyberbolic sine (IHS) function. Unlike in a log transformation, zeroes are defined in an IHS transformation. Table A.17 presents the results. Estimates are in line with the main results.

Since the data on earnings are available only for a self-selected group of women (women who work for pay), sample selection bias is a potential concern. In order to address this concern, as a second robustness check, I use the two-step Heckman estimator. An exclusion restriction, a variable that affects women's decision to work for pay (her reservation labor income), but not the labor income (labor income offer), identifies the two-step model. I use the number of young children (age 0-5) in the household as such variable in my model. Having young children at home makes it more costly for women to work due to taking care of children. However, it does not affect the amount of income received for per unit labor. The variable is commonly used in the literature that uses the correction in models on female wages and labor force participation (Mulligan and Rubinstein 2008, Blau and Kahn 2017). Table A.18 presents the results. The estimates are still positive and statistically significant.

7.3 Monthly Hospitalizations for Domestic Violence

I complement my analysis using monthly hospitalizations for domestic violence. Mills provide job opportunities to women only during the harvest months. I show that there is a decline in hospitalizations during the harvest months relative to one month before the harvest season. Yet, the decline is short-lived and not observed during the post-harvest months. The exercise has two advantages. First, the monthly results confirm the previous estimates. Moreover, this confirmation is done via administrative records which alleviates concerns regarding the reporting bias in self-reported data. Second, seasonality of the decline in hospitalizations speaks to the mechanisms. It shows that in a context where wages and household resources are low, access to credit markets and saving technologies are limited, the effects of providing job opportunities to women may be concentrated when women have the jobs. If women have better outside options and husbands' non-monetary benefit from violence is smaller due to women's contribution to household earnings specifically when women work, it is plausible that the decline in hospitalizations are concentrated during the harvest months only.

I estimate the dynamic impact of mill exposure on monthly hospitalizations for gender based violence using equation 10. Figure 5 plots the coefficient of the interaction terms for every month in a calendar year. Mills operate only during the harvest season, March-July. In a given year, January and February are the pre-harvest period, May-July is the peak of the harvest where majority of the neighboring community around the mills work in the mills. August-December is the post-harvest period. In the specification, the omitted category is February, which means that the dynamic impact of being exposed to a mill is estimated with respect to one month prior to a mill's month of operation. The top subfigure is for women aged older than 18, where the bottom subfigure is for women younger than 19. Since overwhelming majority of women aged older than 18 is married in Rwanda, I define hospitalizations for gender based violence for women age older than 18 as domestic violence. I find that it is 18 and 14 percentage points less likely for a hospital in the catchment area of a mill to have a domestic violence patient in June and July respectively (peak of the harvest) compared to one month before the mills' month of operation (p-value$=0.01$ and p-value$=0.06$). The estimated impact represents a reduction of 23% and 17% respectively with respect to the sample mean (0.79). There is not a statistically significant change in hospitalizations when mills do no operate (January, August-December). Figure A.3 visualizes the raw means for hospitalizations for domestic violence. The trend in means are also in line with the estimates.

Before moving on, one important thing to recall is that the hospitalizations results are based on the period after the rapid expansion of the mills, during 2012, 2013 and 2014. In those years, there is no change in hospitalizations in the post harvest months relative to February, one month before the harvest season. No change in hospitalizations during the post-harvest months do not mean that the hospitalizations in the catchment areas and non-catchment areas are the same. As seen in Figure A.3, during post-harvest months, the hospitalization rates in the catchment areas are still lower compared to the rates outside of the catchment areas.

There is no changes in hospitalizations for gender based violence among girls aged 10-18. I do the same analysis for men and do not find any statistically significant results. I also do not find any statistically significant change in deaths due to gender based violence for both age groups and genders. I plot the results in Figures A.4 and A.7 respectively. All results are also shown in Tables A.20.

Placebo Test. As a placebo test, I perform the same analysis for universe of monthly hospitalizations for other diseases, bone and joint disorders other than fractures.[28] Examples of such disorders include osteoarthritis, gout, rheumatoid arthritis, lupus and bursitis. I report the results in Figure 6 and Table A.21. I find no changes in hospitalizations for these disorders within a year, specifically during the harvest months relative to one month before the harvest season.

This rules out the concern that women may go to hospitals less during the harvest season due to the increased opportunity cost of a hospital visit. For women who are exposed to a mill, a day in the hospital is costly during the harvest season since it means loss of daily labor income. This can make women less likely to go to a hospital and drive the decline in hospitalizations for domestic

[28]This means that broken bones, injuries are not included. Thus the these hospitalizations are not related to domestic violence.

violence during the harvest months. No change in non-domestic violence hospitalizations suggests that the decline in hospitalizations due to domestic violence is not driven by a decreased likelihood of going to a hospital during the harvest season.

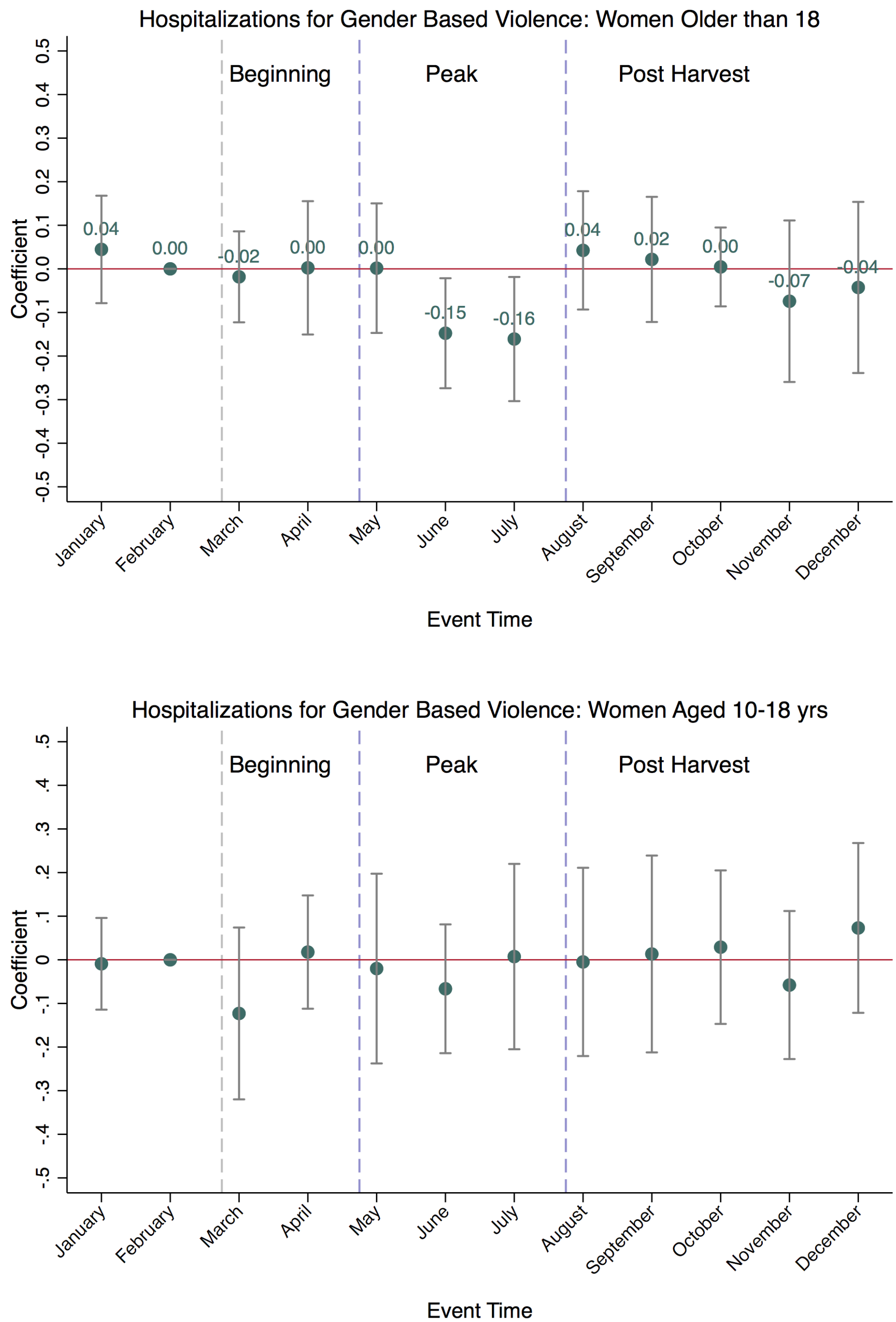
One might argue that the group of women who have bone and joint disorders may be very old, less likely to work in the mills and thus their opportunity cost of time do not increase with the harvest season (let's say it remains the same within a year). If that is the case, no change in hospitalizations for these women is not ruling out the possible scenario for the decline in violence hospitalizations where women go to hospitals less due to the increased opportunity cost of going to a hospital. I build on medical research to tackle this argument. Medical research suggests that although osteoarthritis (OA), the most common disease in the data, becomes more prevalent as one gets older, age is not a precondition to have the disease. It is also prevalent among occupations including farmer, construction worker, miner, that are physically demanding and require individuals to use the same bones and joints regularly (Yucesoy et al., 2015). This suggests that the women who visit a hospital for bone and joint disorders and domestic violence are plausibly both working farmers who have similar opportunity costs of going to a hospital.[29] One may also argue that among farmers in the same age group, women with bone and joint disorders can have a lower opportunity cost of going to a hospital compared to women who experience domestic violence. This low opportunity cost may not increase with the harvest season as well. This is plausibly because those women have a long term disease that decreases their labor productivity regularly and may make them unable to work efficiently within a year including the harvest months. However, it should be noted that according to data, domestic violence is also a health problem that occurs regularly and thus may affect women's labor productivity consistently. Thus, those two groups of women are comparable and the placebo test plausibly rules out the change in opportunity cost of going to a hospital as a mechanism behind the decline in violence hospitalizations.

7.4 Mechanisms behind the Decline in Domestic Violence

Staggered DID and DID event study estimates based on monthly hospitalizations both show a decline in domestic violence. In this subsection, I investigate the potential mechanisms behind the decline via analyzing the impact of a mill opening on bargaining power related outcomes, doing a subsample analysis and analyzing the seasonality of the decline in hospitalizations for domestic violence within a year. As outlined in the literature and model sections, there can be multiple reasons behind a decline in domestic violence. These include the increase in women's outside options, decline in husbands' non-monetary utility for domestic violence with an increase

[29] The number of hospitalizations for bone and joint disorders is much higher than the number of domestic violence hospitalizations. It is also plausible that some women visit a hospital for both health problems.

Figure 5: Dynamic Impact of a Mill Opening on Hospitalizations for Gender Based Violence (Women)



Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include hospital controls, hospital fixed effects, district fixed effects, province-by-year fixed effects, linear time trends interacted with baseline district level characteristics. 4 km catchment area is used. *** p<.01, ** p<.05, * p<.1

Figure 6: Dynamic Impact of a Mill Opening on Log Hospitalizations for Bone and Joint Disorders other than Fractures (Women)

Note: Dependent variable is in logs. Fractures (broken bones) are not included. Examples of bone and joint disorders include osteoarthritis, gout, rheumatoid arthritis, lupus, bursitis. Robust standard errors clustered at the sector level are in parentheses. All estimations include hospital controls, hospital fixed effects, district fixed effects, province-by-year fixed effects, linear time trends interacted with baseline district level characteristics. 4 km catchment area is used. *** p<.01, ** p<.05, * p<.1

in household earnings (via an increase in women's and/or husbands' earnings) and exposure reduction. While I cannot disentangle the exact mechanism, my analysis suggests that the decline in violence is driven by the channels that are active via women's paid employment. Those channels are the increase in women's outside options and decrease in husbands' non-monetary utility for domestic violence with women's contribution to household earnings, not exposure reduction. The increase in husbands' earnings is not the dominant mechanism.

Increase in the Outside Option. According to the family economics literature, an increase in women's outside option increases her bargaining power within the household. Using data on household decision-making, I investigate whether women's employment opportunities translate into an improvement in women's bargaining power. Table 7 presents the results of estimating the impact of mill exposure on household decision-decision making. Three different decisions are investigated. These are making large household purchases, making decisions on own health and visiting family. The estimation captures whether women are more likely to make these decisions by themselves or jointly with their husbands compared to their husbands or someone else in the family is making the decision for them. When a within district approach is used, women who are exposed to a mill are 5 percentage points (p-value= 0.02) more likely to make decisions on large household purchases by themselves or jointly with their husbands. The estimated impact represents an increase of 7% with respect to the sample mean (0.69). There is no change in decision making related to women's own health and visiting family. These results suggests that mill exposure improves women's say on financial decisions in the household.

I also investigate the impact of mill exposure on couple's decision-making on contraception. Table 8 presents the results. The estimation captures whether women's decision to use contraception is taken jointly with their husbands compared to alone or husbands are making the decision for them. For this variable, making the decision alone is not a proxy for bargaining power. Research finds that women in Sub-Saharan Africa may use contraception covertly as a response to their husbands' desire to have more children (Ashraf et al., 2014). When within district approach is used, upon a mill opening, among women under the age of 40, women who are exposed to a mill are 5 percentage points (p-value= 0.07) more likely to decide to use contraception jointly with their husbands. The estimated impact represents an increase of 6% with respect to the sample mean (0.87). This is accompanied with a decline in the likelihood of women deciding to use contraception by themselves. This suggests that the women who were making the contraception decision on their own start to jointly decide to use contraception with their husbands. I do not have data on whether women who decide to use contraception on their own are the ones who use contraception covertly. Yet, the increase in joint decision-making accompanied with a decline in women making their contraception decision alone suggest that a mill opening increases communication and negotiation between couples.

Taken together, results on household decisions suggest that women's improvement in their outside options due to mill exposure also improved their bargaining power, say, in some household decisions. These results support the argument that an increase in women's outside options due to paid employment is a potential mechanism behind the decline in domestic violence.

Increase in the Outside Option and Seasonality of Hospitalizations. No change in hospitalizations during the post-harvest months relative to the hospitalizations in February (one month before harvest) further speaks to the outside option mechanism. After the harvest months, women are plausibly not able to credibly threat their husbands with separation. In a context where wages are low, access to credit markets and saving technologies are limited, it is plausible for seasonal jobs to improve women's outside options only when women have the jobs. First, schools reopen right after the harvest season, August. Although education is free in Rwanda upto nine years, parents have school expenses, primarily a school uniform fee. Anecdotal evidence suggests that

Table 7: Effect of Mill Exposure on Household Decision Making: Woman Alone or Jointly with Husband

	Within District			Donut		
	(1) Large HH Purchases	(2) Own Health	(3) Family Visit	(4) Large HH Purchases	(5) Own Health	(6) Family Visit
Mill	0.05**	0.02	0.02	0.03	-0.01	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	9823	9823	9823	5165	5165	5165
Dependent variable mean	0.69	0.73	0.81	0.71	0.75	0.82

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All dependent variables are coded as 1 if the decision is taken by women alone or jointly with their husbands and zero otherwise. Otherwise category includes husband only or someone else. The survey question on household decisions changed significantly over the data cycles. in 2005, the question asks "Who has the final say on decision x?" After 2005, the question is "Who usually decides on x". The answer option "Respondent and other" is also discontinued in 2010 and 2014 rounds. To make a comparable variable, I create the variable based on whether the woman had a say in the decision, either alone or jointly. Results should be interpreted with caution. 4 km catchment area is used. *** p<.01, ** p<.05, * p<.1

women buy school uniforms with the money they earn from the mills, so that their children can go to elementary school. In Table A.19, I report the results of estimating the impact of mill exposure on household's education expenditures for elementary school-age children among couples who work in agriculture (school uniform expenses are included in the variable). 1% increase in mills per capita increases the education expenditures by 1.3%. If women are more likely to invest in their children's education compared to their husbands, they have less resources left to save for post-harvest months.[30] Second, the share of women who do not have a savings account is high in Rwanda. 65% of the women in my sample do not have a savings account and this number increases to 73% in rural areas. Limited access to savings accounts can affect how much women save and this can affect women's outside options during post-harvest months negatively.[31]

Exposure Reduction. Another possible mechanism behind the decline in domestic violence can be the reduction in the time couples spend together. Working hours in the mill are long. If women

[30] Doepke and Tertilt (2019) finds that in Mexico, cash transfers to women (PROGRESA) lead to an increase in spending on children and a decline in the savings rate.

[31] Anderson and Baland (2002) shows that in Kenya, participating in roscas, rotating savings and credit associations, is the wife's strategy to protect her savings against claims by her husband for immediate consumption.

Table 8: Effect of Mill Exposure on (Modern) Contraception Decision-Making: Joint between Couples, Woman Only, Husband Only

	Within District			Donut		
	(1) Joint	(2) Woman	(3) Husband	(4) Joint	(5) Woman	(6) Husband
Mill	0.05*	-0.04*	-0.01	0.05	-0.03	-0.02
	(0.03)	(0.03)	(0.01)	(0.03)	(0.03)	(0.01)
Observations	2775	2775	2775	1575	1575	1575
Dependent variable mean	0.87	0.10	0.04	0.88	0.09	0.03

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women younger than 40 who married before the expansion of the mills. 4 km catchment area is used.. *** p<.01, ** p<.05, * p<.1

were farming in the same plot with their husbands before the expansion, starting to work in the mills for pay is a shock to the time they are exposed to their husbands as well as their earnings. To provide evidence that exposure reduction is unlikely to drive my results, I take advantage of the information on women and their husbands' occupation. I perform a subsample analysis. I run equation 8 using the sample of women who do not share the same occupation with their husbands. Self-employed women working in agriculture (smallholder farmers) whose husbands have skilled or unskilled manual jobs (truck drivers, plumbers, refuse workers, laborers in mining, construction and manufacturing etc.) constitute the majority of the subsample. Given that those couples have different occupations, they do not work together during working hours. Thus, women starting working in the mills will not be a shock to the time couples spend together. Their exposure to each other will continue to be the same (no exposure during work hours). However, the workplace of women will be shifted to mills where they work for pay. If there is a statistically significant increase in the probability of women working for cash and a decline in the probability of experiencing domestic violence in the past 12 months for this subsample, it suggests that my main result, reduction in domestic violence, is plausibly not driven by exposure reduction.

Results for women's employment and domestic violence are reported in Table 9. Only within the district approach is used due to sample size. Upon a mill opening, being exposed to a mill increases the probability of working for cash in the past 12 months by 10 percentage points where the probability of working in the past 12 months remain unchanged. The estimated impact represents an increase of 32% with respect to the sample mean (0.31). Moreover, being exposed to a mill still decreases the probability of experiencing domestic violence in the past 12 months by 11 percentage points. The estimated impact represents a decrease of 32% with respect to the sample mean (0.34). The results show that there is a statistically significant decline in the probability of experiencing domestic violence even among women whose exposure to their husbands are presumably not affected by the expansion. Moreover, the magnitude of the decline is also similar (11 percentage points, 0.34 mean) to the result based on the whole sample (9 percentage points, 0.35 mean). This further confirms that exposure reduction is not necessarily the main driver of the decline in domestic violence.

Table 9: Effect of Mill Exposure on Women's Employment, Type of Earnings and Self-Reported Domestic Violence in the Past 12 Months: Couples with Different Occupations

	Within District		
	(1) Work	(2) Cash	(3) Violence
Mill	-0.00	0.09**	-0.11*
	(0.03)	(0.04)	(0.06)
Observations	3981	2893	1410
Dependent variable mean	0.71	0.31	0.34

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. For the exposure reduction robustness check, the sample is restricted to women who are not working with their husbands. The restriction is made based on the occupation of women and their husbands. All dependent variables are measured for the past 12 months. 4 km catchment area is used. *** p<.01, ** p<.05, * p<.1

One potential concern is whether the subsample is among couples with very educated husbands compared to the main sample. This is because in the current subsample, husband occupations are non-agricultural jobs. However, according to the data, the mean number of husbands' education is 5.7 for this subsample and it is 4.4 for the whole sample (husbands working in agriculture is not dropped). Taken together, the exercise provides suggestive evidence that exposure reduction is not the mechanism behind my main results. I also further restricted the subsample to women who are farmers and married to men with non-agricultural jobs. There is a statistically significant increase in working for cash for this subsample. I still find a negative estimate for the domestic violence result. However, due to low sample size, I do not have enough power to defend my (statistically insignificant) negative estimate.

Increase in Household Earnings. A mill opening increases household earnings via women's wages as well as husbands receiving higher earnings from selling cherries to the mill compared to selling home-processed coffee in the domestic market. Based on my conceptual framework, keeping women's earnings constant, an increase in husbands' earnings decreases their marginal non-monetary benefit from inflicting violence. Intuitively, more resources in the household can make the husband less financially stressed. If the husband inflicts violence for relieving financial stress, an increase in his resources may decrease violence. Thus, the increase in husbands' earnings, not women's paid employment, can be the main driver behind the decline in domestic violence in the data. In order to investigate this mechanism, I build on the results from the previous exercise.

Recall that there is a decline in domestic violence even among couples with different occupations. Women working in agriculture and husbands working in non-agricultural manual jobs constitute the majority of that subsample. To provide evidence that the increase in husbands' earnings is unlikely to be the only mechanism, I estimate the impact of a mill opening on earnings of women who work in agriculture and husbands who work in non-agricultural (again mostly manual) jobs. If there is no change in husbands' earnings for this subsample, then there is a decline in violence even among couples where husbands' earnings do not increase with mill exposure. This will suggest that the decline in husbands' non-monetary benefit from inflicting violence due to an increase in their earnings is not the only mechanism behind the decline in domestic violence.

Results are reported in Table 10. I find that mill exposure significantly increases women's daily earnings, however, there is no statistically significant change in their husbands' earnings. The magnitude is also close to 0. This is plausible. Although mills may demand paid labor from men with non-agricultural occupations (construction workers to build a mill, technicians to provide repairs in a mill), the expansion is primarily a (persistent) shock to individuals who are working in agriculture. No effect on husbands' earnings shows that there is decline in violence even among couples where husbands' earnings do not change with mill exposure. Moreover, the magnitude of the decline in violence is similar (11 percentage points, 0.34 mean) to the result based on the whole sample (9 percentage points, 0.35 mean). These evidence confirm that an increase in husbands' earnings is unlikely to be the main/only mechanism behind my results.

Recall from the model that the husband's marginal non-monetary benefit can also decrease due to an increase in women's earnings. For this sample, there is an increase in women's earnings that is accompanied with no change in husbands' earnings and there is a decline in domestic violence. This suggests that women's contribution to household earnings is also a plausible mechanism behind the decline in violence.

It should also be noted that the increase in women's earnings for these couples is bigger compared to the increase for the overall sample where majority of the couples are both farmers. The reason is as follows. Women who are married to men with non-agricultural manual jobs are plausi-

Table 10: Effect of a Mill Opening on Log of Last Daily Earnings: Couples with Different Occupations

	Couples with Different Occupations	
	(1) Woman's Log of Last Daily Earnings: Agriculture	(2) Husband's Log of Last Daily Earnings: Non-Agriculture
Log of Mills per capita in the District	2.65***	0.97
	(0.56)	(1.00)
Observations	1828	1050
Dependent variable mean	6.18	6.71

Note: Robust standard errors clustered at the district level are in parentheses. All estimations include individual controls, cohort fixed effects, district-by-year fixed effects, linear time trends interacted with baseline district level characteristics. Sample consists of couples who married before the expansion of the mills and have different occupations. Women report their occupation as agricultural where the husbands report their occupation as non-agricultural. Non-agricultural occupations mostly consist of manual (unskilled and skilled) jobs. Since EICV is not geocoded, the mill variable is log of total number of mills per capita in the district in a given year. *** p<.01, ** p<.05, * p<.1

bly earning income from both selling coffee cherries to the mill and working in the mill as a wage worker (or earns from selling cherries only which still means earning a higher amount of money compared to working in the mill only). This confirms that among the farmer couples, money earned by selling coffee is husbands' money.

It is also valid to ask what were women who are married to non-farmer men were doing before the expansion. According to DHS data, in 2004 and 2005, before the expansion, 59% of those women reported agricultural self-employed as their occupation. 61% of those self-employed are unpaid workers before the expansion. This suggests that they were subsistence farmers that did not use cash-crops. To understand the effect of a mill opening on them better, I use information on crops and find that the share of farmer women who have coffee in their family plots increases with mill expansion over the years but the share of farmer women who have beans in their plots do not change over time. This suggests that those women were not having coffee on their plots before, but they planted coffee trees with the expansion.

Increase in Household Earnings and Seasonality of Hospitalizations. No change in hospitalizations during post-harvest, let's say August, relative to the hospitalizations in February (one month before the harvest) further speaks to this mechanism. In a context where household resources are low, access to credit markets and saving technologies are limited, the effects of providing job opportunities to women may be concentrated only during the period when women have the jobs. After the harvest months, the household has less resources since women do not work for pay. This may increase the husband's financial stress and lead to an increase in domestic violence. According to EICV data (earnings data), in 2010, among couples where women work in agriculture and have positive earnings, women's last daily earnings constitute 38% of their households' daily food consumption expenditures.[32] A descriptive study from Nyamasheke district, Bayisenge et al. (2019), shows that households benefit women's earnings from coffee production. The study documents that in the district, most of coffee farmer women's earnings (68.75%) are spent to household daily needs. If women contribute to household consumption with their wages from the mills during the harvest months, the discontinuity of her contribution may lead to an increase in financial stress and thus violence. This may potentially be one of the reasons why the hospitalizations in the catchment areas shift back to its pre-harvest level, when women do not work for pay.[33]

Mechanisms and Women's Paid Employment. My analysis suggests that the decline in violence is driven by the channels that are active via women's paid employment. Those channels are the increase in women's outside options and women's contribution to household earnings. An increase in husbands' earnings is not the dominant mechanism behind the decline in domestic violence. Moreover, I rule out exposure reduction, that is not depicted in the model, yet documented in the literature.

The result that there is a decline in hospitalizations for domestic violence only when women are working for pay reinforces that the decline in violence is plausibly driven by women's paid employment. It further confirms the increase in women's outside options and their contribution to household earnings as mechanisms. It also suggests that in a context where wages are low, household resources, access to credit markets and saving technologies are limited, the effect is concentrated when women have the jobs.

Research suggests that employment has non-monetary benefits (Hussam et al., 2021). In this context, non-monetary value of earning personal income (confidence, dignity etc.) and having a social network (coworkers in the mills) are such potential benefits. Although they plausibly affect the decline in domestic violence, unfortunately I am not able to quantify them with my data. Yet,

[32] Husbands' last daily earnings constitute for 55% of the households' daily food expenditures

[33] Recall that the husbands may receive a second payment from the mill in November. Thus in November, there may be an increase in household earnings via husbands only and women do not work for pay. In November, there is a statistically *insignificant* decline in hospitalizations and the magnitude is half of the effect during the peak of the harvest. This is in line with the theoretical prediction that the larger the women's outside options and their contribution to household earnings, the larger the effect is in magnitude. When both channels are not present, a statistically significant prominent decline in domestic violence is not observed. Lastly, increase in husbands' earnings that is accompanied with no increase in domestic violence hospitalizations in November also suggests that husbands' non-monetary utility for domestic violence is not zero and plausibly decreasing in household earnings. Yet, this discussion should be reviewed with caution since there is limited knowledge on receiving second payments in the context.

both channels are active via women's paid work and I show that the decline in domestic violence in my context is plausibly driven by women's paid employment. As future research, I aim to further disentangle how paid job opportunities affect domestic violence.

8 Robustness Checks

8.1 Dynamic Impact of Mill Exposure and Pre-Trends

I also estimate the impact of a mill opening using an even-study specification. The specification exploits the variation in years when individuals are exposed to a mill. The results provide insights on the dynamics of the effects, the impact of a mill in the short and long-run. Moreover, estimates during the years before mill exposure constitute a test for the parallel trends assumption. I estimate the dynamic impact of a mill opening with the event study specification below:

$$Y_{istk} = \beta_0 + \sum_{k=-3}^{6} Mill_{is} \times \beta_k \mathbb{1}[\tau = k] + \mathbf{X_{ist}}\phi + \lambda_c + \omega_m + \alpha_s + \gamma_{dt} + (\mathbf{X_s} \times t)\theta + \varepsilon_{istk}. \tag{11}$$

The dependent variable Y_{istk} is the outcome of interest of woman i (or the husband of woman i), in sector s, in year t and at event-time k. $Mills_{is}$ is a binary variable coded as 1 if woman/husband i resides within the catchment area of a mill and zero otherwise by the end of the sample, 2014. It is interacted with event-year dummies, $\mathbb{1}[\tau = k]$, to investigate the dynamic impact of a mill opening. τ denotes the event-year. $\tau = 0$ represents mill's year of operation. For $k > 0$, $\tau = k$ represents k years after a mill's opening. For $k < 0$, $\tau = k$ represents k years before a mill's year of operation. The omitted category is $\tau = -1$, which means that the dynamic impact of being exposed to a mill is estimated with respect to one year prior to a mill opening. $\mathbf{X_{ist}}$ is the same set of controls in the static empirical specification. λ_c is the cohort fixed effects. ω_m is the year of marriage fixed effects. α_s is the sector fixed effects. γ_{dt} is the district-by-year fixed effects. $\mathbf{X_s}$ is a vector of baseline geographical variables interacted with linear time trends. I clustered standard errors at the district level. The main dependent variables for this specification are being employed, working for cash and experiencing domestic violence in the past 12 months.

The coefficients of interest are β_ks when $k \geq 0$. For $k \geq 0$, each β_k provides the change in outcomes for the individuals who are exposed to a mill relative to the individuals who are not within the same district, k years after a mill opening, relative to one year before a mill's year of operation. Since $k < 0$ represents the years before a mill opening, I expect to see small and statistically insignificant estimates for such β_ks when $k < 0$. If so, such estimates will constitute supportive evidence in favor of the parallel trends assumption.

Figure 7 presents the results from estimating equation 11 (event-study specification). It plots the coefficient of the interaction term for 3 years before and 6 years after a mill opening. I use the within district approach to have balanced number of observations every time period. The dynamic results are mostly in line with the static estimates. I find a statistically significant decrease in the probability of experiencing domestic violence in the past 12 months right after a mill opening. Exposure to a mill opening also increases women's probability of working for cash starting from right after a mill opening. There is no change in women's probability of working. I need to note that number of women who are in the treatment group is lower for the event times 1, 2 and 3 compared to the remaining event times. This is because the number of mill openings are not balanced across the 2000s and I have the DHS data cycles for specific years. This can plausibly be the reason why the coefficients at event times 1, 2 and 3 are statistically insignificant for the working for cash variable although they are positive.

I should also note that there is no statistically significant decline in DV at event times 4, 5 and 6, although women are more likely to work for cash in these years relative to one year before a mill opening. The number of observations is not low compared to other years for these event times. This suggests that the effect of women's paid employment in low-paid jobs on domestic violence may not persist for long years.

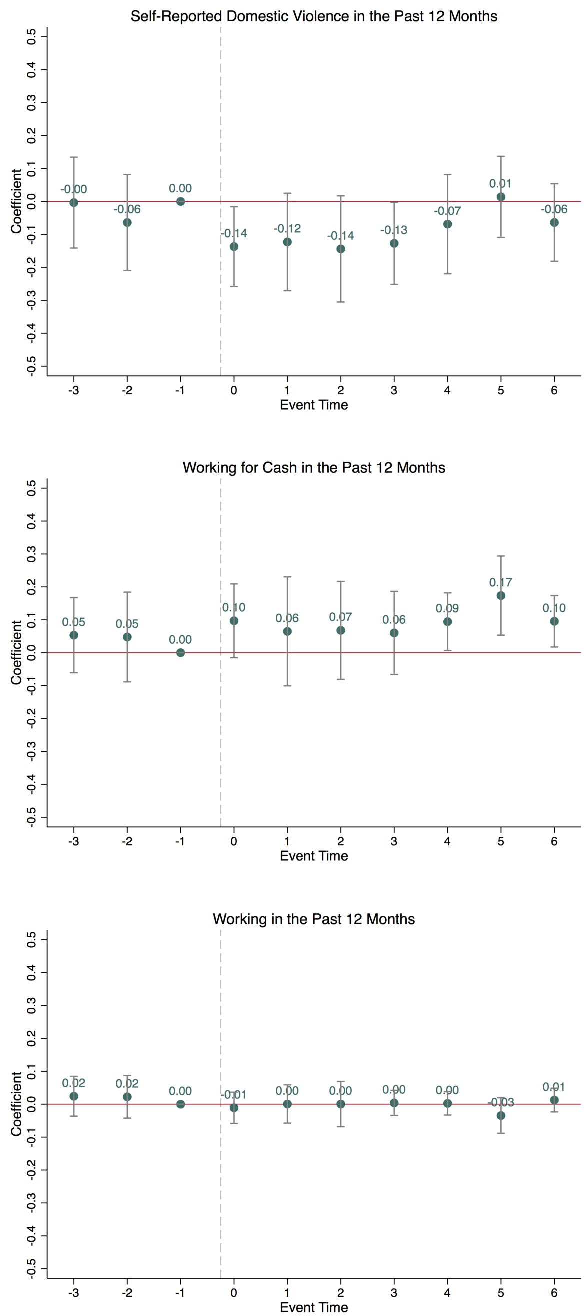
Figure 8 plots the coefficient of the interaction terms for the same specification for husbands. As expected, there is no change in probability of working and working for cash in the past 12 months right after a mill opening. I need to note that there is a statistically significant decline in the husband's probability of working only at event time 2. For working for cash variable, the estimates for event times 1 and 2 are also much bigger than 0 compared to the remaining event times, although insignificant. This is plausibly due to the lower number of observations at event times 1, 2 and 3 based on my data and the imbalance in the mill expansion.

For all variables, the coefficients are close to zero and statistically insignificant for the years before a mill opening. Thus, the estimates constitute evidence in favor of the parallel trends assumption. All results are also shown in Tables A.23, A.24, A.25 and A.26.

8.2 Role of Variation in Treatment Timing

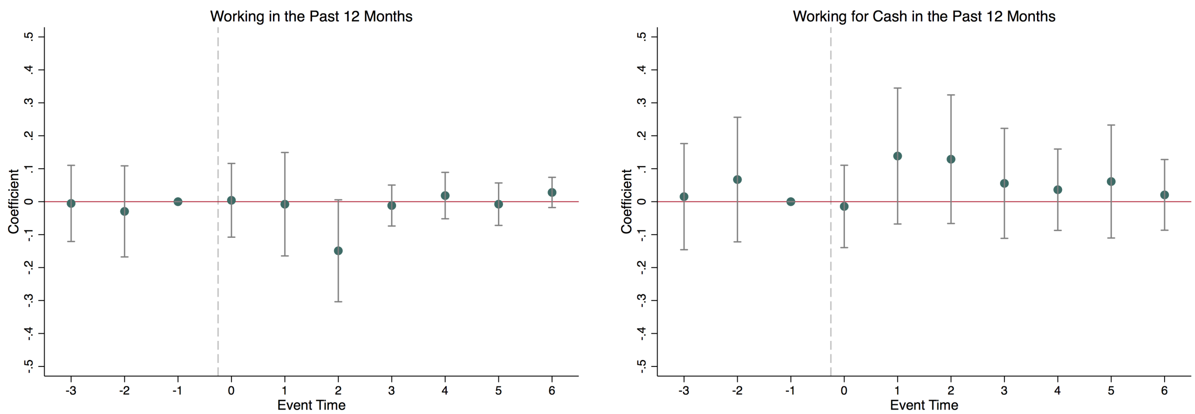
Goodman-Bacon (2021) demonstrates that twoway fixed effects difference-in-differences (TWFEDD) estimator is a weighted average of all possible 2x2 DD estimators that compare timing groups to each other. Under time-varying treatment effects, TWFEDD estimates a weighted average treat-

Figure 7: Dynamic Impact of a Mill Opening on Self-Reported Domestic Violence, Women's Type of Earnings and Employment in the Past 12 Months



Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All variables are measured for the past 12 months. 4 km catchment area is used. Within district approach is used. *** p<.01, ** p<.05, * p<.1

Figure 8: Dynamic Impact of a Mill Opening on Husbands' Employment and Type of Earnings in the Past 12 Months



Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partners of women in the first specification. All variables are measured for the past 12 months. 4 km catchment area is used. *** p<.01, ** p<.05, * p<.1

ment effect with *negative weights* (Borusyak and Jaravel 2018, de Chaisemartin and D'Haultfœuille 2020, Sun and Abraham 2020, Callaway and Sant'Anna 2020, Goodman-Bacon 2021) which biases the results. This occurs when the later-treated group uses the earlier-treated group as control. Goodman-Bacon (2021) highlights that specifically the units treated near the beginning or the end of the panel can get more weight as controls than treatments, which is always the case in designs without untreated units. I do not expect this to be a major concern in my context. I have untreated units and out of the 211 mill openings as of 2002, only 21 percent of them opened near the beginning or the end of the panel (2012). 79% of the mills opened between 2005-2010. In order to analyze the 2x2 DD comparisons and weights formally, I perform the Goodman-Bacon (2021) decomposition.[34] The decomposition calculates the weights of each type of 2x2 DD comparison and how it contributes to the TWFEDD estimate. I find that 80-81% of the TWFEDD estimate for labor market outcomes (working for pay, working cash for the past 12 months. and domestic violence is derived from Treatment vs. Never Treated comparisons. Earlier Group Treated vs. Later Group Control and Later Group Treatment Control each has 0.01 weights and do not contribute much to the TWFEDD estimate as expected. The weight for Treated vs. Already Treated comparison is only 0.16.

I also follow the test proposed by de Chaisemartin and D'Haultfœuille (2020) which enables researchers to understand when treatment effect heterogeneity would be a serious concern for the

[34]I implement the decomposition following Goodman-Bacon (2021) and based on bacondecomp STATA package.

validity of their estimates.[35] de Chaisemartin and D'Haultfœuille (2020) recommends researchers to calculate both the weights and the ratio of the TWFE estimate divided by the standard deviation of the weights. If many weights are negative, and if the ratio is not very large, then treatment effect heterogeneity would be a serious concern for the validity of the estimate.[36] For the working for pay and cash in the past 12 months outcomes, I find that 92 and 93% of my treatment effects receive positive weights respectively where the remaining receive negative weights. I also calculate the ratios based on my estimates and the standard errors of the weights and they are sufficiently high. Thus, given that approximately only 7% of the weights are negative and the ratios are sufficiently high, treatment effect heterogeneity is not a concern for the validity of my estimates. For a complete robustness check, I estimate my results using the estimator proposed in de Chaisemartin and D'Haultfœuille (2020) that gives valid results even if the treatment effect is heterogeneous over time and across groups. I plot the estimation results for main results in Figure A.5.[37] As expected, the estimates are very similar to my main results.[38]

Sun and Abraham (2020) demonstrates that in event study designs with variation in treatment timing across units, the coefficient on a given lag or lead can be contaminated from other periods. Pretrends can arise from heterogeneity of the treatment effects as well. As a robustness check for my event study results, I perform the alternative estimation method proposed in Sun and Abraham (2020) that is free from such contamination.[39] The event study results from this method is reported in Figure A.6 and very similar to my main event study results.

8.3 Measuring the Catchment Area

8.3.1 Using Different Buffer Radii for the Catchment Area

Throughout the paper, I use a 4 km radius buffer around a mill to construct the treatment group. I also experiment with multiple radii to construct the treatment group using within the district approach for the control group. I show that as the radius of the catchment area increases, meaning more DHS clusters who are actually not treated become a part of the treatment group, my results fade out. Tables A.27, A.28 and Figures A.8, A.9 presents and plots the results using DHS and HMIS (hospital) data. This rules out the concern that the households who are right outside of the

[35] My calculations are based on twowayfeweights STATA package.

[36] If that ratio is close to 0, that estimate and the average treatment effect can be of opposite signs even under a small and plausible amount of treatment effect heterogeneity. This is the case where, treatment effect heterogeneity would be a serious concern for the validity of that estimate.

[37] The results are based on didmultiplegt STATA package.

[38] The weights and the results in Figure 10 are based on within district approach. The results are also robust and similar when donut approach is used.

[39] The results are based on eventstudyinteract STATA package.

catchment area are sorting themselves into the treatment group.

If the coffee farmers who reside outside of the catchment areas bring their coffee cherries to the mills, the cherries will rot by the time they arrive to the mills. Thus, the husbands will not receive earnings from selling cherries to the mills. Yet, women can walk all the distance and request a job in the mills since mills do not prohibit those women to work there as wage workers. There are two potential reasons why I do not observe this in my data. First, the paid jobs in the mills are in short supply. There are not enough jobs for both the coffee farmer women who reside within the catchment area as well as the women who reside outside. However, it is also possible that women who reside within the catchment areas can hire women who are just outside to work for them in the mills.

Suppose women in the catchment areas may work in the mills for three days during the week and hire the women outside on the fourth day with the money they earned from working previously. If that scenario happens, women outside of the catchment areas will be treated by the mills. This brings us to the second potential reason why I do not observe this in my data. It is likely that the wage in the mills is lower than the reservation wage of the woman outside of the catchment area. The woman farmer who is outside is processing coffee at home and the husband sells the processed coffee in the domestic market. Thus, she contributes to agricultural production in the household. She also contributes to home production by performing subsistence farming (wheat for bread etc.) for household consumption. It is plausible that the wage in the mills is not high enough to compensate the total of the money she receives from her husband for her contribution to the household's agricultural production and her contribution to the home production. In contrast, a household in the catchment area can afford to buy food from the market rather than the woman producing it via home production every day. This is because the husband has higher earnings from selling cherries to the mill compared to selling home-processed coffee in the local market. This is another way of saying that in the catchment area, the household income without women's paid work is high enough (plausibly due to husbands' earnings from the mills) for the women to not perform subsistence farming every day, do work in the mills for long hours and bring more money to the household.

This robustness check also alleviates the concern regarding the random displacement of DHS clusters and measurement error. The results are weakly significant when 5 km buffer radius is used and there is no effect when the radius is 10 km. As the buffer radius increases, there is a gradual fading of the results. This suggests that the 4 km buffer radius is a valid measure for the catchment area and I am not picking up an effect only due to the displacement of DHS clusters. Yet, it is still possible for the results to have measurement error when I use 4 km as the buffer radius. This is because the rural clusters contain a maximum of 5 kilometers of positional error, which is higher than than the 4 km buffer radius. A DHS cluster that is originally not in the catchment area can be in the catchment area due to the random displacement. Yet, I am still picking up an effect on women's paid employment and domestic violence with a 4 km buffer radius and randomly displaced DHS clusters. Thus, the results constitute a lower bound for the effect and if I have precise coordinates for the clusters I would likely observe larger effects.

9 Conclusion

This paper investigates whether providing paid employment opportunities to women decrease the violence they face from their partners using the transformation of the Rwandan coffee industry as a natural experiment. I answer my research question in two steps. First, I provide causal evidence that the government-induced rapid expansion of the coffee mills in Rwanda in the 2000s, increased women's paid employment, earnings of women and their husbands and decreased domestic violence. To identification, I uniquely perform two strategies with two sources of domestic violence data, self-reports and novel administrative data on the universe of monthly hospitalizations. Then, I provide evidence to show that the decline in violence is plausibly driven by women's paid employment, not by an increase in husbands' earnings. First, after a mill opening, women in the catchment areas are more likely to participate in household decisions. Second, there is a decline in violence even among couples where women work in agriculture and husbands work in occupations with no change in earnings with a mill, non-agricultural manual jobs. Since a mill opening is not a shock to these couples' shared time during work hours, this also suggests that women's paid employment does not affect violence via exposure reduction. The seasonality of the decline in hospitalizations (decline in violence only during the harvest months when mills do not operate, not before or after the season) further speaks to the mechanisms and reinforces that the decline in violence is plausibly driven by women's paid employment. When women can credibly threat men with short term separation and when there is less financial stress in the household due to women's paid employment during the harvest months, domestic violence decreases. When women stop earning personal incomes, domestic violence shifts back to its pre-harvest level.

My results provide insights to policymakers that aim to combat domestic violence. Based on my results, providing job opportunities to women has the potential to alleviate domestic violence in developing countries. Sub-Saharan Africa is currently under a large-scale economic transition that provides paid job opportunities to women. Although the region has the highest FLFP rates globally since the 1990s, more than 60% of the employed women are often unpaid agricultural family workers in their family plots (FAO, 2010). Recently, between 2000 and 2018, 9 million paid jobs are created per year, mostly in the agricultural sector where women work dominantly

(IMF, 2018). My results suggest that the transition has the potential to decrease the violence women face from their partners in the region.

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Appendix

A Additional Tables and Figures

Table A.1: Summary Statistics of Mills

	Mean	Std. Dev.
Panel A: Mill Level Characteristics		
Owner: Cooperative	0.5	0.5
Owner: NGO	0.2	0.4
Opened before 2005	0.1	0.3
Opened between 2005-2010 (Rapid Expansion period)	0.8	0.4
Panel B: Sector Level Characteristics		
Number of coffee farmers in 1999	702.2	464.2
Log Coffee Trees in 1999	11.5	0.6
Log Coffee Trees in 2003	11.6	0.6
Log Coffee Trees in 2009	12.9	0.7
Log Coffee Trees in 2015	13.1	0.9
FAO-GAEZ Coffee Suitability Index for Coffee: Marginal	0.3	0.5
FAO-GAEZ Coffee Suitability Index for Coffee: Moderate	0.4	0.5
FAO-GAEZ Coffee Suitability Index for Coffee: Medium	0.2	0.4
FAO-GAEZ Coffee Suitability Index for Coffee: Good	0.0	0.2
Panel A: Spatial Characteristics		
Sector Area in km2	52.4	26.3
District Area in km2	834.2	274.7

Note: Mill level characteristics are from the Rwanda GeoPortal and Macchiavello and Morjaria (2020). Data on coffee trees and farmers are from the coffee censuses. FAO-GAEZ Suitability Index categories are based on FAO-GAEZ's suitability categories. Aggregate crop suitability is (1) Very high when index $>$ 8500; (2) High when 7000 $<$ index $\leq$ 8500; (3) Good when 5500 $<$ index $\leq$ 7000; (4) Medium when 4000 $<$ index $\leq$ 5500; (5) Moderate when 2500 $<$ index $\leq$ 4000; (6) Marginal when 1000 $<$ index$\leq$ 2500; (7) Very marginal when 0 $<$ index $\leq$ 1000; and (8) Not suitable when index $=$ 0. The continuous index is at 9 km^2 resolution. I aggregate the index at the sector level and classify the sector level index based on FAO's suitability categories. Spatial characteristics are the author's calculations using spatial maps by the Rwanda GeoPortal via ArcGIS software.

Table A.2: Summary Statistics for Women: DHS Women's Recode

	All		Not Exposed to a mill		Exposed to a mill	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Main dependent variables						
Worked in the past 12 months	0.88	0.32	0.88	0.32	0.88	0.32
Worked for cash in the past 12 months	0.39	0.49	0.37	0.48	0.47	0.50
Experienced domestic violence in the past 12 months	0.34	0.47	0.33	0.47	0.37	0.48
Panel B: Controls						
Husband lives in the house	0.88	0.32	0.89	0.32	0.87	0.34
Husband's age	42.42	9.85	42.20	9.88	43.11	9.72
Husband's Occupation: Agricultural	0.72	0.45	0.71	0.45	0.73	0.44
Husband's education in years	4.32	3.76	4.32	3.81	4.32	3.60
Occupation: Agricultural	0.77	0.42	0.76	0.43	0.79	0.41
Marital status: Married	0.73	0.44	0.71	0.45	0.80	0.40
Monogamy (No other wives)	0.89	0.31	0.88	0.33	0.92	0.27
Number of unions: One	0.84	0.37	0.84	0.37	0.85	0.36
Age at first marriage	19.84	3.33	19.74	3.30	20.16	3.39
Years since marriage	16.45	6.44	16.31	6.48	16.87	6.28
Education in years	3.99	3.54	3.90	3.58	4.26	3.42
Muslim	0.02	0.13	0.02	0.14	0.01	0.11
Christian	0.96	0.19	0.96	0.19	0.97	0.17
Has children aged 5 and under	0.76	0.43	0.77	0.42	0.73	0.44
Type of residence: Rural	0.84	0.37	0.83	0.38	0.86	0.35
Household has a radio	0.63	0.48	0.62	0.48	0.64	0.48
Household's main floor material is cement	0.17	0.37	0.17	0.38	0.16	0.37
Household has electricity	0.12	0.33	0.12	0.32	0.13	0.34
Household wealth is above the median	0.51	0.50	0.51	0.50	0.49	0.50
Observations	11652		8799		2853	

Note: Sample consists of partnered women who married before the expansion of the mills. "Exposed to the mill" represents being in the catchment areas of a mill. Catchment area radius is 4 km.

Table A.3: Summary Statistics for Women based on Treatment Status: 2005 DHS Women's Recode (Before Rapid Expansion/Baseline)

	Never Treated Sector Level		Before Treatment Sector Level	
	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Main dependent variables				
Worked in the past 12 months	0.84	0.37	0.83	0.38
Worked for cash in the past 12 months	0.18	0.39	0.20	0.40
Experienced domestic violence in the past 12 months	0.22	0.42	0.22	0.41
Panel B: Controls				
Husband lives in the house	0.89	0.31	0.86	0.35
Husband's age	41.24	9.74	41.54	9.33
Husband's Occupation: Agricultural	0.72	0.45	0.82	0.39
Husband's education in years	4.16	3.84	3.77	3.39
Occupation: Agricultural	0.74	0.44	0.77	0.42
Marital status: Married	0.62	0.49	0.70	0.46
Monogamy (No other wives)	0.86	0.34	0.88	0.32
Number of unions: One	0.83	0.37	0.82	0.38
Age at first marriage	19.67	3.33	19.92	3.35
Years since marriage	15.08	6.85	15.40	7.08
Education in years	3.56	3.59	3.64	3.21
Muslim	0.02	0.14	0.02	0.14
Christian	0.96	0.20	0.97	0.17
Has children aged 5 and under	0.85	0.36	0.83	0.38
Type of residence: Rural	0.81	0.39	0.85	0.36
Household has a radio	0.53	0.50	0.53	0.50
Household's main floor material is cement	0.14	0.35	0.11	0.31
Household has electricity	0.06	0.24	0.03	0.18
Household wealth is above the median	0.51	0.50	0.47	0.50
Observations	2566		905	

Note: Sample consists of partnered women who married before the expansion of the mills. "Treatment" represents a mill opening. Since a mill serves only to its catchment area, after treatment is at the catchment area level rather than the sector level. Catchment area radius is 4 km.

Table A.4: Summary Statistics for Women based on Treatment Status: 2005, 2010, 2014 DHS Women's Recode

	Never Treated Sector Level		Before Treatment Sector Level		After Treatment Catchment Area Level	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Main dependent variables						
Worked in the past 12 months	0.88	0.32	0.84	0.37	0.88	0.32
Worked for cash in the past 12 months	0.37	0.48	0.26	0.44	0.47	0.50
Experienced domestic violence in the past 12 months	0.34	0.47	0.26	0.44	0.37	0.48
Panel B: Controls						
Husband lives in the house	0.89	0.32	0.86	0.35	0.87	0.34
Husband's age	42.13	9.89	41.65	9.33	43.11	9.72
Husband's Occupation: Agricultural	0.69	0.46	0.82	0.39	0.73	0.44
Husband's education in years	4.43	3.90	3.92	3.38	4.32	3.60
Occupation: Agricultural	0.75	0.43	0.78	0.41	0.79	0.41
Marital status: Married	0.70	0.46	0.72	0.45	0.80	0.40
Monogamy (No other wives)	0.88	0.33	0.88	0.33	0.92	0.27
Number of unions: One	0.84	0.37	0.83	0.38	0.85	0.36
Age at first marriage	19.69	3.31	19.90	3.29	20.16	3.39
Years since marriage	16.28	6.42	15.56	7.00	16.87	6.28
Education in years	3.94	3.66	3.68	3.21	4.26	3.42
Muslim	0.02	0.14	0.02	0.14	0.01	0.11
Christian	0.96	0.19	0.97	0.18	0.97	0.17
Has children aged 5 and under	0.77	0.42	0.82	0.38	0.73	0.44
Type of residence: Rural	0.82	0.38	0.86	0.34	0.86	0.35
Household has a radio	0.63	0.48	0.57	0.50	0.64	0.48
Household's main floor material is cement	0.18	0.39	0.12	0.32	0.16	0.37
Household has electricity	0.13	0.34	0.04	0.19	0.13	0.34
Household wealth is above the median	0.52	0.50	0.49	0.50	0.49	0.50
Observations	7194		1041		2853	

Note: Sample consists of partnered women who married before the expansion of the mills. "Treatment" represents a mill opening. Since a mill serves only to its catchment area, after treatment is at the catchment area level rather than the sector level. Catchment area radius is 4 km.

Table A.5: Summary Statistics for Husbands: DHS Couple's Recode

	All		Not Exposed to a mill		Exposed to a mill	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Main dependent variables						
Worked in the past 12 months	0.87	0.33	0.87	0.34	0.89	0.31
Worked for cash in the past 12 months	0.80	0.40	0.79	0.41	0.82	0.38
Panel B: Controls						
Husband lives in the house	1.00	0.07	1.00	0.07	0.99	0.08
Wife's Age	36.20	6.85	35.96	6.87	36.97	6.70
Wife's Occupation: Agricultural	0.76	0.43	0.75	0.43	0.79	0.41
Wife's Education in years	3.91	3.44	3.84	3.47	4.14	3.32
Occupation: Agricultural	0.62	0.49	0.61	0.49	0.66	0.48
Marital status: Married	0.77	0.42	0.74	0.44	0.84	0.37
Monogamy (No other wives)	0.95	0.22	0.94	0.23	0.96	0.20
Number of unions: One	0.76	0.43	0.76	0.43	0.77	0.42
Age at first marriage	23.71	4.42	23.58	4.42	24.12	4.41
Years since marriage	17.16	7.25	17.03	7.29	17.59	7.09
Education in years	4.33	3.69	4.31	3.71	4.39	3.61
Muslim	0.02	0.14	0.02	0.15	0.01	0.12
Christian	0.95	0.21	0.95	0.22	0.96	0.20
Has children aged 5 and under	0.78	0.42	0.78	0.41	0.76	0.43
Type of residence: Rural	0.84	0.37	0.83	0.37	0.87	0.33
Household has a radio	0.65	0.48	0.65	0.48	0.66	0.47
Household's main floor material is cement	0.16	0.37	0.16	0.37	0.16	0.37
Household has electricity	0.12	0.32	0.11	0.32	0.13	0.34
Household wealth is above the median	0.53	0.50	0.53	0.50	0.53	0.50
Observations	4816		3657		1159	

Note: Sample consists of the partners of women in Table A.5. "Exposed to the mill" represents being in the catchment area of a mill. Catchment area radius is 4 km.

Table A.6: Summary Statistics for Husbands based on Treatment Status: DHS Couple's Recode

	Never Treated Sector Level		Before Treatment Sector Level		After Treatment Catchment Area Level	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Main dependent variables						
Worked in the past 12 months	0.88	0.33	0.73	0.44	0.89	0.31
Worked for cash in the past 12 months	0.82	0.39	0.66	0.47	0.82	0.38
Panel B: Controls						
Husband lives in the house	1.00	0.06	1.00	0.06	0.99	0.08
Wife's Age	35.97	6.81	35.30	7.11	36.97	6.70
Wife's Occupation: Agricultural	0.74	0.44	0.75	0.43	0.79	0.41
Wife's Education in years	3.91	3.60	3.82	3.14	4.14	3.32
Occupation: Agricultural	0.59	0.49	0.57	0.49	0.66	0.48
Marital status: Married	0.74	0.44	0.77	0.42	0.84	0.37
Monogamy (No other wives)	0.94	0.23	0.95	0.22	0.96	0.20
Number of unions: One	0.77	0.42	0.75	0.43	0.77	0.42
Age at first marriage	23.60	4.48	23.98	4.47	24.12	4.41
Years since marriage	17.05	7.15	16.11	7.70	17.59	7.09
Education in years	4.47	3.85	3.97	3.34	4.39	3.61
Muslim	0.03	0.16	0.01	0.11	0.01	0.12
Christian	0.95	0.22	0.95	0.21	0.96	0.20
Has children aged 5 and under	0.78	0.42	0.84	0.37	0.76	0.43
Type of residence: Rural	0.82	0.38	0.84	0.36	0.87	0.33
Household has a radio	0.65	0.48	0.61	0.49	0.66	0.47
Household's main floor material is cement	0.18	0.38	0.12	0.33	0.16	0.37
Household has electricity	0.14	0.35	0.04	0.20	0.13	0.34
Household wealth is above the median	0.54	0.50	0.50	0.50	0.53	0.50
Observations	3219		612		1159	

Note: Sample consists of the partners of women in Table A.5. "Treatment" represents a mill opening. Since a mill serves only to its catchment area, after treatment is at the catchment area level rather than the sector level. Catchment area radius is 4 km.

Table A.7: Summary Statistics for Hospitals: HMIS

	All		Not Exposed to a mill		Exposed to a mill	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Main dependent variables						
Has a GBV Patient: Women aged older than 18	0.79	0.41	0.85	0.36	0.70	0.46
Has a GBV Patient: Women aged 10-18 yrs	0.84	0.36	0.89	0.31	0.77	0.42
Has a GBV Patient: Men aged older than 18	0.24	0.43	0.27	0.45	0.19	0.39
Has a GBV Patient: Men aged 10-18 yrs	0.13	0.34	0.15	0.36	0.11	0.31
Death due to GBV: Women aged older than 18	0.02	0.16	0.02	0.15	0.03	0.17
Death due to GBV: Women aged 10-18 yrs	0.01	0.08	0.01	0.08	0.01	0.08
Death due to GBV: Men aged older than 18	0.02	0.13	0.02	0.12	0.02	0.15
Death due to GBV: Men aged 10-18 yrs	0.01	0.07	0.00	0.06	0.01	0.10
Panel B: Breakdown of dependent variables in numbers						
Patients w. physical GBV symptoms: Women aged older than 18	2.52	4.33	3.07	5.07	1.56	2.19
Patients w. sexual GBV symptoms: Women aged older than 18	1.70	2.37	2.02	2.63	1.16	1.70
Patients w. physical GBV symptoms.: Women aged 10-18 yrs	0.24	0.80	0.29	0.92	0.16	0.49
Patients w. sexual GBV symptoms: Women aged 10-18 yrs	5.07	5.24	5.58	5.49	4.36	4.67
Panel C: Controls						
Patient is referred to the hospital by police	0.83	0.38	0.86	0.35	0.77	0.42
Patient is referred to the hospital by community health worker	0.28	0.45	0.33	0.47	0.20	0.40
Patient is referred for care to higher level health facility	0.08	0.28	0.09	0.28	0.08	0.27
Observations	1499		966		497	

Note: GBV stands for gender based violence. Variables in Panel A and C are dummy variables. Panel B reports the monthly hospitalizations for GBV. Variables reported in Panel B are used to construct the "has a GBV patient" dummy variable for a specific age group. "Patient" in Panel C is a gender based violence patient. Sample consists of hospitals. HMIS is a panel data. There are 42 hospitals which are observed for every month for 3 years. Thus, the number of observations is a product of the number of hospitals, 12 and 3. "Exposed to the mill" represents being in the catchment area of a mill. Catchment area radius is 4 km.

Table A.8: Summary Statistics for Hospitals (non Gender Based Violence Hospitalizations): HMIS

	All		Not Exposed to a mill		Exposed to a mill	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Main dependent variables						
Log Hospitalizations: Bone and Jone Disorders other than Fractures	3.10	1.35	3.16	1.41	3.01	1.25
Panel B: Dependent variables in levels						
Hospitalizations: Bone and Jone Disorders other than Fractures	46.35	86.95	52.96	104.51	35.51	42.90
Panel C: Controls						
Patient is referred to the hospital by police	0.84	0.37	0.86	0.34	0.78	0.42
Patient is referred to the hospital by community health worker	0.29	0.45	0.34	0.47	0.20	0.40
Patient is referred for care to higher level health facility	0.08	0.27	0.09	0.28	0.07	0.25
Observations	3505		2279		1130	

Note: GBV stands for gender based violence. Variables in Panel A and C are dummy variables. Panel B reports the monthly hospitalizations for bone and joint disorders other than fractures. Sample consists of hospitals. HMIS is a panel data. There are 42 hospitals which are observed for every month for 3 years. Thus, the number of observations is a product of the number of hospitals, 12 and 3. "Exposed to the mill" represents being in the catchment area of a mill. Catchment area radius is 4 km.

Table A.9: Summary Statistics for Couples: EICV

	All		Not Exposed to a mill		Exposed to a mill	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Labor income variables						
Women's last daily earnings, in Rwandan francs	464.56	3064.42	385.00	2652.90	476.38	3120.82
Husbands' last daily earnings, in Rwandan francs	1186.65	5318.57	1021.14	5471.99	1211.23	5295.18
Panel B: Controls						
Husband is not absent in the past 12 months	0.78	0.42	0.80	0.40	0.77	0.42
Husband's age	40.18	8.23	40.28	8.11	40.16	8.25
Husband's Occupation: Agricultural	0.26	0.44	0.25	0.43	0.27	0.44
Husband's Education: No education	0.11	0.31	0.12	0.33	0.11	0.31
Husband's Education: Incomplete primary	0.56	0.50	0.52	0.50	0.56	0.50
Husband's Education: Primary completed	0.26	0.44	0.27	0.44	0.26	0.44
Husband's Education: More than primary	0.16	0.37	0.16	0.37	0.16	0.36
Household size	5.78	1.95	6.05	1.99	5.74	1.94
Occupation: Agricultural	0.79	0.40	0.82	0.38	0.79	0.41
Marital status: Married monogamous	0.83	0.37	0.77	0.42	0.84	0.36
Marital status: Married polygamous	0.04	0.19	0.05	0.22	0.03	0.18
Education: No education	0.12	0.32	0.18	0.39	0.11	0.31
Education: Incomplete primary	0.57	0.49	0.51	0.50	0.58	0.49
Education: Primary completed	0.24	0.43	0.18	0.39	0.25	0.43
Education: More than primary	0.13	0.34	0.12	0.32	0.13	0.34
Children in the HH aged 5 and under	0.79	0.41	0.82	0.39	0.79	0.41
Type of residence: Rural	0.83	0.38	0.82	0.38	0.83	0.37
Household's main floor material is cement	0.19	0.39	0.18	0.38	0.20	0.40
Household has electricity	0.15	0.36	0.12	0.33	0.15	0.36
Observations	15244		1971		13273	

Note: Sample consists of partnered women who presumably married before the expansion of the mills. Year of marriage is not collected in EICV. In order to construct the sample of women who partnered before the expansion of the mills (as in DHS), I took the cohorts of women I observe in DHS. EICV is not geocoded. Thus, "Exposed to the mill" represents having a mill in the district. District is a 800 km^2 area.

Table A.10: Summary Statistics for Couples based on Treatment Status: EICV

	Never Treated District Level		Before Treatment District Level		After Treatment District Level	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Labor income variables						
Women's last daily earnings, in Rwandan francs	545.79	3649.95	330.42	1930.79	475.45	3119.86
Husbands' last daily earnings, in Rwandan francs	1436.62	7621.97	761.91	2128.73	1216.18	5314.34
Panel B: Controls						
Husband is not absent in the past 12 months	0.78	0.42	0.83	0.37	0.77	0.42
Husband's age	39.65	7.97	40.85	8.13	40.16	8.25
Husband's Occupation: Agricultural	0.28	0.45	0.22	0.41	0.26	0.44
Husband's Education: No education	0.10	0.29	0.18	0.38	0.11	0.31
Husband's Education: Incomplete primary	0.59	0.49	0.48	0.50	0.56	0.50
Husband's Education: Primary completed	0.27	0.44	0.25	0.43	0.26	0.44
Husband's Education: More than primary	0.15	0.36	0.18	0.38	0.16	0.36
Household size	6.00	1.86	6.04	2.10	5.74	1.94
Occupation: Agricultural	0.85	0.36	0.76	0.43	0.79	0.41
Marital status: Married monogamous	0.83	0.37	0.71	0.45	0.84	0.36
Marital status: Married polygamous	0.05	0.21	0.06	0.23	0.03	0.18
Education: No education	0.15	0.36	0.23	0.42	0.11	0.31
Education: Incomplete primary	0.58	0.49	0.46	0.50	0.58	0.49
Education: Primary completed	0.16	0.37	0.21	0.41	0.25	0.43
Education: More than primary	0.11	0.31	0.15	0.35	0.13	0.34
Children in the HH aged 5 and under	0.78	0.41	0.83	0.38	0.79	0.41
Type of residence: Rural	0.86	0.34	0.75	0.43	0.83	0.37
Household's main floor material is cement	0.13	0.34	0.23	0.42	0.20	0.40
Household has electricity	0.13	0.34	0.14	0.35	0.15	0.36
Observations	973		1593		13273	

Note: Sample consists of partnered women who presumably married before the expansion of the mills. Year of marriage is not collected in EICV. In order to construct the sample of women who partnered before the expansion of the mills (as in DHS), I took the cohorts of women I observe in DHS. EICV is not geocoded. Thus, "Treatment" represents a mill opening in the district. District is a 800 km^2 area.

Table A.11: Balance Check: Within District Approach

	Husband		Women		
	(1) Occupation: Agricultural	(2) Education in Years	(3) Occupation: Agricultural	(4) Education in Years	(5) Civil Marriage
Mill	-0.00	0.10	-0.01	-0.08	-0.00
	(0.02)	(0.15)	(0.02)	(0.14)	(0.02)
Observations	9823	9823	9823	9823	9823
Dependent variable mean	0.71	4.34	0.76	4.02	0.73
	Women		Household		
	(1) Age at: First Marriage	(2) Religion: Christian	(3) Residence: Rural	(4) Cement Floor	(5) Electricity
Mill	0.01	-0.00	0.02	-0.00	0.01
	(0.06)	(0.01)	(0.03)	(0.01)	(0.01)
Observations	9823	9823	9823	9823	9823
Dependent variable mean	19.90	0.96	0.83	0.17	0.12

Note: Robust standard errors clustered at the sector level are in parentheses. 4 km catchment area is used for the treatment group. Within district approach is used for the control group. The estimates are based on DHS data and estimated with the main specification presented in Section 5.2.1
*** p<.01, ** p<.05, * p<.1

Table A.12: Balance Check: Donut Approach

	Husband		Women		
	(1) Occupation: Agricultural	(2) Education in Years	(3) Occupation: Agricultural	(4) Education in Years	(5) Civil Marriage
Mill	-0.01	-0.02	-0.01	-0.18	-0.01
	(0.02)	(0.17)	(0.02)	(0.17)	(0.02)
Observations	4900	4900	4900	4900	4900
Dependent variable mean	0.70	4.46	0.75	4.41	0.79
	Women		Household		
	(1) Age at: First Marriage	(2) Religion: Christian	(3) Residence: Rural	(4) Cement Floor	(5) Electricity
Mill	-0.01	0.00	0.04	-0.00	0.02
	(0.07)	(0.01)	(0.03)	(0.01)	(0.01)
Observations	4900	4900	4900	4900	4900
Dependent variable mean	20.15	0.96	0.81	0.20	0.16

Note: Robust standard errors clustered at the sector level are in parentheses. 4 km catchment area is used for the treatment group. Donut approach is used for the control group. The estimates are based on DHS data and estimated with the main specification presented in Section 5.2.1 *** p<.01, ** p<.05, * p<.1

Table A.13: Effect of Mill Exposure on Women's Occupation: Within District Approach

	(1) Managers	(2) Sales	(3) Agricultural Self-Employed	(4) Agricultural Employee	(5) Manual Skilled & Unskilled
Mill	0.00	-0.01	-0.01	-0.00	0.02
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Observations	8762	8762	8762	8762	8762
Dependent variable mean	0.03	0.07	0.82	0.04	0.03

Note: Robust standard errors clustered at the sector level are in paranthesis. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All dependent variables are measured for the past 12 months. Catchment area radius is 4 km. Within district approach is used for the control group. *** p<.01, ** p<.05, * p<.1

Table A.14: Effect of Mill Exposure on Husbands' Occupation: Within District Approach

	(1) Managers	(2) Sales	(3) Agricultural Self-Employed	(4) Agricultural Employee	(5) Manual Skilled & Unskilled
Mill	0.00	0.03**	-0.04	0.00	0.01
	(0.01)	(0.02)	(0.03)	(0.01)	(0.03)
Observations	3547	3547	3547	3547	3547
Dependent variable mean	0.05	0.06	0.66	0.04	0.17

Note: Robust standard errors clustered at the sector level are in parantheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partners of women in the first specification. All dependent variables are measured for the past 12 months. Catchment area radius is 4 km. Within district approach is used for the control group. *** p<.01, ** p<.05, * p<.1

Table A.15: Effect of Mill Exposure on Women's Occupation Donut Approach

	(1) Managers	(2) Sales	(3) Agricultural Self-Employed	(4) Agricultural Employee	(5) Manual Skilled & Unskilled
Mill	0.01	-0.01	-0.01	-0.01	0.02
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Observations	4628	4628	4628	4628	4628
Dependent variable mean	0.03	0.08	0.80	0.03	0.04

Note: Robust standard errors clustered at the sector level are in parantheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All dependent variables are measured for the past 12 months. Catchment area radius is 4 km. Donut approach is used for the control group. *** $p<.01$, ** $p<.05$, * $p<.1$

Table A.16: Effect of Mill Exposure on Husbands' Occupation: Donut Approach

	(1) Managers	(2) Sales	(3) Agricultural Self-Employed	(4) Agricultural Employee	(5) Manual Skilled & Unskilled
Mill	0.01	0.04**	-0.05	-0.01	0.01
	(0.01)	(0.02)	(0.04)	(0.02)	(0.03)
Observations	1958	1958	1958	1958	1958
Dependent variable mean	0.05	0.06	0.67	0.04	0.16

Note: Robust standard errors clustered at the sector level are in parantheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partners of women in the first specification. All dependent variables are measured for the past 12 months. Catchment area radius is 4 km. Donut approach is used for the control group. *** p<.01, ** p<.05, * p<.1

Table A.17: Effect of a Mill Opening on Women's and Their Husbands' Log of Last Daily Earnings using Inverse Hypberbolic Sin Transformation for the Dependent Variables

	All Sample		Occupation: Agriculture	
	(1) Woman: Log of Last Daily Earnings	(2) Husband: Log of Last Daily Earnings	(3) Woman: Log of Last Daily Earnings	(4) Husband: Log of Last Daily Earnings
Log of Mills per capita in the District	2.778***	2.539***	2.236***	2.786***
	(0.19)	(0.24)	(0.17)	(0.15)
Observations	5218	8329	4157	3511
Dependent variable mean	7.07	7.51	6.84	6.94

Note: Robust standard errors clustered at the district level are in paranthesis. All estimations include individual controls, cohort fixed effects, district-by-year fixed effects, linear time trends interacted with baseline district level characteristics. Since EICV is not geocoded, the mill variable is log of mills per capita in a district in a given year In Columns 3-4, the sample consists of women and their husbands who reported their occupation as agricultural. *** p<.01, ** p<.05, * p<.1

Table A.18: Effect of a Mill Opening on Women-to-Husband Log of Last Daily Earnings Ratio using Heckman Selection Model

	All Sample
	(1) Woman: Log of Last Daily Earnings
Log of Last Daily Earnings	
Log of Mills per capita in the District	1.813***
	(0.18)
Observations	5218

Note: Robust standard errors clustered at the district level are in parentheses. Estimates show the second stage results. In both specifications, total number of children under the age 5 is used as the identifying variable and used in the first stage, selection equation. It affects women's labor market participation (reservation wage), but not the wages (wage offer). All estimations include individual controls, cohort fixed effects, district-by-year fixed effects, linear time trends interacted with baseline district level characteristics. In the selection equation, province fixed effects are used to avoid collinearity. Since EICV is not geocoded, the mill variable is log of mills per capita in a district in a given year. In Columns 4-6, the sample consists of women and their husbands who reported their occupation as agricultural. *** p<.01, ** p<.05, * p<.1

Table A.19: Effect of Mill Exposure on Household's Log Education Expenditures for Elementary School-Aged Children

	(1) Household's Log Education Expenditures for Children Aged 6-13
Log of Mills per capita in the District	1.26*
	(0.73)
Observations	1530

Note: Robust standard errors clustered at the district level are in parentheses. Robust standard errors clustered at the district level are in parentheses. All estimations include individual controls, cohort fixed effects, district-by-year fixed effects, linear time trends interacted with baseline district level characteristics. Since EICV is not geocoded, the mill variable is log of total number of mills per capita in a district a given year. Sample consists of households that have elementary school aged children (aged 6-13). *** p<.01, ** p<.05, * p<.1

Table A.20: Effect of Mill Exposure on Hospitalizations for Gender Based Violence

	Women		Men	
	(1) Older than 18	(2) Younger than 18	(3) Older than 18	(4) Younger than 18
Mill x Month 1	0.05	-0.01	0.06	-0.03
	(0.07)	(0.05)	(0.05)	(0.06)
Mill x Month 2	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)
Mill x Month 3	-0.04	-0.12	-0.10	-0.05
	(0.06)	(0.10)	(0.06)	(0.08)
Mill x Month 4	-0.02	0.02	-0.08	0.01
	(0.08)	(0.06)	(0.07)	(0.09)
Mill x Month 5	-0.01	-0.02	0.01	0.03
	(0.08)	(0.11)	(0.07)	(0.10)
Mill x Month 6	-0.18**	-0.07	-0.02	-0.01
	(0.07)	(0.07)	(0.10)	(0.08)
Mill x Month 7	-0.14*	0.01	0.11	0.07
	(0.07)	(0.10)	(0.09)	(0.12)
Mill x Month 8	0.06	-0.00	-0.04	0.04
	(0.07)	(0.10)	(0.09)	(0.10)
Mill x Month 9	0.02	0.01	0.03	-0.05
	(0.07)	(0.11)	(0.09)	(0.09)
Mill x Month 10	0.00	0.03	-0.06	-0.02
	(0.05)	(0.09)	(0.07)	(0.11)
Mill x Month 11	-0.14	-0.06	-0.09	-0.02
	(0.11)	(0.08)	(0.07)	(0.08)
Mill x Month 12	-0.07	0.07	-0.06	0.00
	(0.11)	(0.09)	(0.09)	(0.07)
Observations	1210	1210	1209	1210
Dependent variable mean	0.79	0.84	0.24	0.14

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include hospital controls, hospital fixed effects, district fixed effects, province-by-year fixed effects, linear time trends interacted with baseline district level characteristics. Omitted categeory is the hospitalizations in Month 2, February. Catchment area radius is 4 km. *** p<.01, ** p<.05, * p<.1

Table A.21: Effect of Mill Exposure on Hospitalizations for Bone and Joint Disorders (Women)

	Bone and Joint Disorders
	(1) Women Older than 18
Mill x Month 1	0.14
	(0.18)
Mill x Month 2	0.00
	(.)
Mill x Month 3	0.07
	(0.14)
Mill x Month 4	-0.01
	(0.12)
Mill x Month 5	-0.08
	(0.16)
Mill x Month 6	-0.11
	(0.23)
Mill x Month 7	0.03
	(0.16)
Mill x Month 8	-0.02
	(0.19)
Mill x Month 9	-0.03
	(0.24)
Mill x Month 10	-0.04
	(0.22)
Mill x Month 11	-0.01
	(0.20)
Mill x Month 12	-0.03
	(0.19)
Observations	1078
Dependent variable mean	20.37

Note: Fractures are excluded. Examples include osteoarthritis, gout, rheumatoid arthritis, lupus, bursitis. Dependent variable is in logs. Robust standard errors clustered at the sector level are in parentheses. All estimations include hospital controls, hospital fixed effects, district fixed effects, province-by-year fixed effects, linear time trends interacted with baseline district level characteristics. Omitted categeory is the hospitalizations in Month 2, February. Catchment area radius is 4 km. *** p<.01, ** p<.05, * p<.1

Table A.22: Hospitalizations for Gender Based Violence Among Women Older than 19 across Different Catchment Areas

	Women Older than 19		
	(1)	(2)	(3)
	4 km	5 km	10 km
Mill x Month 1	0.05	0.05	0.11
	(0.07)	(0.06)	(0.10)
Mill x Month 2	0.00	0.00	0.00
	(.)	(.)	(.)
Mill x Month 3	-0.04	-0.04	0.08
	(0.06)	(0.06)	(0.10)
Mill x Month 4	-0.02	-0.01	0.06
	(0.08)	(0.07)	(0.11)
Mill x Month 5	-0.01	0.00	0.10
	(0.08)	(0.07)	(0.07)
Mill x Month 6	-0.18**	-0.16**	-0.12
	(0.07)	(0.07)	(0.08)
Mill x Month 7	-0.14*	-0.13	0.01
	(0.07)	(0.08)	(0.10)
Mill x Month 8	0.06	0.05	-0.01
	(0.07)	(0.07)	(0.09)
Mill x Month 9	0.02	0.03	-0.02
	(0.07)	(0.07)	(0.07)
Mill x Month 10	0.00	0.00	-0.05
	(0.05)	(0.04)	(0.07)
Mill x Month 11	-0.14	-0.11	0.08
	(0.11)	(0.10)	(0.10)
Mill x Month 12	-0.07	-0.04	0.08
	(0.11)	(0.10)	(0.10)
Observations	1210	1210	1210
Dependent variable mean	0.79	0.79	0.79

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include hospital controls, hospital fixed effects, district fixed effects, province-by-year fixed effects, linear time trends interacted with baseline district level characteristics. Omitted category is the hospitalizations in Month 2, February. Catchment area radius is 4 km. *** p<.01, ** p<.05, * p<.1

Table A.23: Effect of Mill Exposure on Women's Employment and Type of Earnings

	Work Variables	
	(1)	(2)
	Work	Cash
Mill x Event Time -3	0.02	0.05
	(0.03)	(0.06)
Mill x Event Time -2	0.02	0.05
	(0.03)	(0.07)
Mill x Event Time -1	0.00	0.00
	(.)	(.)
Mill x Event Time 0	-0.01	0.10*
	(0.02)	(0.06)
Mill x Event Time 1	0.00	0.06
	(0.03)	(0.08)
Mill x Event Time 2	0.00	0.07
	(0.03)	(0.08)
Mill x Event Time 3	0.00	0.06
	(0.02)	(0.06)
Mill x Event Time 4	0.00	0.09**
	(0.02)	(0.04)
Mill x Event Time 5	-0.03	0.17***
	(0.03)	(0.06)
Mill x Event Time 6	0.01	0.10**
	(0.02)	(0.04)
Observations	7827	8163
Dependent variable mean	0.89	0.41

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All variables are measured for the past 12 months. Ommitted categeory is Event Time -1, 1 year before a mill opening. Catchment area radius is 4 km. *** p<.01, ** p<.05, * p<.1

Table A.24: Effect of Mill Exposure on Self-Reported Domestic Violence

	(1) Domestic Violence
Mill x Event Time -3	0.01
	(0.07)
Mill x Event Time -2	-0.06
	(0.08)
Mill x Event Time -1	0.00
	(.)
Mill x Event Time 0	-0.16***
	(0.06)
Mill x Event Time 1	-0.17**
	(0.09)
Mill x Event Time 2	-0.12
	(0.09)
Mill x Event Time 3	-0.14**
	(0.06)
Mill x Event Time 4	-0.05
	(0.05)
Observations	3528
Dependent variable mean	0.35

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All variables are measured for the past 12 months. Omitted category is Event Time -1, 1 year before a mill opening. Catchment area radius is 4 km. *** p<.01, ** p<.05, * p<.1

Table A.25: Effect of Mill Exposure on Women's Employment and Type of Earnings across Different Catchment Areas

	4 km		5 km		10 km	
	(1) Work	(2) Cash	(3) Work	(4) Cash	(5) Work	(6) Cash
Mill x Event Time -3	0.01	0.03	0.00	-0.03	-0.02	-0.03
	(0.03)	(0.05)	(0.02)	(0.06)	(0.02)	(0.04)
Mill x Event Time -2	0.02	0.07	0.01	-0.00	-0.04	0.04
	(0.02)	(0.05)	(0.03)	(0.04)	(0.03)	(0.05)
Mill x Event Time -1	0.00	0.00	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)	(.)	(.)
Mill x Event Time 0	-0.01	0.04	-0.02	0.04	-0.03	0.04
	(0.02)	(0.06)	(0.02)	(0.04)	(0.02)	(0.04)
Mill x Event Time 1	0.01	0.06	0.01	0.06	0.01	0.03
	(0.03)	(0.08)	(0.02)	(0.06)	(0.03)	(0.06)
Mill x Event Time 2	-0.00	0.05	0.00	0.11*	-0.01	0.01
	(0.03)	(0.07)	(0.03)	(0.07)	(0.02)	(0.05)
Mill x Event Time 3	-0.01	0.07	-0.03	-0.01	-0.05*	-0.02
	(0.02)	(0.06)	(0.02)	(0.04)	(0.03)	(0.05)
Mill x Event Time 4	0.02	0.09**	-0.03	-0.01	-0.01	0.06
	(0.02)	(0.04)	(0.02)	(0.04)	(0.02)	(0.04)
Mill x Event Time 5	-0.04*	0.14**	-0.05**	0.01	0.00	0.09**
	(0.02)	(0.06)	(0.02)	(0.06)	(0.02)	(0.04)
Mill x Event Time 6	0.01	0.08**	-0.01	-0.00	-0.01	-0.03
	(0.02)	(0.04)	(0.02)	(0.04)	(0.02)	(0.04)
Observations	9823	10081	9823	10081	9823	10081
Dependent variable mean	0.88	0.39	0.88	0.39	0.88	0.39

Note: Robust standard errors clustered at the sector level are in paranthesis. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All variables are measured for the past 12 months. Omitted category is Event Time -1, 1 year before a mill opening. *** p<.01, ** p<.05, * p<.1

Table A.26: Effect of Mill Exposure on Self-Reported Domestic Violence across Different Catchment Areas

	Domestic Violence		
	(1) 4 km	(2) 5 km	(3) 10 km
Mill x Event Time -3	0.00	-0.00	0.00
	(0.07)	(0.06)	(0.07)
Mill x Event Time -2	-0.06	-0.09	0.01
	(0.08)	(0.07)	(0.09)
Mill x Event Time -1	0.00	0.00	0.00
	(.)	(.)	(.)
Mill x Event Time 0	-0.16**	-0.09	-0.02
	(0.07)	(0.06)	(0.06)
Mill x Event Time 1	-0.14*	-0.08	-0.03
	(0.08)	(0.09)	(0.08)
Mill x Event Time 2	-0.13	-0.04	-0.05
	(0.09)	(0.08)	(0.07)
Mill x Event Time 3	-0.14**	-0.09	0.01
	(0.06)	(0.08)	(0.08)
Mill x Event Time 4	-0.05	-0.01	0.01
	(0.05)	(0.05)	(0.06)
Observations	3583	3583	3583
Dependent variable mean	0.35	0.35	0.35

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All variables are measured for the past 12 months. Omitted category is Event Time -1, 1 year before a mill opening. *** p<.01, ** p<.05, * p<.1

Table A.27: Effect of Mill Exposure on Women's Employment, Type of Earnings and Self-Reported Domestic Violence in the Past 12 Months for Different Catchment Area Sizes

	4 km			5 km			10 km		
	(1) Work	(2) Cash	(3) Violence	(4) Work	(5) Cash	(6) Violence	(7) Work	(8) Cash	(9) Violence
Mill	-0.00	0.07***	-0.09***	-0.01	0.04**	-0.07*	-0.01	-0.02	0.02
	(0.01)	(0.02)	(0.03)	(0.01)	(0.02)	(0.04)	(0.01)	(0.03)	(0.04)
Observations	9823	8766	3583	9823	8766	3583	9823	8766	3583
Dependent variable mean	0.88	0.40	0.35	0.88	0.40	0.35	0.88	0.40	0.35

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All dependent variables are measured for the past 12 months. Catchment areas are constructed by buffers around the mills where 4, 5 and 10 km represent buffer radius. *** p<.01, ** p<.05, * p<.1

Table A.28: Effect of Mill Exposure on Household Decision Making: Woman Alone or Jointly with Husband

	4 km			5 km			10 km		
	(1) Large HH Purchases	(2) Own Health	(3) Family Visit	(4) Large HH Purchases	(5) Own Health	(6) Family Visit	(7) Large HH Purchases	(8) Own Health	(9) Family Visit
Mill	0.05**	0.02	0.02	0.04*	0.01	0.01	0.02	0.01	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	9823	9823	9823	9823	9823	9823	9823	9823	9823
Dependent variable mean	0.69	0.73	0.81	0.69	0.73	0.81	0.69	0.73	0.81

Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All dependent variables are coded as 1 if the decision is taken by women alone or jointly with their husbands and zero otherwise. Otherwise category includes husband only or someone else. The survey question on household decisions changed significantly over the data cycles. in 2005, the question asks "Who has the final say on decision x?" After 2005, the question is "Who usually decides on x". The answer option "Respondent and other" is also discontinued in 2010 and 2014 rounds. To make a comparable variable, I create the variable based on whether the woman had a say in the decision, either alone or jointly. Results should be interpreted with caution. Cathment areas are constructed by buffers around the mills where 4, 5 and 10 km represent buffer radius. *** p<.01, ** p<.05, * p<.1

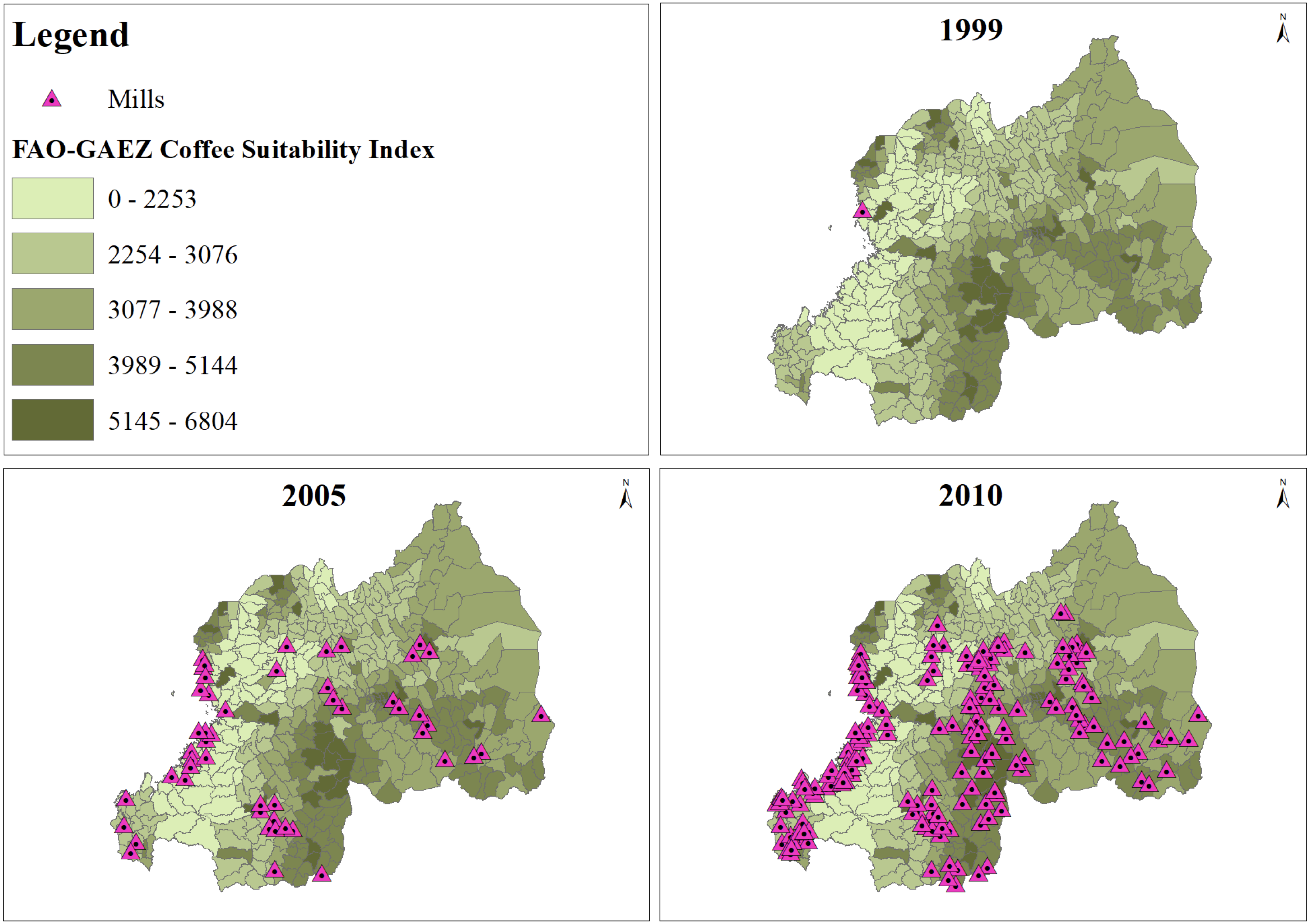


Figure A.1: FAO-GAEZ Coffee Suitability Index and Expansion of Mills in Rwanda

Note: The maps are constructed by combining data on mills, FAO-GAEZ Coffee Coffee Suitability Index, The Rwandan GeoPortal spatial data on sector boundries.

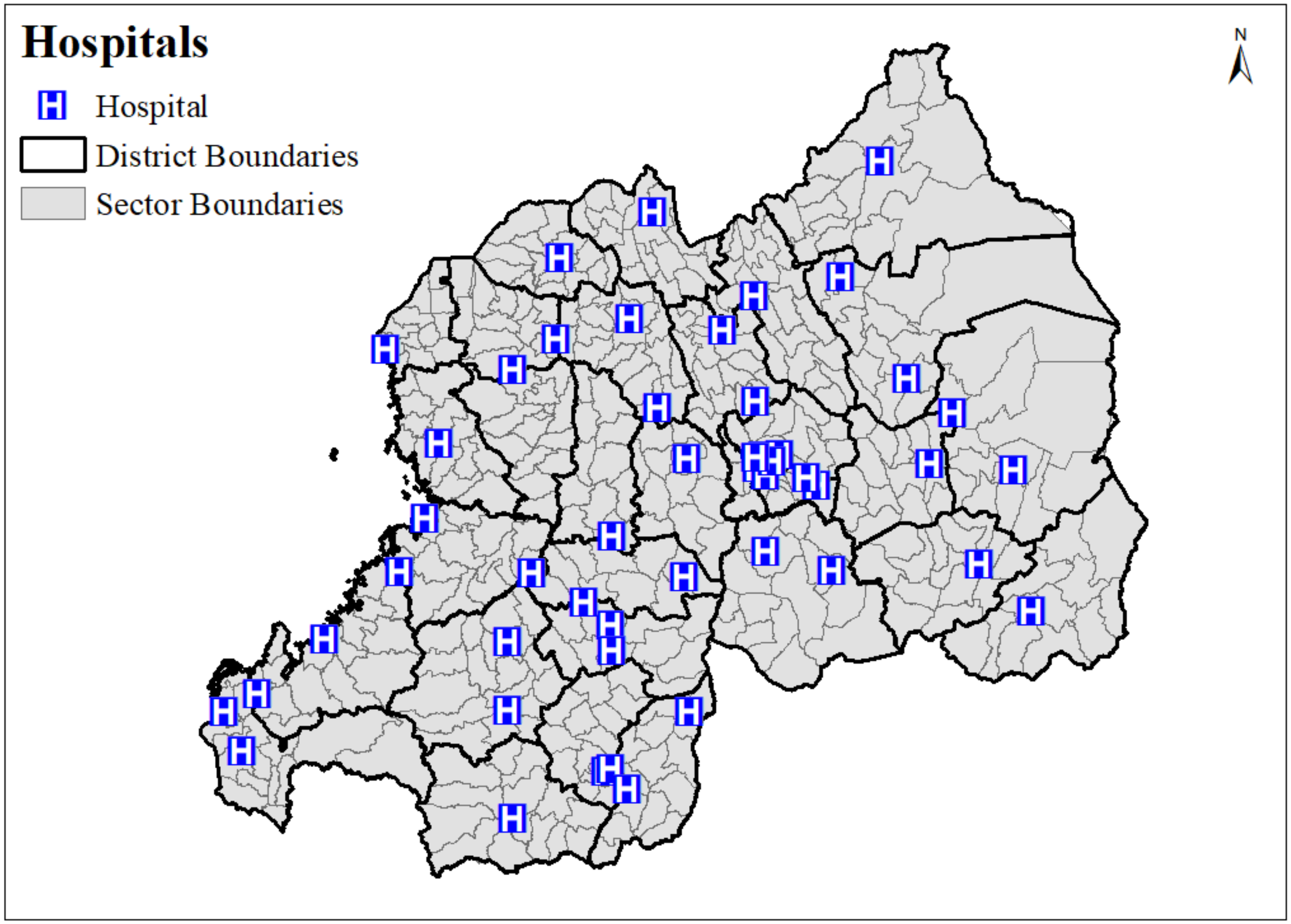
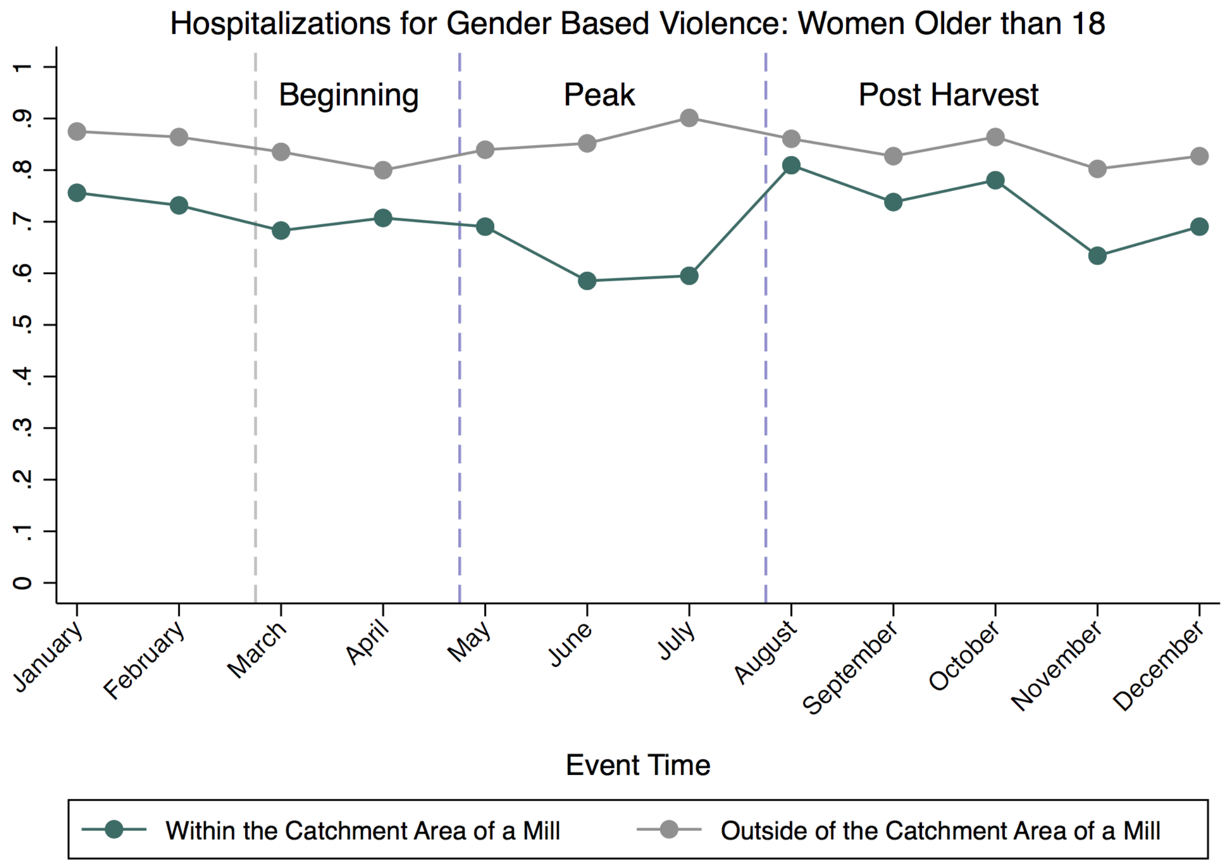


Figure A.2: Hospitals in Rwanda

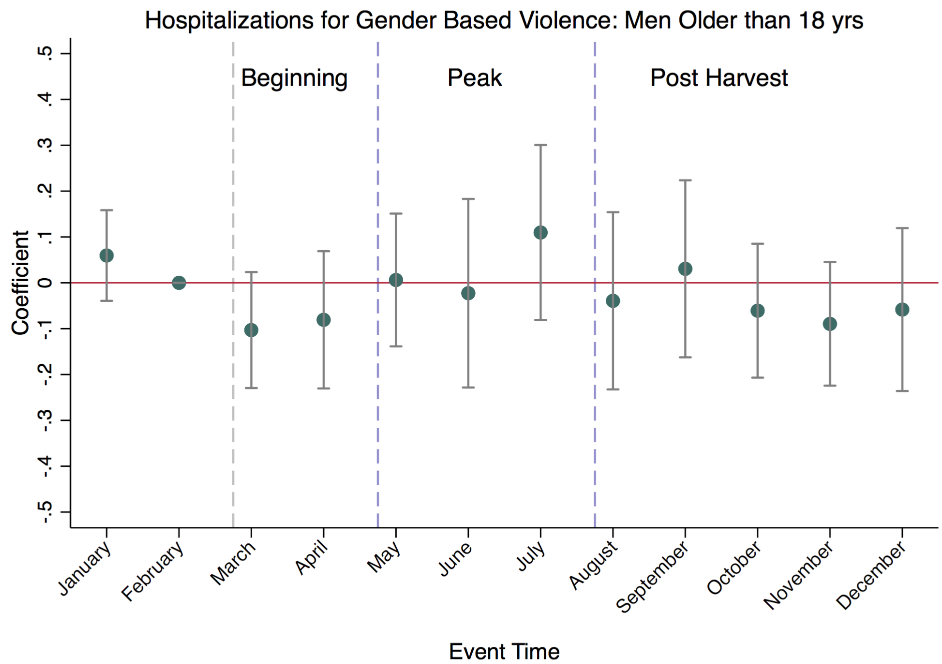
Note: The map is constructed by combining HMIS data with the GPS coordinates of the hospitals provided by the Rwanda Ministry of Health.

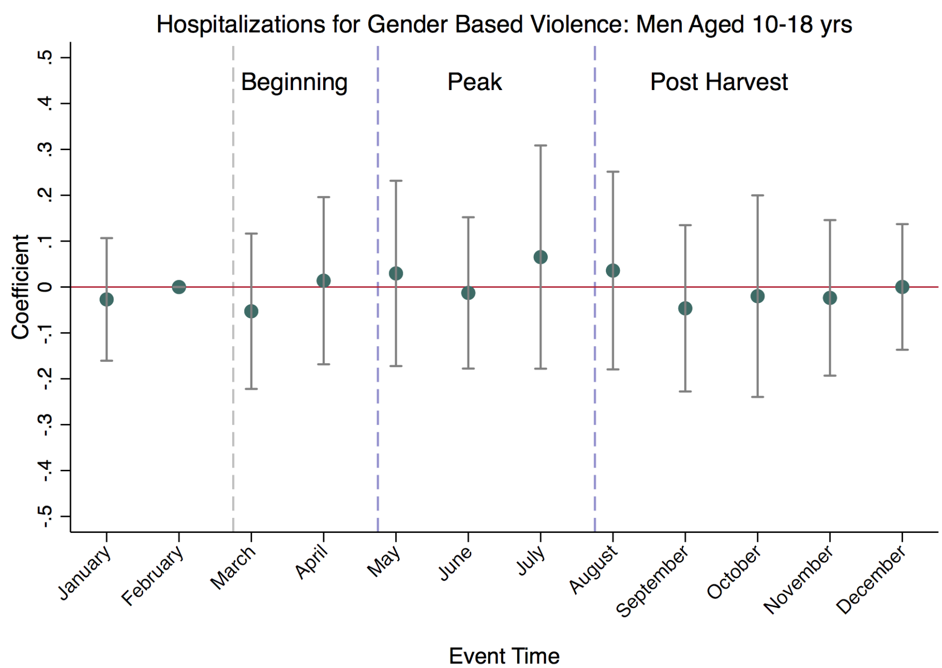
Figure A.3: Mean Hospitalizations for Gender Based Violence within a Year



Note: This figure shows the raw means for hospitalizations for women older than 18 within a year.

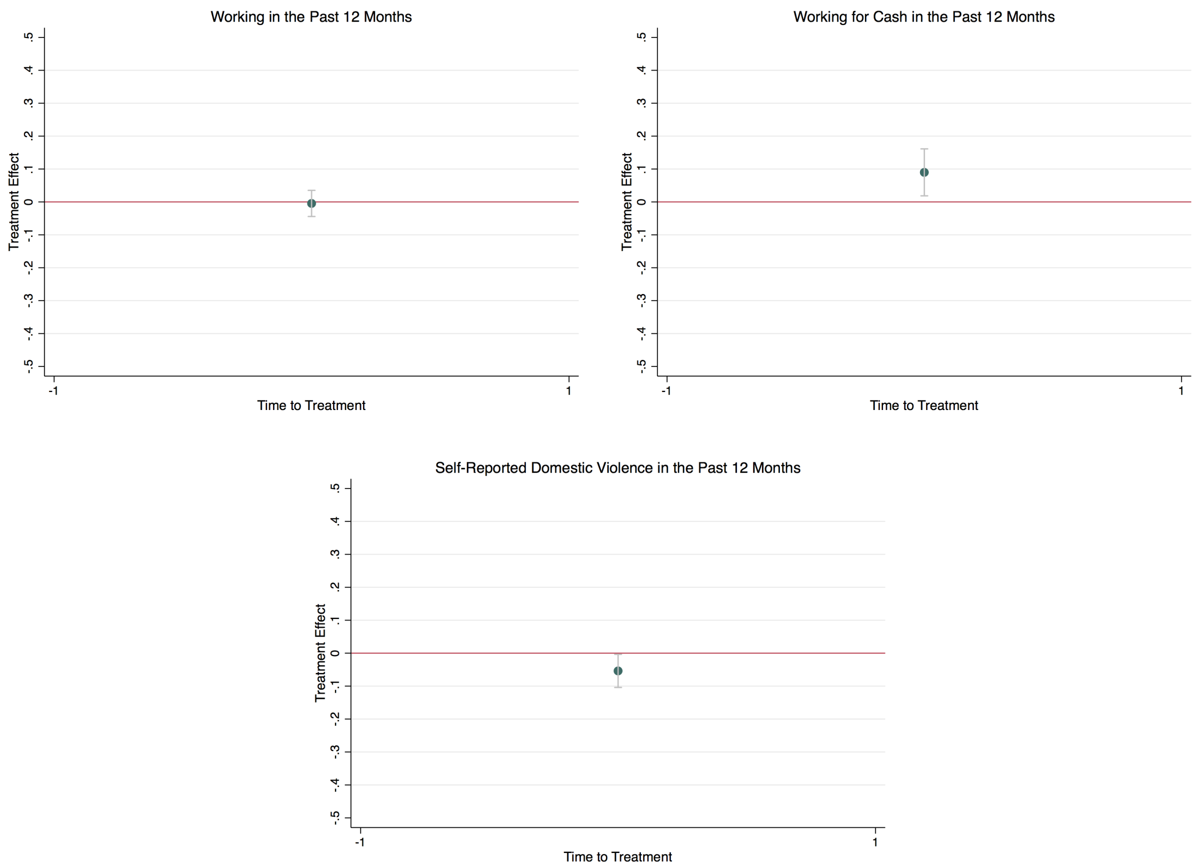
Figure A.4: Dynamic Impact of a Mill Opening on Hospitalizations for Gender Based Violence (Men)





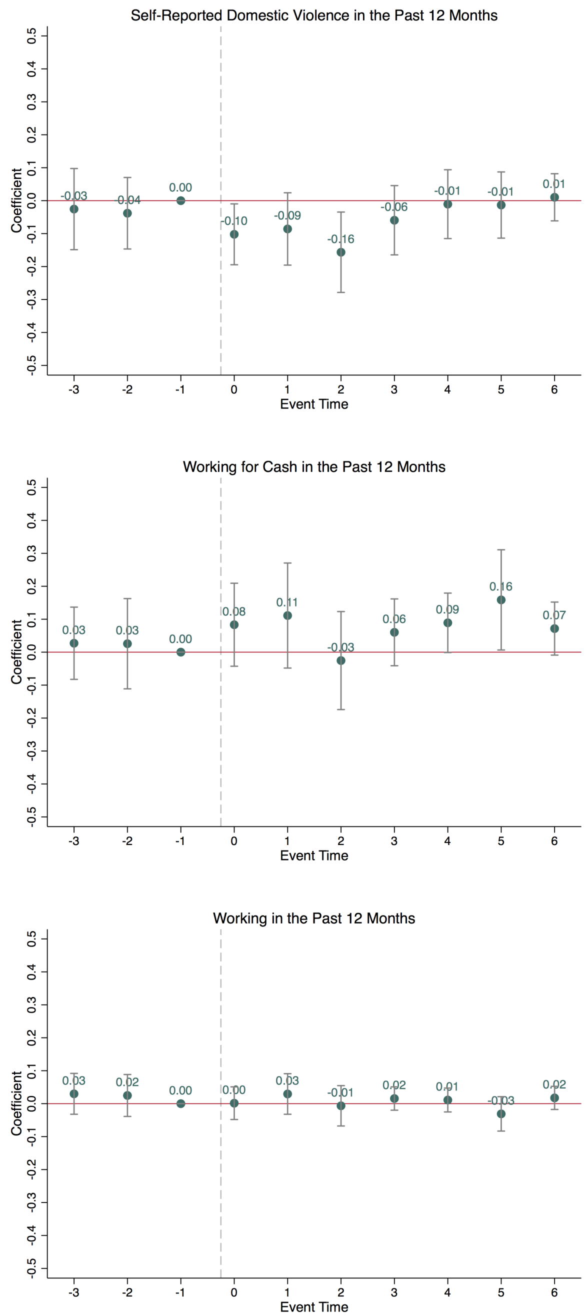
Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include hospital controls, hospital fixed effects, district fixed effects, province-by-year fixed effects, linear time trends interacted with baseline district level characteristics. 4 km catchment area is used. *** p<.01, ** p<.05, * p<.1

Figure A.5: Impact of a Mill Opening on Women's Employment, Type of Earnings and Self-Reported Domestic Violence in the Past 12 Months using de Chaisemartin and D'Haultfœuille (2020)



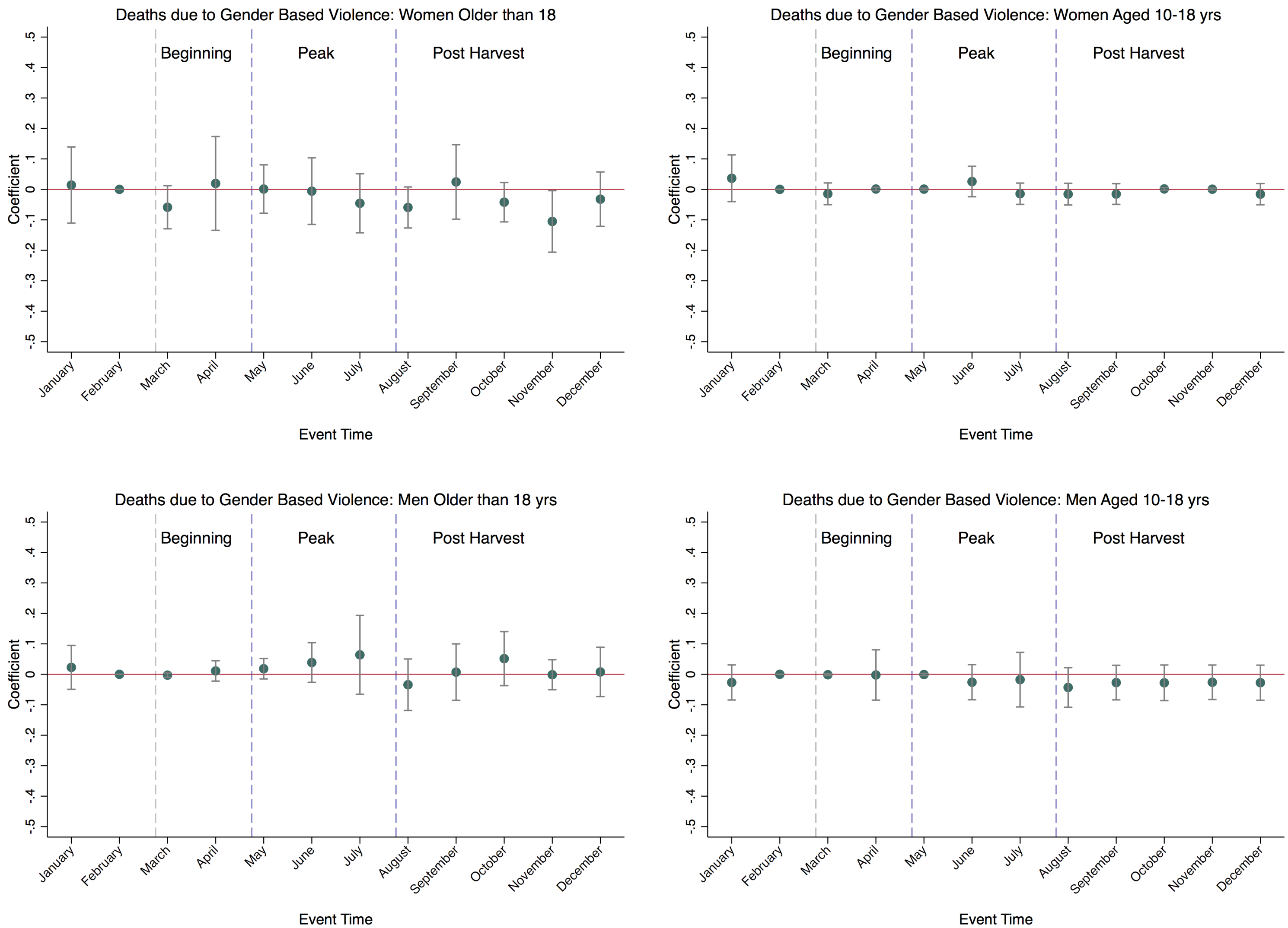
Note: Sample consists of partnered women who married before the expansion of the mills. All variables are measured for the past 12 months. 4 km catchment area is used. Within district approach is used.

Figure A.6: Dynamic Impact of a Mill Opening on Women's Employment, Type of Earnings and Self-Reported Domestic Violence in the Past 12 Months using Sun and Abraham (2020)



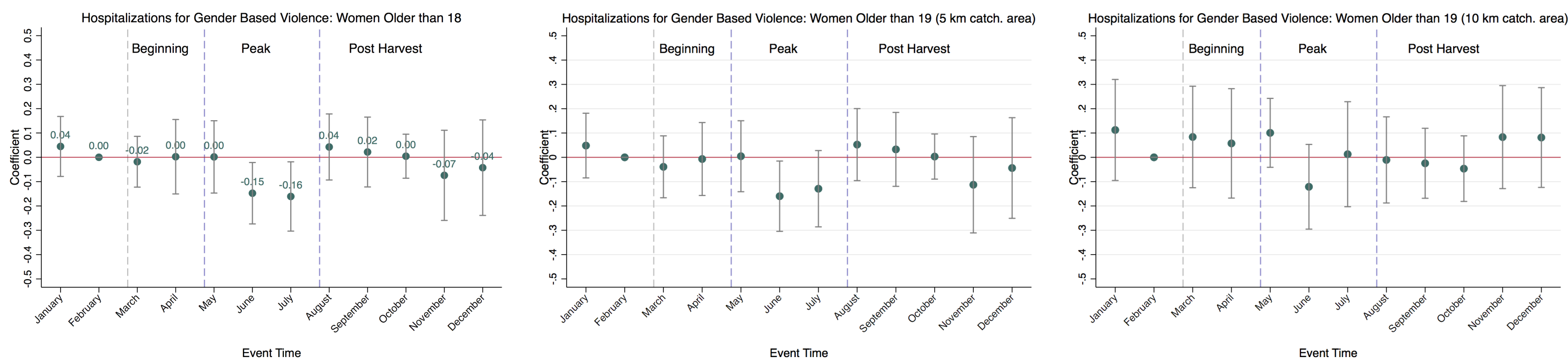
Note: Sample consists of partnered women who married before the expansion of the mills. All variables are measured for the past 12 months. 4 km catchment area is used. Within district approach is used.

Figure A.7: Dynamic Impact of a Mill Opening on Deaths due to Gender Based Violence (Women and Men)



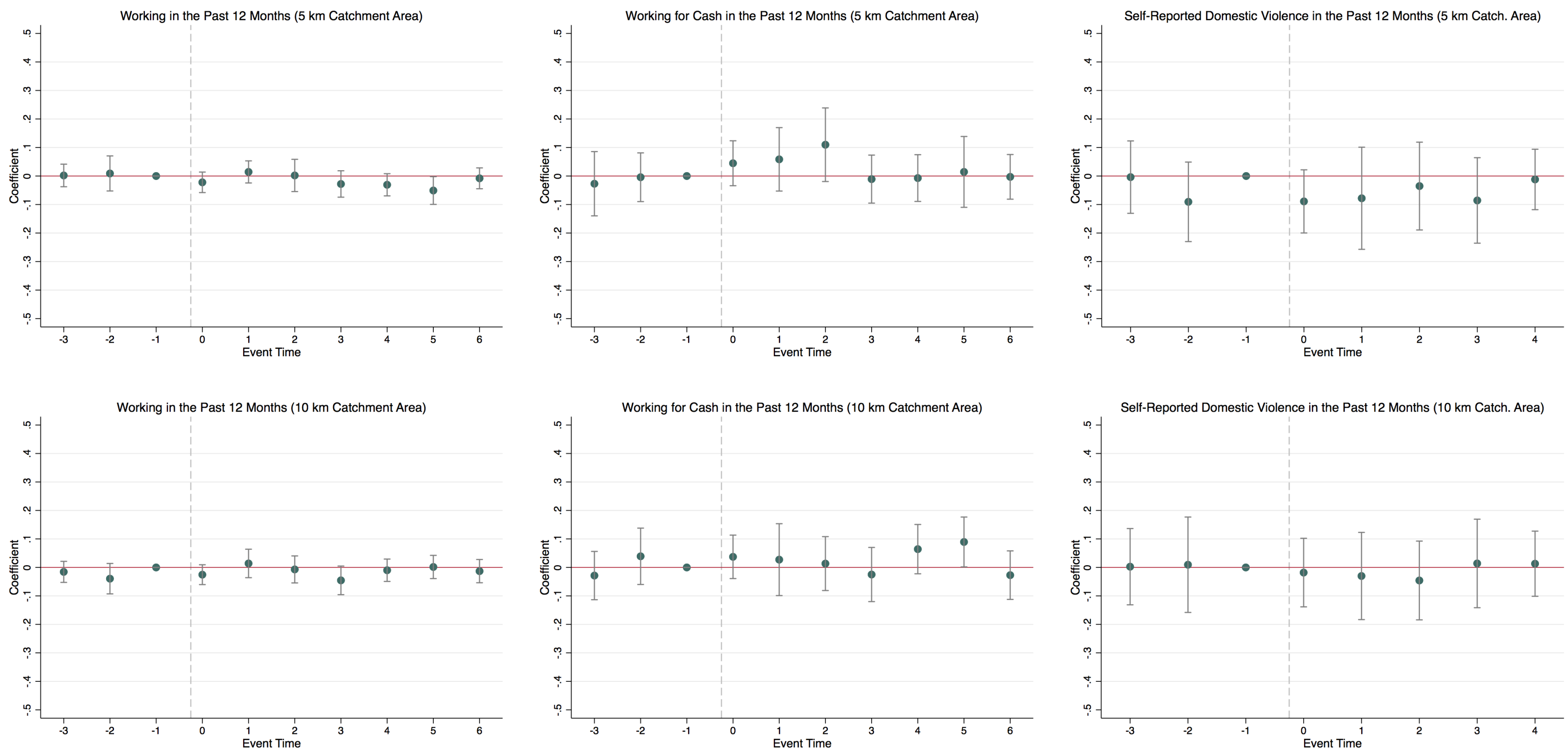
Note: Robust standard errors clustered at the sector level are in parentheses. All estimations include hospital controls, hospital fixed effects, district fixed effects, province-by-year fixed effects, linear time trends interacted with baseline district level characteristics. Catchment area radius is 4 km..
*** p<.01, ** p<.05, * p<.1

Figure A.8: Dynamic Impact of a Mill's Period of Operation on Hospitalizations for Gender Based Violence (Women Aged Older than 19) for Different Catchment Areas



Note: Robust standard errors clustered at the sector level are in paranthesis. All estimations include hospital controls, hospital fixed effects, district fixed effects, province-by-year fixed effects, linear time trends interacted with baseline district level characteristics. 4 km, 5 km and 10 km buffer radii are used respectively for the catchment area. *** p<.01, ** p<.05, * p<.1

Figure A.9: Dynamic Impact of a Mill Opening on Women's Employment, Type of Earnings and Self-Reported Domestic Violence in the Past 12 Months for Different Catchment Areas



Note: Robust standard errors clustered at the sector level are in paranthesis. All estimations include individual controls, cohort fixed effects, year of marriage fixed effects, sector fixed effects, district-by-year fixed effects, linear time trends interacted with baseline sector level characteristics. Sample consists of partnered women who married before the expansion of the mills. All variables are measured for the past 12 months. 5 km and 10 km buffer radii are used respectively for the catchment area. *** p<.01, ** p<.05, * p<.1

B Theoretical Appendix

The probability of the husband choosing violence is

$$F_h\left[(1-y)I_h-(1-x+\tau)I_w-\alpha_h(I_h,I_w)+\frac{\tau I_w+\alpha_h(I_h,I_w)}{F_w[(1-x+\tau)I_w-(1-y)I_h+v]}\right]. \tag{12}$$

B.1 Increase in I_w

$$\frac{\partial F_h}{\partial I_w}=f_w\left[(1-y)I_h-(1-x+\tau)I_w-\alpha_h(I_h,I_w)+\frac{\tau I_w+\alpha_h(I_h,I_w)}{F_w[(1-x+\tau)I_w-(1-y)I_h+v]}\right]\times$$

$$\left[-(1-x+\tau)-\frac{\partial\alpha_h(I_h,I_w)}{\partial I_w}+\right.$$

$$\left.\frac{(\tau+\frac{\partial\alpha_h(I_h,I_w)}{\partial I_w})F_w[(1-x+\tau)I_w-(1-y)I_h+v]-f_w[(1-x+\tau)I_w-(1-y)I_h+v](1-x+\tau)[\tau I_w+\alpha_h(I_w,I_h)]}{F_w[(1-x+\tau)I_w-(1-y)I_h+v]^2}\right].$$

Assume $F_w(.)>0$ and $f_w(.)>0$. Then the first line of the product is positive. The right hand side of the product can be both negative and positive because $F_w(.)>0$, $f_w(.)>0$, $(1-x+\tau)>0$, $\frac{\partial\alpha_h(I_h+I_w)}{\partial I_h}<0$, $\tau I_w>0$ and $\alpha_h(I_h+I_w)>0$. Thus the sign of the derivative is ambiguous. The derivative is negative when the numerator of the fraction in the third line of the product is negative and large enough in magnitude. It should be large enough in magnitude so that when divided by the denominator and added to $-(1-x+\tau)-\frac{\partial\alpha_h(I_h+I_w)}{\partial I_h}$, the right hand side of the product is still negative. Then the condition for the derivative to be negative is

$$\left(\tau+\frac{\partial\alpha_h(I_h,I_w)}{\partial I_w}\right)F_w[(1-x+\tau)I_w-(1-y)I_h+v]<f_w[(1-x+\tau)I_w-(1-y)I_h+v](1-x+\tau)[\tau I_w+\alpha_h(I_w,I_h)].$$

When I_w and $|\frac{\partial\alpha_h(I_h,I_w)}{\partial I_w}|$ are large enough and τ is small enough, the condition holds and the derivative is negative. Moreover, take $\alpha_h(I_h+I_w)$ and $\alpha_h'(I_h+I_w')$ such that $I_w'>I_w$ and thus $\alpha_h'(I_h+I_w')<\alpha_h(I_h+I_w)$ since $\alpha_h(.)$ is monotonically decreasing in I_w. Assuming $|\frac{\partial\alpha_h'}{\partial I_w}|>|\frac{\partial\alpha_h}{\partial I_w}|$, $\frac{\partial F_h(\alpha_h')}{\partial I_w}<\frac{\partial F_h(\alpha_h)}{\partial I_w}$. Thus, $|\frac{\partial F_h(\alpha_h')}{\partial I_w}|>|\frac{\partial F_h(\alpha_h)}{\partial I_w}|$, the negative effect of providing job opportunities to women on domestic violence is larger.

B.2 Increase in I_h

$$\frac{\partial F_h}{\partial I_h} = f_h\left[(1-y)I_h-(1-x+\tau)I_w-\alpha_h(I_h+I_w)+\frac{\tau I_w+\alpha_h(I_h+I_w)}{F_w[(1-x+\tau)I_w-(1-y)I_h+v]}\right]\times\left[(1-y)-\frac{\partial\alpha_h(I_h+I_w)}{\partial I_h}+\right.$$

$$\left.\frac{\frac{\partial\alpha_h(I_h,I_w)}{\partial I_h}F_w[(1-x+\tau)I_w-(1-y)I_h+v]+f_w[(1-x+\tau)I_w-(1-y)I_h+v](1-y)(\tau I_w+\alpha_h(I_h+I_w))}{F_w[(1-x+\tau)I_w-(1-y)I_h+v]^2}\right].$$

Assuming that $F_w(.)$ and $f_h(.)>0$, the left hand side is positive. The right hand side of the product can be both positive or negative because $F_w(.)>0$, $f_w(.)>0$, $(1-y)>0$, $\frac{\partial\alpha_h(I_h+I_w)}{\partial I_h}<0$, $\tau I_w>0$ and $\alpha_h(I_h+I_w)>0$. Thus the sign of the derivative is ambiguous. The derivative is negative when the numerator of the fraction in the second line of the product is negative and large enough in magnitude. It should be large enough in magnitude so that when divided by the denominator and added to $(1-y)+\frac{\partial\alpha_h(I_h+I_w)}{\partial I_h}$, the right hand side of the product is still negative. Then the condition for the derivative to be negative is

$$\frac{\partial\alpha_h(I_h+I_w)}{\partial I_h}F_w[(1-x+\tau)I_w-(1-y)I_h+v]<-f_w[(1-x+\tau)I_w-(1-y)I_h+v](1-y)[\tau I_w+\alpha_h(I_h+I_w)].$$

When $\mid\frac{\partial\alpha_h(I_h+I_w)}{\partial I_w}\mid$ is large enough, the condition holds and the derivative is negative. Moreover, take $\alpha_h(I_h+I_w)$ and $\alpha_h'(I_h'+I_w)$ such that $I_h'>I_h$ and thus $\alpha_h'(I_h'+I_w)<\alpha_h(I_h+I_w)$ since $\alpha_h(.)$ is monotonically decreasing in I_h. Assuming $\mid\frac{\partial\alpha_h'}{\partial I_h}\mid>\mid\frac{\partial\alpha_h}{\partial I_h}\mid$, $\frac{\partial F_h(\alpha_h')}{\partial I_h}<\frac{\partial F_h(\alpha_h)}{\partial I_h}$. Thus, $|\frac{\partial F_h(\alpha_h')}{\partial I_h}|>|\frac{\partial F_h(\alpha_h)}{\partial I_h}|$, the negative effect of increasing husbands' earnings on domestic violence is larger.

B.2.1 No non-monetary benefit of violence case

If $\alpha_h(I_h+I_w)=0$ and thus $\frac{\partial\alpha_h(I_h+I_w)}{\partial I_h}=0$, then the derivative becomes

$$=f_h\left[(1-y)I_h-(1-x+\tau)I_w+\frac{\tau I_w}{F_w[(1-x+\tau)I_w-(1-y)I_h+v]}\right]\times\left[(1-y)+\right.$$

$$\left.\frac{F_w[(1-x+\tau)I_w-(1-y)I_h+v]+f_w[(1-x+\tau)I_w-(1-y)I_h+v](1-y)(\tau I_w)}{F_w[(1-x+\tau)I_w-(1-y)I_h+v]^2}\right]>0,$$

since $f_h(.)>0$, $(1-y)>0$, $F_w(.)>0$ and $\tau I_w>0$.

C Data Appendix

C.1 Panel of Mills

First, I complement the mills data with spatial data by The Rwanda GeoPortal. The portal provides maps of different geographical boundries like sector, district and province. There are 416 sectors, 30 districts and 5 provinces in Rwanda. The mean area of each is approximately 58.4 km^2, 810 km^2 and 5552 km^2. According to 2002 Rwandan Population and Housing Census, average sector population is 1959 where average female population at the sector level is 1024. Average district population is 27698 where average female population at the district level is 14499.

The final panel of mills have information on a mill's location at different levels (including the exact GPS coordinates), number of coffee trees in the sector the mill is located for different years and FAO-GAEZ coffee suitability score. The data also has information on mill characteristics and spatial features of the location of the mill including presence of water bodies, road network, area etc. Figure 2 visualizes the finalized data. The years are selected based on the availability of the coffee census and data on women's outcome variables (2004, 2005, 2010 and 2014). The rapid expansion of the mills between 2005 and 2010 are observed in the areas that had a high number of coffee trees in 1999.

Table A.1 provides summary statistics. 78% of the mills started to operate between 2005-2010, the rapid expansion period. 50% of them are owned by cooperatives where only 25% of them are owned by NGOs. The remaining are owned by entrepreneurs or private companies. Log number of coffee trees increased over time in the sectors where mills are built. 65% of the mills are built in areas where FAO-GAEZ coffee suitability index is either moderate, medium or good. According to Macchiavello and Morjaria (2020), the mean number of coffee farmers that sell a mill is 396 (number of coffee farmers in the catchment area of a mill).[40]

C.2 Individuals and Household Level Data

Rwandan Demographic Health Surveys. DHS asks whether women are paid "cash only" or "cash and in-kind". Field surveys suggest that mills provide clothing, in-kind benefits to women working in the mills beyond giving a daily wage. Thus, I create my cash variable based on women working for both cash and in-kind rather than cash only. According to the data, occupations that pay cash-only wages for women are dominantly non-agricultural (managers in Kigali, sales etc.). Upon a mill opening, I find statistically significant changes in the probability of working for cash

[40] Macchiavello and Morjaria (2020) measures the catchment area with a 5 km radius buffer zone.

when I define the variable as women working for both cash and in kind. However, there is no change in the probability of working for cash upon a mill opening when I define the variable as women working for cash only. This further confirms that working for "cash and in-kind" correctly captures the type of earnings of the women who work in the mills. I perform the same exercise for husbands. There is no change in husbands' working for cash behavior for both definitions which confirms that the expansion did not affect men's earning type.

Tables A.2 and A.5 provide descriptive statistics for women and their husbands. 88% of women worked in the past 12 months, where only 39% of them worked for cash. The share of working women is the same across areas that are exposed and not exposed to a mill. However, 47% of women are working for cash in mill exposed areas where this number is 37% for women in unexposed areas. The dominant occupation for women is agricultural where women are self-employed (farmers). 79% and 76% of women are working in agriculture in exposed and unexposed areas respectively. Agriculture is the dominant occupation for women's husbands as well. 73% and 71% of the husbands are working in agriculture in exposed and unexposed areas respectively. In contrast to women's outcomes, for husbands, the share of working and working for cash in the past 12 months are both similar across both areas. Tables A.3, A.4 and A.6 provide summary statistics based on treatment status (averages for never-treated sectors, sectors before a mill opening and inside the catchment areas) which are all in line with the averages in Tables A.2 and A.5.

The women's questionnaire also has a domestic violence module which collects information on family violence.[41] DHS randomly selects one women per household for the module. Thus, the number of women who have information for domestic violence will always be less than the number of women who answered the women's questionnaire. The module asks partnered women whether they experience physical, sexual or emotional violence in the last 12 months by their partners.

Since emotional violence questions are not asked in the 2010/11 cycle, I use physical and sexual domestic violence in my analysis. Physical domestic violence consists of being pushed, shaken, thrown something at, slapped, kicked, dragged, strangled, burnt and sexual domestic violence consists of physically forced into unwanted sex and perform sexual acts.

I also exploit variables related to household-decision making to analyze the relationship between exposure to mills and women's bargaining power within the household. DHS asks women whether they make certain decisions alone, jointly with their husband or the decisions are made for her by their husbands or someone else. Such decisions include decisions regarding large household purchases, women's own health and women visiting their own family.

The surveys also collect GPS coordinates for every cluster of households. Using the GPS

[41] The module is prepared with respect to WHO guidelines "Putting Women First: Ethical and Safety Recommendations for Research on Domestic Violence against Women" World Health Organization, 2001.

coordinates, I spatially merge the DHS data with the mills data. One potential concern is that DHS randomly displace the GPS coordinates to maintain confidentiality. Due to the random displacement, urban clusters contain a minimum of 0 and a maximum of 2 kilometers of error and rural clusters contain a minimum of 0 and a maximum of 5 kilometers of positional error. Thus, GPS displacement may leads to measurement error and can bias the results (Perez-Heydrich et al., 2013). In order to reduce distance measurement error, I follow Perez-Heydrich et al. (2013), which suggests using a buffer distance rather than a closest distance when using a distance measure. All the distances calculated in the paper are based on a buffer distance measure. Thus, exposure to mill are constructed via creating buffers. Details on measuring exposure to mills are outlined at the end of the section.

DHS data allows me to observe the outcome variables for 2004, 2005, 2010 and 2014. The 2005 cycle was collected in February-July 2005, the 2010/11 cycle was collected in September 2010-March 2011 and the 2014/15 cycle was collected in November 2014-April 2015. Given that the harvest season runs from April to July and key variables captures individuals' experience in the past 12 months, 2005 data cycle contains information on both 2004 and 2005 harvest season. The 2010/11 cycle contains information on 2010 harvest season and the 2014/15 cycle provides information on 2014 harvest season. Thus, DHS data enables me to observe 4 harvest years in total, 2004, 2005, 2010 and 2014.

Integrated Household Living Conditions Surveys. Table A.9 provides descriptive statistics for women and their husbands.

Since EICV does not provide information on the year of marriage, unfortunately, I cannot restrict the sample to couples who married before the expansion. However, I include cohort fixed effects in my specifications that can provide a control for the year of marriage. Moreover, I restrict the sample to individuals who are in the same age groups with the DHS data.

C.3 Administrative Hospital Level Domestic Violence Data

District hospitals constitute the overwhelming majority of the hospitals (47 in total) in the country.[42] The remaining 5 hospitals are either referral and teaching hospitals. Referral hospitals are located either in Kigali (capital) or urban areas, have the latest technology and provide care under the public national health insurance system if a district hospital or health clinic refers a current patient to visit a referral hospital. Thus, they do not constitute a first stop for a patient. Teaching hospitals focus on medical research.

[42] Given that there are in total 30 districts, some districts have more than one district hospital.

Figure A.2 visualizes the hospitals on a map. The district hospitals have gender based violence centers in them which aim to combat gender based violence. These centers, also known as the Isange One Stop Centers (IOSCs), are state institutions which provide medical, police and legal help for gender based violence victims under one roof and are free of charge. By combining all services under one roof, MOH, Rwanda National Police, the Ministry of Justice (MOJ) and the Ministry of Gender and Family Promotion (MIGEPROF) aim to ease the reporting process of gender based violence victims. Sviatschi and Trako (2021) finds that such centers in Peru reduced gender-based violence and increased human capital investments in children, raised children's enrollment, attendance, and test scores.

Table A.7 provides descriptive statistics for the hospitals. 79% of the hospitals have hosted at least a domestic violence patient (GBV patient older than 18) in a given month. The share is 70% for the hospitals who are exposed to the mills where it is 85% for the ones who are not exposed. Mean number of patients with physical domestic violence and sexual domestic violence symptoms in a month in a hospital is 2.52 and 1.71 respectively. The numbers are 1.56 and 1.16 for the hospitals who are exposed to the mills. For the hospitals who are not exposed to the mills, the mean number of patients with physical domestic violence and sexual domestic violence symptoms in a month are 3.07 and 2.02 respectively.

To perform a placebo test, I requested additional data from the Rwandan Ministry Health, hospitalizations for non-domestic violence diseases. I receive bone and joint disorders other than fractures. Table A.8 provides descriptive statistics for the hospitals. Osteoarthritis, gout, rheumatoid arthritis, lupus, bursitis are examples of such diseases. Injuries and broken bones are excluded which rules out the concern that this group of hospitalizations also capture domestic violence. Mean of hospitalizations is 46 in a month.