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The legacy of coercive cotton cultivation in colonial Mozambique

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Abstract: We examine the long-term impact of forced labour on individual risk behaviour and economic decisions. For that, we focus on a policy of coercive cotton cultivation enforced in colonial Mozambique between 1926 and 1961. We combine archival sources about the boundaries of historical cotton concessions with survey data collected specifically for this study. By employing a regression discontinuity design to compare individuals living in areas inside and outside the historical cotton concessions, we document significant disparities in risk aversion and agricultural patterns between communities. Our findings reveal that individuals living in regions unsuitable for producing cotton but still subjected to the coercive cotton regime have higher risk aversion, are more likely to be farmers, and have more agricultural production destined to be commercialized. These results are mostly driven by women, who felt the brunt of the forced labour regime. As a novel contribution, this paper highlights the long-lasting consequences of colonial agricultural policies on risk and economic behaviour, offering insights into the challenges faced by post-colonial societies in overcoming historical legacies.

Key words: long-run development, colonialism, economic behaviour, regression discontinuity, Africa

JEL classification: F54, O13, D10, D81

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1 Introduction

The relationship between trauma, violence, and their influence on human behaviour is a well-documented area of study, highlighting the effects these factors can have on social norms, risk behaviour or economic decision making (Callen et al. 2014; Voors et al. 2012). Despite the acknowledgment of these immediate impacts, there remains a significant gap in our understanding of the long-term consequences of such experiences. Historical episodes can provide useful natural laboratories to understand the long-term effects of trauma and violence on risk preferences and economic decision making.

In this paper we consider the long-term impact of European colonial policies in Africa within the agricultural sector, which often involved forced production of cash crops and perpetuation of trauma in the subjected populations (Tadei 2020; S. Jones and Gibbon 2022). In particular, we explore the enduring impacts of forced labour policies on risk-taking behaviour and investment decisions, focusing on a coercive cotton cultivation program enforced between 1926 and 1961 in colonial Mozambique. Under this regime, vast regions of the country were designated as cotton concession areas, with control subsequently handed over to cotton concession companies. Supported by local colonial authorities, these companies compelled rural households within these areas to grow cotton, which they then purchased at government-fixed prices. This regime, characterized by its coercive enforcement mechanisms, not only dictated the livelihoods of farmers within cotton concession areas but also had profound implications for food security, economic independence, and gender roles within society. By compelling farmers to dedicate their lands to cotton over food or more profitable cash crops, the colonial policy disrupted traditional agricultural practices and livelihood strategies, setting the stage for a complex legacy that continues to influence Mozambican society. Women bore the brunt of this regime, as they constituted the majority of rural farmers in these areas due to the migration of men to work in South African mines.

To identify the causal effects of being exposed to the regime of forced cotton cultivation, we employ a spatial regression discontinuity design, comparing individuals living in areas inside and outside the boundaries of the historical cotton concessions. We leverage this analysis by combining the spatial information from historical concessions with new survey data of 2,000 individuals that we collected outside and inside cotton concessions in Mozambique. Our identification strategy is grounded in the arguably arbitrary delineation of cotton concessions boundaries, where concession companies aimed to include as much land as possible within the concession system, regardless of the agronomic suitability of the region. Within this framework, we examine the long-term implications of this forced labour regime on a range of outcomes, including risk aversion, agricultural decisions and economic practices, thereby illuminating the multifaceted legacy of the colonial forced cotton regime.

We find that the exposure to cotton concessions shaped individuals risk behaviour, agricultural and economic decisions, particularly in areas where natural conditions make cotton less suitable to be produced. In those areas, individuals who were historically exposed to cotton concessions are 14.3 percentage points (pp) more likely to exhibit risk-averse behaviour compared to people living outside the concessions. In what concerns farming decisions, the probability of being a farmer, as opposed to any other type of occupation, increases by 10.2 pp. Individuals exposed to cotton concessions are also more likely to sell the output they produce in their crops (17.0 pp) or adopt agricultural technologies (9.2 pp). Although the access to formal credit of our study sample was almost non-existent, the probability of participating in communal savings programs (ROSCA) increased among individuals living inside former cotton concessions. We test the robustness of these results against the inclusion of different controls, RD polynomials, or bandwidths. We find that despite slight changes in the magnitude of coefficients, the interpretation of the results remains unchanged. Interestingly, we also measure the impact of cotton concessions on business ownership, but we find no significant changes. In line with historical accounts that the burden of cotton cultivation lay mostly on women, we find that the main impacts of cotton concessions on a range of outcomes are driven by effects on women, whereas no change is observed for men.

The contribution of this paper is threefold. First, we add to existing literature studying the effects of trauma and violence on risk-taking behaviour and economic decision-making (for a general review, see Walden and Zhukov 2020). The hypothesized casual chain is that traumatic historical events such as forced labour led to an increase in risk aversion, which is persistent over time and has adverse consequences for subsequent economic development, such as through reduced technology adoption and innovation. Aspects of this chain have been investigated in other contexts. For example, Cameron and Shah (2015) show that recent exposure to natural disaster reduces risk appetite, while Liu (2013) shows that risk averse farmers are less likely to adopt new cotton varieties. More similar to our own analysis, Blouin (2022) document how the experience of forced coffee cultivation cast a long shadow on inter-ethnic trust with adverse implications for agricultural risk management. In this study, we provide further evidence that colonial violence increased risk-averse behaviour with long-lasting effects.

Second, this paper contributes to the broader literature studying the long-term consequences of European colonialism on the economic development of the Global South, particularly in what concerns labour exploitation (Nunn 2008; Dell 2010; Bruhn and Gallego 2012). This paper provides evidence that colonial policies not only negatively impacted social norms (Nunn and Wantchekon 2011; Lowes and Montero 2021), but they also altered risk-taking behaviour and preferences of the children of victims – a dimension that remains largely understudied.

Third, this paper also contributes to policy discussion of how to mitigate the adverse long-lasting impact of colonial policies. Our findings may contribute to understanding what are

the key features of policy design aimed at mitigating the long-term burden of forced labour on its victims. This is motivated by the United Nations' goal of eradicating forced labour worldwide, despite the year of 2021 witnessed an estimate of 27.6 million people globally enduring forced labour conditions (ILO, 2022) – mostly in agriculture environments. While significant policy efforts focus on the eradication of forced labour, understanding the long-term consequences on the behaviour and well-being of its victims and their descendants remains a critical domain.

This remainder paper is structured as follows. Section 2 details the historical context of cotton concessions and in what the forced cotton policy consisted. Next, Section 3 details the research design, including the collection of survey data and summary statistics. This is followed by Section 4 which details the outcomes measured and the regression discontinuity specification used. After, the main results are presented in Section 5. Section 6 concludes the paper.

2 Historical background

In the latter years of colonial rule, concessions granted to private companies became widespread across Africa. While having a common economic framework for labour and resource extraction, concessions displayed significant variation in the type of natural resources extracted, as well as in their levels of coercive power and use of violence. Between 1926 and 1961, the Portuguese colonial government enforced a system of forced cotton cultivation in Mozambique. This was achieved by establishing cotton zones and subsequently granting concessions to private companies. Prior to the implementation of these concessions, cotton production in Mozambique was virtually nonexistent (Guimarães 2021). Within the cotton zones, the concessionary companies had the right to purchase the cotton that farmers were compelled to produce. Cotton seeds were distributed by the concession holder to be planted on farmers' plots, and cotton was bought at government-fixed prices.[1]

The labour regime was highly controlled, with the colonial government dictating plot sizes and locations and a fixed work schedule that farmers had to follow often at the expense of food crop production (Isaacman 1992, 1996). Throughout the country, cotton production fell disproportionately to women. This was particularly true in southern Mozambique, where most male labour force were migrant workers in neighbouring South Africa. The absence of soil data, temperature, and rainfall patterns led to the designation of cotton zones across various regions, regardless of their suitability for cultivation. The core strategy behind the cotton concession companies was to boost agricultural production by expanding territory to accommodate more

[1] The production of cotton in Portuguese colonies was part of a larger neo-mercantilist economic model. Colonies produced cotton and exported it to mainland Portugal. There, textile industries manufactured clothing that was then export back to the colonies (Guimarães 2021).

cotton growers and achieve greater output, but this resulted in significant portions of the designated cotton zones being unsuitable for cultivation (Isaacman 1996). Consistent with this approach, concession boundaries were defined using a mix of prominent geographic features and administrative limits (J.E.A.C. 1946).

Concessions relied on local government officials and the African police to enforce production, often delegating cotton production enforcement to local village leaders. Leaders' refusal to oversee production was met with violence, and they faced possible replacement for individuals more sympathetic to the regime (Isaacman 1985). Infractions or the inability to meet production targets was punished with *palmatória* (being beaten by a wooden paddle-like instrument) or a *chamboco* (a whip made from rhinoceros hide) (Guimarães 2021).

In addition to physical abuse, the colonial system also imposed heavy taxes on local farmers. This included increases in the *hut tax* (a lump-sum tax per dwelling), that would make the production of any other crop financially unfeasible, leaving cotton as the only remaining option (Guimarães 2021). Despite the violence, social unrest, and significant food shortages generated by the cotton regime, the objective of maximizing profitability led the colonial authorities to also invest in increasing the productivity of Mozambican farmers throught the transmission of scientific knowledge and adoption of agriculture technology (Guimarães 2021). For that, the colonial authorities created the *Fundo do Algodão* (Cotton Fund) which developed infrastructure providing local farmers with water supply and agricultural hydraulics; and the provision of financial credits to the purchase of cattle and agricultural tools and machinery.

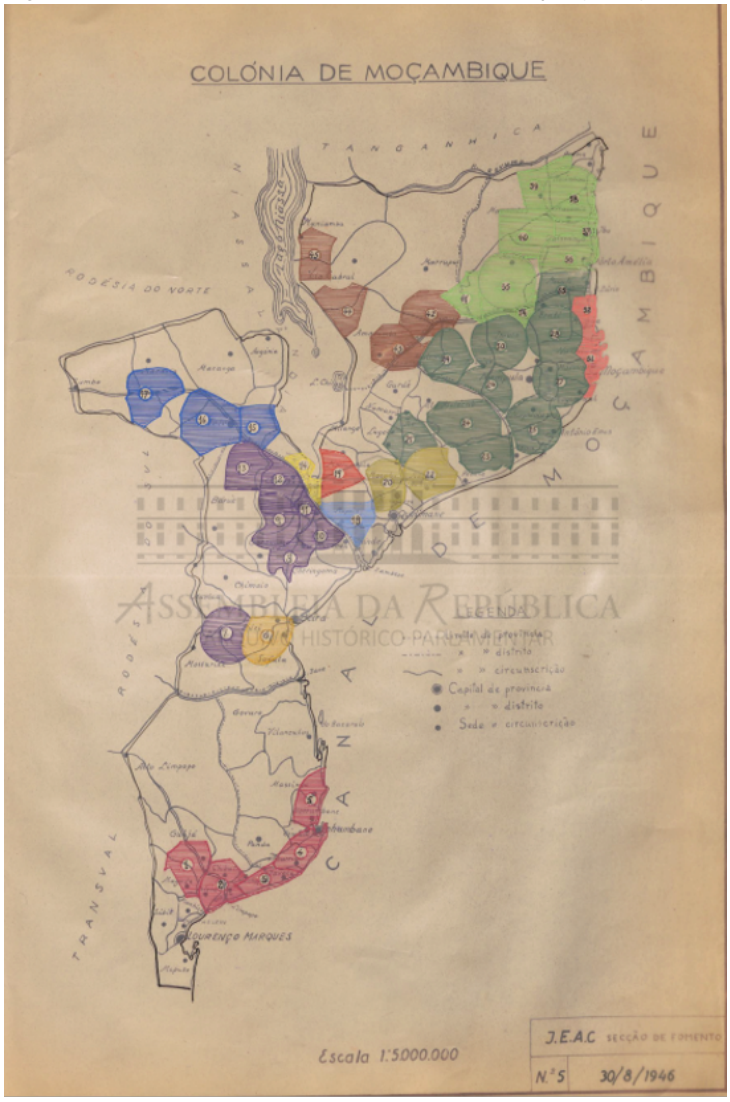
The regime of coercive cotton production formally ended as late as 1961, following an uprising in Angola that led to widespread international criticism of Portugal's colonial policy, and heralded the beginning of the struggle for liberation of Portuguese colonies.

3 Research design

To examine the long-term implications of coercive cotton production, we leveraged the quasi-experimental spatial variation of the arbitrarily defined borders of cotton concessions. The core of this study combined archival data to define the boundaries of the cotton zones with survey and experimental data collected along the cotton concession borders. Figure 1 provides the map of Mozambique with the cotton concessions in 1946, used to define the cotton concession borders (J.E.A.C. 1946).

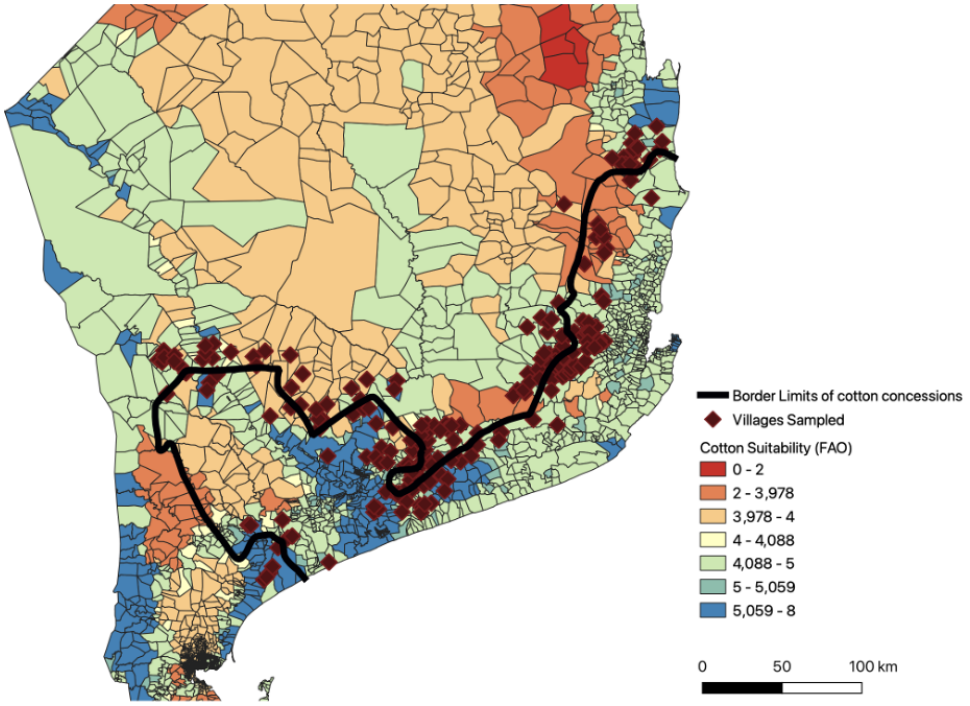
Following Cattaneo et al. (2019), our dataset consists of villages situated near the cutoff point, defined by the boundaries of the cotton concessions. Throughout our analysis, we aggregated villages from a two-dimensional spatial measure to an uni-dimensional distance measure from the closest concession boundary.

Figure 1: Cotton concessions in colonial Mozambique (1946)



Source: reproduced from the Assembly of the Republic, Parliamentary Historical Archive. More details here: J.E.A.C. (1946).

Figure 2: The distribution of villages sampled and cotton suitability



Source: authors' construction based on the Mozambique Census of 2007 and the Global Agro-Ecological Zones (GAEZ) database (Fischer et al. 2021).

Our study sample included 200 villages equally distributed on each side of the cutoff. These villages were randomly chosen using the Mozambique Census of 2007 (INE, 2007) – the latest available census –, comprising the provinces of Maputo, Gaza, and Inhambane, where the cotton concession Algodoeira do Sul do Save operated. We restricted the villages eligible to be sampled in our study by imposing two additional conditions. First, villages had to be located within 20 kilometers of the cotton border (inside and outside). Second, villages at the 10 percent tail of the population distribution were excluded. We further stratified villages within 5 kilometers segments from the border, and sampled villages randomly drawn within those segments. The number of villages selected from each segment was defined according to the total number of villages in each segment, according to the 2007 Mozambique Census. Our final sample of villages comprised 100 villages inside and 100 villages outside the cotton border (See Figure 2).

Figure 2 illustrates the geographical boundaries of each village, as delineated by the Mozambique Census of 2007. These areas are represented by polygons, each one colored to reflect the suitability for cotton cultivation. The suitability index is derived from the Global Agro-Ecological Zones (GAEZ) database, assembled by the Food and Agriculture Organization (Fischer et al. 2021). The cotton suitability index is from 3 to 6.94, indicating the lowest to highest potential for cotton growth. The average suitability score for cotton cultivation across the sampled villages is 4.72.

Table 1: Differences of cotton suitability at the concession border

	Distance from border			All
	<5Km	<10 Km	15Km	Villages
	(1)	(2)	(3)	(4)
Cotton concession	0.242	0.083	0.091	0.091
	(0.158)	(0.133)	(0.116)	(0.109)
Obs. outside	32	57	80	100
Obs. inside	29	57	78	100

Note: OLS estimates. The dependent variable in Columns (1) to (4) is the cotton suitability index. Columns (1), (2) and (3) include villages within 5Km, 10Km and 15Km from the cotton concessions borders, respectively. Column (4) includes all villages. The main explanatory variable is a binary variable measuring whether respondents live within the area of a colonial cotton concession. All specifications used include a RD polynomial of degree 1. No controls are included. ***, **, and * indicate significance at the 1%, 5%, and 10% critical level. Source: authors' calculations.

Table 1 provides RD estimates of the cotton suitability around the concession boundaries. The estimates presented in this table suggest that the villages sampled outside and inside the cotton concessions, regardless of their distance to the concession boundaries, do not show any significant difference in cotton suitability. This suggests that the delineation of concession borders may have been somewhat arbitrary, not closely considering the agricultural potential of adjacent areas.

3.1 Survey design

Within each village, we randomly selected 10 households to participate in the study, totaling 2,000 individuals, which were selected using a random walk procedure. The sample of individuals was stratified based on gender, with an even split in each village of male and female respondents. To mitigate potential bias from individuals whose families originated from other parts of the country, we restricted our sampled households to respondents whose mother was a native of the village. Households received a 60 MZN ($\approx USD0.94$) for participating in study activities.

In addition to the household survey, we also surveyed the village leader (the highest government-appointed representative at the village-level) and we conducted a community survey with village elders. Both surveys covered basic demographics, household assets, and village history.

The household data collection was divided into a survey module and experimental measures (risk game), which were both conducted at respondents' houses. The survey module included standard questions on demographics, investments, household assets, and consumption, as well

as a module on family history, agriculture and business patterns, trust, government perceptions, civic participation, and gender norms.

4 Empirical strategy

4.1 Outcomes

This study examined the effect of coercive plantation of cotton on the risk behaviour, agriculture and business decisions of Mozambican farmers. For that, we use a diverse array of outcomes, following the registered pre-analysis plan (Bove et al. 2023).

Risk behaviour

Farmers exposed to cotton concessions were forced to produce cotton in unsuitable environments and often to the detriment of their food production, bearing the entire risk of cotton production. Though the literature presents mixed results on risk-taking response to traumatic experiences (Callen et al. 2014; Kim and Lee 2014; Voors et al. 2012), we hypothesize that forced cotton production increased risk aversion inside cotton concessions.

Risk behaviour was measured by a risk game. The game took the form of an incentivized ordered lottery choice based on the approach of Eckel and Grossman (2002). In this activity, respondents were asked to choose one of six lotteries, in which each lottery had a 50 percent probability of receiving a high or a low payoff. The first lottery was a safe payment with equally high and low payoffs. With each additional lottery, the expected return of each lottery increased linearly, except for the sixth and last lottery options. The expected return between lottery 5 and 6 remained the same, but there was an increase in the payoff standard deviation. We follow the expected utility theory and classify respondents according to their risk preferences. Risk-averse individuals are more likely to select one of the less risky gambles with lower returns, such as gambles 1–4. Conversely, risk-neutral individuals prefer gambles 5 or 6. Moreover, individuals who choose gamble 6 over gamble 5, despite its higher risk, could be reasonably described as having a preference for risk. Table 2 presents the summary statistics of survey respondents' risk behaviour. Outside and inside the cotton concessions, 77.4% and 79.1% of respondents are risk averse. 13.7% and 11.8% are risk neutral, while 8.9% and 9.1% are risk lovers, respectively. There are no observable statistical differences in risk behaviour between respondents outside and inside cotton concessions.

Based on the data from the risk game, we constructed an outcome variable measuring risk aversion. This is a binary variable taking value 1 if respondents are risk averse (according to the game) and 0 if they are risk neutral or lover.

Table 2: Summary of risk behavior outcomes.

	Observations		Mean		Standard	p value
	Outside	Inside	Outside	Inside	error	
Risk behaviour						
Risk averse	998	1000	.774	.791	.018	.373
Risk neutral	998	1000	.137	.118	.015	.221
Risk lover	998	1000	.089	.091	.013	.887

Agriculture and business decisions

Being forced to produce cotton may have led to the inherited aversion to risky agriculture and business decisions, especially where planting cotton was less well suitable to be planted. Thus, we hypothesize that exposure to cotton concession led to decreased risk-taking in agriculture and business practices, in particular in areas with less cotton suitability.

Table 3: Summary statistics of farming and business outcomes.

	Observations		Mean		Standard	p value
	Outside	Inside	Outside	Inside	error	
Farming and business ownership						
Farming is main occupation	999	1000	.799	.843	.017	.01
Does subsistence farming	999	1000	.787	.769	.018	.339
Does commercial farming	999	1000	.207	.227	.018	.284
Intended to sell crop production last year	999	1000	.166	.164	.017	.896
Fraction of crops to be sold last year	999	1000	.061	.06	.007	.942
Index of farming technology adoption	963	978	.271	.274	.009	.719
Business owner	999	1000	.127	.119	.015	.581

With this purpose, we used survey data to construct multiple outcomes. On the agricultural side, we constructed a binary variable taking value 1 when respondents' main occupation is farming, and 0 for any other occupation.

Next, we also focus on how exposure to coercive cotton production may have changed respondents' bias towards selling their crops. For that, we constructed a variable capturing the whether respondents intended to sell at least one crop that they produced during the last campaign before data collection (2011-2022).

In an additional dimension, during the operation of cotton concessions, the colonial government invested significantly in transferring scientific knowledge to local farmers. This consisted in the use of better quality seeds, fertilizers or tools (Guimaraes, 2021). We hypothesize that exposure to cotton concessions increased the adoption of farming technology. For that we constructed an index measuring the adoption of different farming technology (seeds, fertilizer, pesticides, specialized advisory, plow, tractors). This index varies between 0 and 1, where higher values correspond to a greater farming technology adoption.

We are also interested in understanding how exposure to cotton concessions affected respondents' pattern of savings. Under the hypothesis that risk aversion increased, we also expected that concessions led to relatively more savings among exposed individuals. In our survey, we accounted for savings in two ways. The first one used a question asking whether respondents' have ever requested a loan from a financial institutions. Not surprisingly, only a small percentage of individuals (4.75% of the sample) had ever requested a loan, and 2.6% of individuals reported that their loan request was denied. In addition, we documented respondents' involvement in communal saving schemes akin to the Rotating Savings and Credit Association (ROSCA), locally known as *Xitique* in Mozambique. These schemes are widely used in low and middle-income countries, where access to formal financial institutions is often inaccessible to most people. This type of communal savings program consists of each participating individual contributing to a common pot of money for a given time period. At the end of the period, one participating individual receives the sum of all contributions. The scheme repeats and the winner rotates among all participating individuals. In our survey, 687 respondents (34.37%) reported participating in community savings. We constructed a binary variable based on this information, which takes value 1 if respondents participate in community savings and 0 otherwise.

Finally, in line with the hypothesized changes in risk behaviour, we also measured if exposure to cotton concessions also affected respondents' household business investment. We constructed a binary variable taking value 1 if anyone at the respondents' household are business owners and 0 otherwise. The activities considered as businesses ranged from informal street selling, basic services, restaurants, or shops to formal enterprises such as manufacturing or small-scale industry. It is important to note that our study sample was primarily composed of rural farmers by design. Therefore, it is unsurprising that the percentage of respondents owning businesses was 12.7% outside cotton concessions and 11.9% inside.

4.2 Econometric specification

In our baseline specification we employ a sharp spatial regression discontinuity using the arbitrarily defined borders of cotton concessions to examine the causal effects of forced cotton production. The running variable is defined as the distance from each sampled village to the nearest point on the cotton concession border. The specification to be used is presented in Equation 1.[2]

$$y_{i,v} = \alpha + \beta \text{Cotton}_v + f(\text{geographic location}_v) + \partial \text{X}_i + \delta C_v + _{i,v} \quad (1)$$

[2] We follow the previous literature that employs spatial regression discontinuity (Ambrus et al. 2020; Dell 2010; M. Jones et al. 2022; Michalopoulos and Papaioannou 2014; Lowes and Montero 2021; Michalopoulos and Papaioannou 2013, 2016; Becker et al. 2016)

Where $y_{i,v}$ represents the outcome of interest for individual i in village v. $Cotton_{i,v}$ is an indicator variable, equal to one if the village v is inside a cotton zone and zero otherwise. $f(\text{geographic location}_v)$ is the regression discontinuity polynomial, which controls for smooth functions of geographic location. Following Gelman and Imbens (2019), our preferred specification employs a local linear polynomial. The vectors X_i and C_v contain observed individual-level and village-level characteristics, respectively. The error term is clustered at the village level.

5 Results

Table 4 presents the RD estimates of the effect of cotton concessions on respondents' risk behaviour, farming, and business decisions. Panel A includes the entire study sample and documents an average positive but statistically insignificant impact on risk aversion or agricultural patterns. We find similar results on savings decisions and business ownership, which are not statistically significant at conventional levels.

Table 4: Cotton suitability and the impact of cotton concessions on risk behaviour, farming and business decisions

	Risk aversion	Farmer	Sells crop output	Farm technology adoption	Does community savings	Business ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Entire sample						
Cotton concession	0.060	0.040	0.000	0.038	0.072	-0.006
	(0.044)	(0.041)	(0.052)	(0.029)	(0.057)	(0.029)
Obs. outside	998	999	999	963	999	999
Obs. inside	1000	1000	1000	978	1000	1000
Panel B. Villages with low cotton suitability						
Cotton concession	0.143**	0.102*	0.170**	0.092*	0.253***	0.008
	(0.060)	(0.053)	(0.067)	(0.050)	(0.086)	(0.039)
Obs. outside	548	549	549	535	549	549
Obs. inside	270	270	270	263	270	270
Panel C. Villages with high cotton suitability						
Cotton concession	0.027	0.018	-0.076	0.019	0.009	-0.017
	(0.059)	(0.055)	(0.068)	(0.037)	(0.074)	(0.039)
Obs. outside	450	450	450	428	450	450
Obs. inside	730	730	730	715	730	730

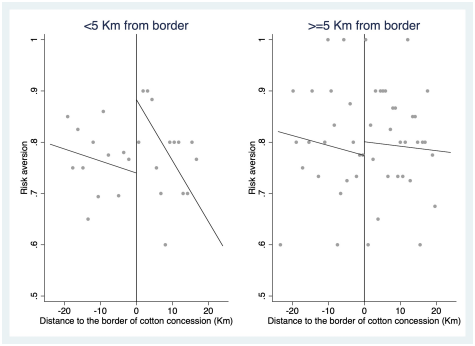
Note: OLS estimates. Standard errors clustered at the village level. Panel A includes the entire study sample. Panels B and C restrict the analysis only to respondents living in areas of low and high suitability for cotton production, respectively. The dependent variable in Column (1) is measured by the risk game and it is binary, taking value 1 if the respondent is risk averse and 0 when the respondent is risk neutral or lover. Column (2) uses as dependent variable an indicator taking value 1 if respondents' self-reported main occupation is farming. In column (3) the dependent variable takes value 1 if respondents' intended to sell at least one of the crops produced in the last campaign prior to data collection (and 0 otherwise). Column (4) uses as dependent variable an index measuring the adoption of farming technology, which ranges between 0 and 1. The dependent variable in Column (5) is binary, taking value 1 if respondents' contribute to a communitary savings scheme (*Xitique*), and 0 otherwise. The dependent variable in Column (6) takes value 1 if respondents own a business, and 0 otherwise. The main explanatory variable is a binary variable measuring whether respondents live within the area of a colonial cotton concession. All specifications used include a RD polynomial of degree 1. No controls are included. ***, **, and * indicate significance at the 1%, 5%, and 10% critical level.

These results mask substantial heterogeneity according to cotton suitability. Panels B and C show the RD estimates when the sample is split between respondents living in villages where cotton suitability is low or high, respectively. Starting with the respondents living in areas of low cotton suitability (Panel B), it is possible to observe that exposure to the cotton concessions increased risk aversion, by 14.3 percentage points (5% significance level). The likelihood of becoming a farmer also incresed by 10.2 percentage points, although this effect is less precise being only significant at the 10% level. The results in Column (3) show that respondents in cotton concession areas were 17.0 percentage points more likely to sell their crop production. Exposure to cotton concessions also seems to have led to greater adoption of farming technology, as suggested by the 0.092 increase in the index of column (5). Respondents inside cotton concessions are also 25.3 percentage points more likely to participate in *Xitique* – a popular

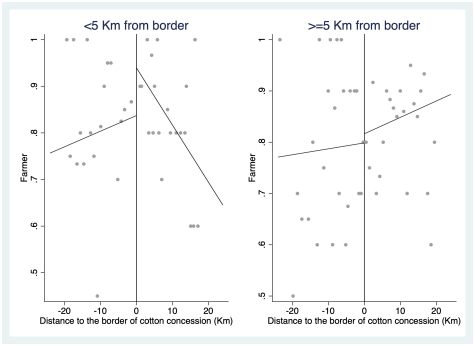
savings scheme identical to ROSCAS. The effect of cotton concessions of business ownership remains close to zero, we interpret that despite cotton concessions having affected risk behaviour and farming decisions, they do not seem to have alter behaviour related to business entrepreneurship. These results are further corroborated by Figure 3, which displays the RD plots for the outcome variables employed in Table 4.

Interestingly, we observe no statistically significant results for individuals living in areas of high cotton suitability. Overall, Table 4 highlights that cotton concessions significantly affected the risk aversion of respondents living in areas of low cotton suitability, as well as their farming decisions. These results can be interpreted as cotton plantation being coercive mostly in areas where it was less suitable for production. For the remaining of this section we will focus on the respondents living in areas of lower cotton suitability.

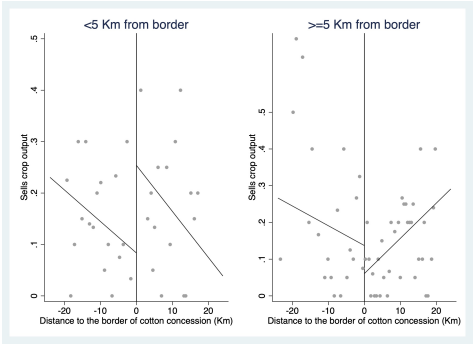
Figure 3: RD plots



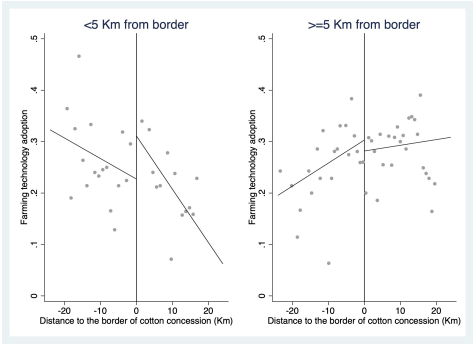
(a) Risk aversion



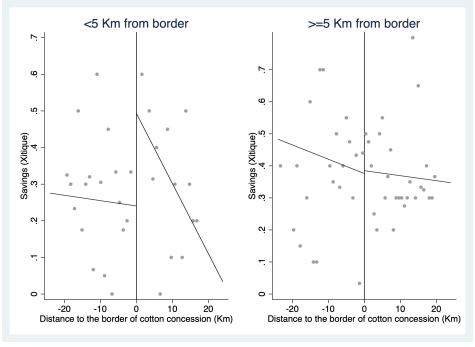
(b) Farmer



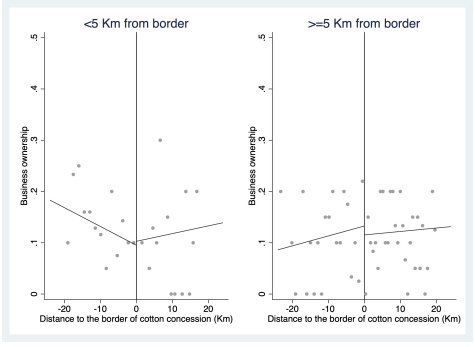
(c) Sells crop output



(d) Farming technology adoption



(e) Community savings programme (Xitique)



(f) Business ownership

Source: authors' calculations.

5.1 Robustness: individual and geographical controls

In this section, we examine the robustness of the effects of cotton concessions on respondents residing in regions with low cotton suitability (Table 4, Panel B), by including individual and geographic controls. The findings are presented in Table 5.

In Panel A we observe the effects when no controls are included, thus corresponding to the results previously described in Table 4. In Panel B we include individual controls for age and gender.[3] The results show that effects of cotton concessions remain fairly stable in magnitude, relatively to the estimates without individual controls presented in Panel A. Furthermore, the coefficients for the probability of being a farmer and crop production for sale exhibit an increase in statistical significance, reaching the 5% and 1% levels respectively.

The results including individual and geographical controls are presented in Panel C. There, we account for province fixed-effects, distance segment of each village from the closest cotton concession border (in bandwidths of 5 kilometers), altitude, precipitation and soil suitability. The results show a marginal decrease in the magnitude of the coefficients related to risk aversion and farming (columns (1) to (5)). The precision of the estimates of risk aversion, being a farmer or producing at least one crop to be sold remains stable (columns (1), (2) and (4)). The effect on the fraction of crops destined to be sold (column (3)) increases its significance to the 1% level, while the effects on farming technology adoption (column (5)) become less precise and are only significant at the 10% level.

[3] We do not account for other individual characteristics such as religion, ethnicity, educational attainment, or occupation, as they could potentially be correlated with the presence of cotton concessions, making them "bad controls".

Table 5: Robustness to the inclusion of individual and geographical controls.

	Risk aversion	Farmer	Sells crop output	Farm technology adoption	Does community savings	Business ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. No controls						
Cotton concession	0.143**	0.102*	0.170**	0.092*	0.253***	0.008
	(0.060)	(0.053)	(0.067)	(0.050)	(0.086)	(0.039)
Obs. outside	548	549	549	535	549	549
Obs. inside	270	270	270	263	270	270
Panel B. Individual controls						
Cotton concession	0.144**	0.107**	0.173***	0.091*	0.251***	0.005
	(0.061)	(0.052)	(0.065)	(0.048)	(0.085)	(0.040)
Obs. outside	548	549	549	535	549	549
Obs. inside	270	270	270	263	270	270
Panel C. Individual and geographical controls						
Cotton concession	0.131**	0.095**	0.160***	0.071*	0.225***	0.025
	(0.058)	(0.048)	(0.050)	(0.042)	(0.078)	(0.039)
Obs. outside	548	549	549	535	549	549
Obs. inside	270	270	270	263	270	270

Note: OLS estimates. Standard errors clustered at the village level. All estimates include only respondents living in areas of low suitability for cotton production. Panel A includes no individual nor geographical controls. Panel B includes individual controls. Panel C includes individual and geographical controls. The dependent variable in Column (1) is measured by the risk game and it is binary, taking value 1 if the respondent is risk averse and 0 when the respondent is risk neutral or lover. Column (2) uses as dependent variable an indicator taking value 1 if respondents' self-reported main occupation is farming. In column (3) the dependent variable takes value 1 if respondents' intended to sell at least one of the crops produced in the last campaign prior to data collection (and 0 otherwise). Column (4) uses as dependent variable an index measuring the adoption of farming technology, which ranges between 0 and 1. The dependent variable in Column (5) is binary, taking value 1 if respondents' contribute to a communitary savings scheme (*Xitique*), and 0 otherwise. The dependent variable in Column (6) takes value 1 if respondents own a business, and 0 otherwise. The main explanatory variable is a binary variable measuring whether respondents live within the area of a colonial cotton concession. All specifications used include a RD polynomial of degree 1. ***, **, and * indicate significance at the 1%, 5%, and 10% critical level.

5.2 Heterogeneity by gender

As previously described, the coercive plantation of cotton during the colonial period ended up affecting mostly women. In this section we explore the heterogeneous effects of cotton concessions on both women and men, with the results presented in Table 6. As the results with and without controls are fairly similar, we exclude the vectors of individual and geopgraphical controls from the estimates presented in Table 6. In Panel A we present the results using both women and men (identical to Table 4 Panel B, or Table 5 Panel A). The effects on the women and men samples are presented in Panels B and C, respectively. It is possible to observe that the effects on all outcomes related to risk aversion and farming are driven by female respondents. Cotton concessions increase the probability of women being risk averse by 23.9 percentage points – corresponding to a 9.6 percentage points increase relatively to estimate for the entire

sample (Panel A) – and the statistical significance increases to 1%. The probability of being a farmer remains stable among women, but the estimates become more precise such that the coefficient estimated is significant at the 5% level (as opposed to the 1% level for the entire sample). The fraction of crops produced that were destined to be sold is also higher among women, maintaining the same level of statistical significance. Women in areas exposed to cotton concessions are also more likely to produce at least one crop destined to be sold, with the effect being statistically significant at the 1% level. The adoption of farming technology increases among women by 11.7 percentage points (versus the 9.2 percentage points for the entire sample) but the loss in precision leads to a reduction in statistical significance (to the 10% level).

Table 6: Heterogeneous effects between females and males

	Risk aversion	Farmer	Sells crop output	Farm technology adoption	Does community savings	Business ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Entire sample						
Cotton concession	0.143**	0.102*	0.170**	0.092*	0.253***	0.008
	(0.060)	(0.053)	(0.067)	(0.050)	(0.086)	(0.039)
Obs. outside	548	549	549	535	549	549
Obs. inside	270	270	270	263	270	270
Panel B. Women						
Cotton concession	0.239***	0.101**	0.182***	0.117**	0.319***	0.007
	(0.089)	(0.041)	(0.065)	(0.054)	(0.092)	(0.063)
Obs. outside	274	275	275	268	275	275
Obs. inside	134	134	134	129	134	134
Panel C. Men						
Cotton concession	0.048	0.105	0.158	0.068	0.187*	0.008
	(0.070)	(0.090)	(0.097)	(0.056)	(0.106)	(0.061)
Obs. outside	274	274	274	267	274	274
Obs. inside	136	136	136	134	136	136

Note: OLS estimates. Standard errors clustered at the village level. Panel A includes all respondents living in areas of low suitability for cotton production. Panels B and C restrict the analysis only females and males, respectively, living in areas of low suitability for cotton production. The dependent variable in Column (1) is measured by the risk game and it is binary, taking value 1 if the respondent is risk averse and 0 when the respondent is risk neutral or lover. Column (2) uses as dependent variable an indicator taking value 1 if respondents' self-reported main occupation is farming. In column (3) the dependent variable takes value 1 if respondents' intended to sell at least one of the crops produced in the last campaign prior to data collection (and 0 otherwise). Column (4) uses as dependent variable an index measuring the adoption of farming technology, which ranges between 0 and 1. The dependent variable in Column (5) is binary, taking value 1 if respondents' contribute to a communitary savings scheme (*Xitique*), and 0 otherwise. The dependent variable in Column (6) takes value 1 if respondents own a business, and 0 otherwise. The main explanatory variable is a binary variable measuring whether respondents live within the area of a colonial cotton concession. All specifications used include a RD polynomial of degree 1. No controls are included. ***, **, and * indicate significance at the 1%, 5%, and 10% critical level.

5.3 Robustness: quadratic RD polynomial

This section explores how the inclusion of a quadratic RD polynomial, as opposed to the polynomial of degree 1 used in Tables 4, 5, 6. The results are presented in Table 7. Panel A uses the entire study sample (regardless of suitability for cotton production) and does not include any individual or geographic controls. It shows that the magnitude of all coefficients oscillates comparison to the baseline results presented in Table 4, although remaining statistical insignificant. The exception is doing community savings (Column (5)) which more than doubles its coefficient size, becoming statistical significant at the 10% level.

Table 7: Robustness to the inclusion of a quadratic RD polynomial

	Risk aversion	Farmer	Sells crop output	Farm technology adoption	Does community savings	Business ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Entire sample & no controls						
Cotton concession	0.049	0.028	-0.056	0.005	0.157*	-0.046
	(0.072)	(0.062)	(0.083)	(0.042)	(0.083)	(0.042)
Panel B. Low cotton suitability & no controls						
Cotton concession	0.209*	0.022	0.324***	0.055	0.382***	-0.018
	(0.113)	(0.086)	(0.100)	(0.088)	(0.130)	(0.048)
Panel C. High cotton suitability & no controls						
Cotton concession	0.005	0.035	-0.212**	0.016	0.126	-0.051
	(0.092)	(0.075)	(0.097)	(0.049)	(0.103)	(0.055)
Panel D. Low cotton suitability & individual controls						
Cotton concession	0.209*	0.031	0.325***	0.056	0.384***	-0.023
	(0.113)	(0.082)	(0.097)	(0.086)	(0.131)	(0.050)
Panel E. Low cotton suitability & individual + geographical controls						
Cotton concession	0.220**	0.036	0.311***	0.040	0.328**	0.010
	(0.107)	(0.081)	(0.073)	(0.074)	(0.141)	(0.048)
Panel F. Low cotton suitability & no controls & females						
Cotton concession	0.307*	0.045	0.297***	0.099	0.415***	0.011
	(0.163)	(0.053)	(0.092)	(0.103)	(0.151)	(0.085)
Panel G. Low cotton suitability & no controls & males						
Cotton concession	0.115	0.007	0.347**	0.010	0.354**	-0.049
	(0.114)	(0.154)	(0.156)	(0.087)	(0.165)	(0.108)

Note: OLS estimates. Standard errors clustered at the village level. Panel A includes the entire study sample. Panels B, D, E, F and G restrict the analysis only to respondents living in areas of low suitability for cotton production, while Panel C includes respondents living in areas of high suitability for cotton production. In addition, Panels A, B, C, F and G do not include any controls. Panel D includes individual controls, and Panel E adds geographical controls. Panels F and G also restrict the analysis to females and males, respectively. The dependent variable in Column (1) is measured by the risk game and it is binary, taking value 1 if the respondent is risk averse and 0 when the respondent is risk neutral or lover. Column (2) uses as dependent variable an indicator taking value 1 if respondents' self-reported main occupation is farming. In column (3) the dependent variable takes value 1 if respondents' intended to sell at least one of the crops produced in the last campaign prior to data collection (and 0 otherwise). Column (4) uses as dependent variable an index measuring the adoption of farming technology, which ranges between 0 and 1. The dependent variable in Column (5) is binary, taking value 1 if respondents' contribute to a communitary savings scheme (*Xitique*), and 0 otherwise. The dependent variable in Column (6) takes value 1 if respondents own a business, and 0 otherwise. The main explanatory variable is a binary variable measuring whether respondents live within the area of a colonial cotton concession. All specifications used include a quadratic RD polynomial. ***, **, and * indicate significance at the 1%, 5%, and 10% critical level.

In Panel B the sample used is restricted only to respondents living in areas of low suitability for cotton production, and no individual or geographical controls are included. It is possible to observe that the coefficients of risk aversion, selling crop output and doing community savings, relatively to the results in Table 4, increase in magnitude to 0.209, 0.324 and 0.382, respectively (0.209, 0.324 and 0.382, maintaining statistical significance at least at the 10% level). The coefficients of being a farmer and adopting technology decrease in magnitude (0.022 and 0.05), and they are no longer statistical significance, while business ownership maintains a coefficient close to zero (and largely imprecise).

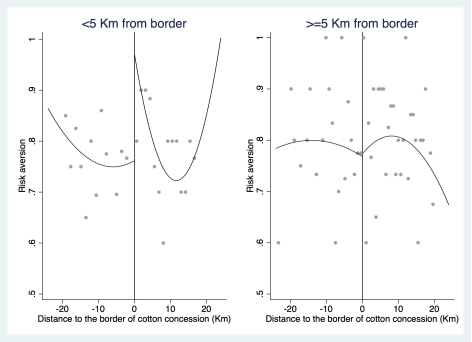
Panel C includes only respondents living in areas of high cotton suitability and, identically to Panels A and B, it does not include any controls. The magnitude of the coefficients estimated oscilates relatively to the specification using a first degree polynomial, with the exception of selling crop output (Column (3)). In the case of this outcome variable, its coefficient shows a 21.2 percentage points decrease in the likelihood of selling crop output (significant at the 5% level). This effect contrasts to its analogous in Column (3) of Panel B. More precisely, exposure to cotton concessions seem to have generated a non-linear and heterogeneous relationship with selling crop output. Respondents in areas of low suitability for cotton production are associated with more crop commercialization, while the opposite happens in areas of high suitability for cotton production.

Panels D and E restrict the analysis only to respondents living in areas of low suitability for cotton production. In the former panel, only individual controls are included, while in the latter geographical controls are also added. The interpretation of Panels D and E is identical to the one of Panel B. If anything, the inclusion of controls slightly improves the precision of the coefficients, without substantially altering the point estimates.

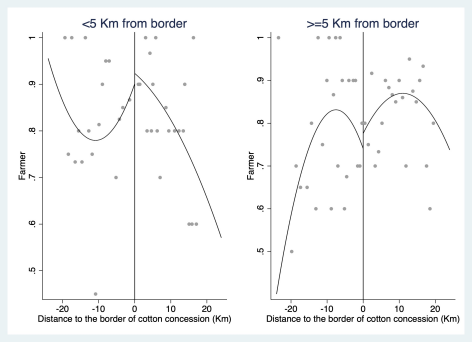
Panels F and G also focus on respondents living in areas of low suitability for cotton production, splitting the sample in females and males respectively. Similarly to the results presented in Table 6, it is possible to observe that the effects of cotton concessions are being generated among female respondents. The variables where a there is a positive and significant effect of cotton concessions are risk aversion, selling crop output and doing community savings (columns (1), (3) and (5)). Following the same pattern as in the other Panels of Table 7, being a farmer, adopting farming technology or business ownership seem to be unaffected by business ownership. Interestingly, the inclusion of a quadratic RD polynomial also reveals that males exposed to cotton concessions are also more likely to sell their crop output (34.7 percentage points, which is higher but not statistically different form the effect on females), and to do community savings (35.4 percentage points).

In addition, Figure 4 also present the RD plots for the outcomes used in Table 4.

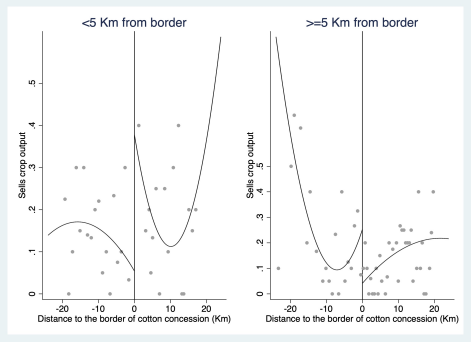
Figure 4: RD plots using quadratic polynomial



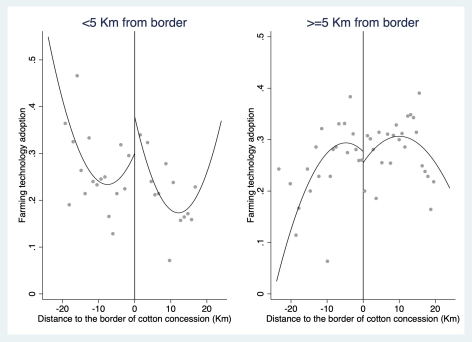
(a) Risk aversion



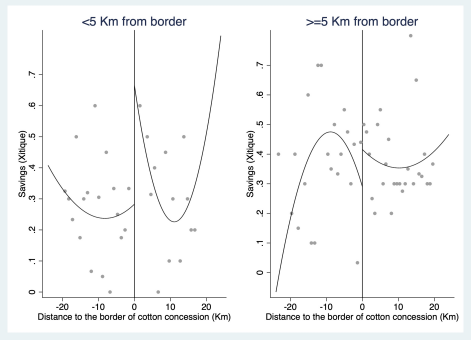
(b) Farmer



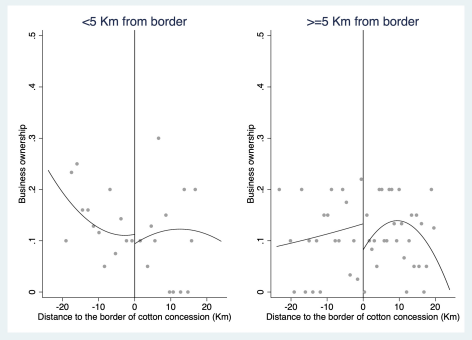
(c) Sells crop output



(d) Farming technology adoption



(e) Community savings programme (Xitique)



(f) Business ownership

Source: authors' calculations.

5.4 Robustness: alternative bandwidths

This section explores whether the main findings presented in Tables 4, 5 and 6 are being driven by respondents further away from concession borders, who may have inherently different characteristics from other individuals on the other side of the border. For that, we replicate the same specification used in Table 4, Panel B (areas of low suitability for cotton production and no inclusion of controls), and we further restrict the analysis to respondents within 5km, 10Km and 15Km from the concession borders (Panels B, C and D, respectively). Overall, the evidence presented in Table 8 shows that the effects of cotton concessions are mainly driven by individuals close to the concessions border, who differ less from each other than individuals living further away on both sides of the border. These results further support our empirical strategy.

Table 8: Robustness to different bandwidths around the cotton concession borders

	Risk aversion	Farmer	Sells crop output	Farm technology adoption	Does community savings	Business ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Entire sample						
Cotton concession	0.143**	0.102*	0.170**	0.092*	0.253***	0.008
	(0.060)	(0.053)	(0.067)	(0.050)	(0.086)	(0.039)
Obs. outside	548	549	549	535	549	549
Obs. inside	270	270	270	263	270	270
Panel B. <5km from concession border						
Cotton concession	0.008	0.004	0.429***	0.062	0.443***	-0.036
	(0.163)	(0.112)	(0.095)	(0.117)	(0.160)	(0.068)
Obs. outside	120	120	120	116	120	120
Obs. inside	110	110	110	107	110	110
Panel C. <10km from concession border						
Cotton concession	0.242***	0.127*	0.252***	0.085	0.365***	-0.031
	(0.092)	(0.072)	(0.090)	(0.074)	(0.118)	(0.050)
Obs. outside	259	260	260	252	260	260
Obs. inside	190	190	190	185	190	190
Panel D. <15km from concession border						
Cotton concession	0.161**	0.066	0.199***	0.089	0.253**	0.003
	(0.065)	(0.056)	(0.076)	(0.055)	(0.099)	(0.044)
Obs. outside	418	419	419	409	419	419
Obs. inside	230	230	230	224	230	230

Note: OLS estimates. Standard errors clustered at the village level. Panel A includes all respondents living in areas of low cotton suitability. Panels B, C and D restrict the analysis to respondents living less than 5Km, 10Km or 15Km away from the cotton concession borders, respectively. The dependent variable in Column (1) is measured by the risk game and it is binary, taking value 1 if the respondent is risk averse and 0 when the respondent is risk neutral or lover. Column (2) uses as dependent variable an indicator taking value 1 if respondents' self-reported main occupation is farming. In column (3) the dependent variable takes value 1 if respondents' intended to sell at least one of the crops produced in the last campaign prior to data collection (and 0 otherwise). Column (4) uses as dependent variable an index measuring the adoption of farming technology, which ranges between 0 and 1. The dependent variable in Column (5) is binary, taking value 1 if respondents' contribute to a communitary savings scheme (*Xitique*), and 0 otherwise. The dependent variable in Column (6) takes value 1 if respondents own a business, and 0 otherwise. The main explanatory variable is a binary variable measuring whether respondents live within the area of a colonial cotton concession. All specifications used include a RD polynomial of degree 1. No controls are included. ***, **, and * indicate significance at the 1%, 5%, and 10% critical level.

Panel B shows that when the sample is restricted to respondents living in areas within 5Km of cotton concession borders, the magnitude of the effect of cotton concessions on selling crop output and doing community savings increases relatively to the baseline estimates of Panel A. The significant 14.3 percentage points increase in risk aversion, displayed in Column (1) of Panel A is no longer observed (the estimated coefficient decreases to approximately zero). This can be related to the smaller sample size being used, mainly relying only on 12 villages outside the concession areas, and 11 inside.

As the sample used in the estimates is further expanded to include individuals living within 10Km of the cotton concessions, we observe that the magnitude of the effects estimated is still larger than those in Panel A, although the magnitude decreases from the estimates of Panel B. In fact, risk aversion increases by 24.2 percentage points (significant at the 1% level).

In Panel C, as the sample used includes the individuals living within 15Km from the cotton concession borders, the coefficients estimated get closer to the baseline results of Panel A.

6 Conclusion

This paper has examined the long-term impacts of forced cotton cultivation in colonial Mozambique, focusing on individual risk behaviour and economic decision making. Through a combination of historical archival research and contemporary survey data analyzed via a spatial regression discontinuity design, we have evaluated how the exposure to historical cotton concessions still affects modern day communities.

Our findings reveal a significant relationship between exposure to the historical cotton concessions and heightened risk aversion, particularly in regions where cotton was less agriculturally suitable. This effect is predominantly observed among women, who bore the brunt of the forced labour regime, highlighting the gendered nature of these historical impacts. The increase in risk aversion among these communities suggests a deep-seated legacy of the coercive cotton cultivation policy, affecting not just economic behaviours but also the social fabric of the affected regions.

Moreover, our analysis suggests that individuals in areas previously subjected to cotton concessions are more likely to engage in agriculture, with a significant portion of their production intended for commercial purposes. This shift towards agricultural production and commercialization, particularly among women, underscores the lasting influence of colonial policies on the economic activities and livelihood strategies of local communities. The robustness of these findings, even after controlling for individual and geographical factors and considering different bandwidths, reinforces the validity of our conclusions.

Our study contributes to the broader literature by highlighting the complex and enduring effects of colonial agricultural policies on risk behaviour, economic decisions, and gender dynamics. It underscores the importance of historical context in understanding contemporary economic behaviours and social structures.

In reflecting on the implications of our research, it is clear that the legacy of coercive cotton cultivation in Mozambique continues to shape the lives of its citizens. As policymakers and researchers work towards addressing the challenges faced by post-colonial societies, recognizing and understanding the historical roots of these issues is crucial. Our study not only adds to the academic understanding of the long-term effects of colonialism but also offers insights into the ongoing efforts to overcome the historical legacies that continue to influence economic and social behaviours in Mozambique and similar contexts. By shedding light on the enduring effects of forced cotton cultivation, our research emphasizes the need for targeted interventions that acknowledge the historical context and aim to mitigate the long-term consequences of such policies on affected communities.

References

Ambrus, A., Field, E., and Gonzalez, R. (2020). 'Loss in the Time of Cholera: Long-Run Impact of a Disease Epidemic on the Urban Landscape'. *American Economic Review*, 110(2): 475–525. https://doi.org/10.1257/aer.20190759

Becker, S. O., Boeckh, K., Hainz, C., and Woessmann, L. (2016). 'The Empire is Dead, Long Live the Empire! Long-Run Persistence of Trust and Corruption in the Bureaucracy'. *The Economic Journal*, 126(590): 40–74. https://doi.org/10.1111/ecoj.12220

Blouin, A. (2022). 'Culture and Contracts: The Historical Legacy of Forced Labour'. *The Economic Journal*, 132(): 89–105. https://doi.org/10.1093/ej/ueab031

Bove, M., Caeiro, R. M., Jones, S., Justino, P., and Barros, H. (2023). *The Legacies of Forced Labor in Mozambique: Evidence from a Regression Discontinuity Design* [Per-Analysis Plan]. Submitted to Evidence in Governance and Politics (EGAP).

Bruhn, M., and Gallego, F. A. (2012). 'Good, Bad, and Ugly Colonial Activities: Do They Matter for Economic Development?' *Review of Economics and Statistics*, 94(2): 433–61. https://doi.org/10.1162/REST_a_00218

Callen, M., Isaqzadeh, M., Long, J. D., and Sprenger, C. (2014). 'Violence and Risk Preference: Experimental Evidence from Afghanistan'. *American Economic Review*, 104(1): 123–48. https://doi.org/10.1257/aer.104.1.123

Cameron, L., and Shah, M. (2015). 'Risk-Taking Behavior in the Wake of Natural Disasters'. *Journal of Human Resources*, 50(2): 484–515. https://doi.org/10.3368/jhr.50.2.484

Cattaneo, M. D., Titiunik, R., and Vazquez-Bare, G. (2019). 'Power Calculations for Regression-Discontinuity Designs'. *The Stata Journal*, 19(1): 210–45. https://doi.org/10.1177/1536867X19830919

Dell, M. (2010). 'The Persistent Effects of Peru's Mining Mita'. *Econometrica*, 78(6): 1863–903. https://doi.org/10.3982/ECTA8121

Eckel, C. C., and Grossman, P. J. (2002). 'Sex Differences and Statistical Stereotyping in Attitudes toward Financial Risk'. *Evolution and human behavior*, 23(4): 281–95. https://doi.org/10.1016/S1090-5138(02)00097-1

Fischer, G., Nachtergaele, F. O., van Velthuizen, H., Chiozza, F., Francheschini, G., Henry, M., Muchoney, D., and Tramberend, S. (2021). *Global Agro-Ecological Zones (GAEZ v4): Model Documentation.* Rome: FAO. https://doi.org/10.4060/cb4744en

Gelman, A., and Imbens, G. (2019). 'Why High-Order Polynomials Should Not Be Used in Regression Discontinuity Designs'. *Journal of Business & Economic Statistics*, 37(3): 447–56. https://doi.org/10.1080/07350015.2017.1366909

Guimarães, P. (2021). 'Violence, Science, and Cotton in Colonial-Fascist Mozambique (1934-1974)'. *Perspectivas-Journal of Political Science*, 25(-): 89–108. https://doi.org/10.21814/perspectivas.3229

Isaacman, A. (1985). 'Chiefs, Rural Differentiation and Peasant Protest: The Mozambican Forced Cotton Regime 1938-1961'. *African Economic History*,(14): 15–56. https://doi.org/10.2307/3601112

Isaacman, A. (1992). 'Peasants, Work and the Labor Process: Forced Cotton Cultivation in Colonial Mozambique 1938-1961'. *Journal of Social History*, 25(4): 815–55. https://doi.org/10.1353/jsh/25.4.815

Isaacman, A. (1996). *Cotton Is the Mother of Poverty: Peasants, Work, and Rural Struggle in Colonial Mozambique, 1938-1961*. London: James Currey Ltd.

J.E.A.C. (1946). *Documentário da Actividade Algodoeira de Mocambique* [PT-AHP/DA/D66, Cota: DA, doc. 113]. Fomento, Fiscalizacao e Estatistica. Assembleia da República, Arquivo Histórico Parlamentar.

Jones, M., Kondylis, F., Loeser, J., and Magruder, J. (2022). 'Factor Market Failures and the Adoption of Irrigation in Rwanda'. *American Economic Review*, 112(7): 2316–52. https://doi.org/10.1257/aer.20210059

Jones, S., and Gibbon, P. (2022). 'What Drove the Profitability of Colonial Firms? Labour Coercion and Trade Preferences on the Sena Sugar Estates (1920-74)'. WIDER Working Paper 2022/70. Helsinki: UNU-WIDER. https://doi.org/10.35188/UNU-WIDER/2022/201-0

Kim, Y.-I., and Lee, J. (2014). 'The Long-Run Impact of a Traumatic Experience on Risk Aversion'. *Journal of Economic Behavior & Organization*, 108(December): 174–86. https://doi.org/10.1016/j.jebo.2014.09.009

Liu, E. M. (2013). 'Time to Change What to Sow: Risk Preferences and Technology Adoption Decisions of Cotton Farmers in China'. *Review of Economics and Statistics*, 95(4): 1386–403. https://doi.org/10.1162/REST_a_00295

Lowes, S., and Montero, E. (2021). 'Concessions, Violence, and Indirect Rule from the Congo Free State'. *The Quarterly Journal of Economics*,(): 2047—91. https://doi.org/10.1093/qje/qjab021

Michalopoulos, S., and Papaioannou, E. (2013). 'Pre-Colonial Ethnic Institutions and Contemporary African Development'. *Econometrica*, 81(1): 113–52. https://doi.org/10.3982/ECTA9613

Michalopoulos, S., and Papaioannou, E. (2014). 'National Institutions and Subnational Development in Africa'. *The Quarterly Journal of Economics*, 129(1): 151–213.

Michalopoulos, S., and Papaioannou, E. (2016). 'The Long-Run Effects of the Scramble for Africa'. *American Economic Review*, 106(7): 1802–48. https://doi.org/10.1257/aer.20131311

Nunn, N. (2008). 'The Long-Term Effects of Africa's Slave Trade'. *Quarterly Journal of Economics*, 123(1): 139–76. https://doi.org/10.1162/qjec.2008.123.1.139

Nunn, N., and Wantchekon, L. (2011). 'The Slave Trade and the Origins of Mistrust in Africa'. *American Economic Review*, 101(7): 3221–52. https://doi.org/10.1257/aer.101.7.3221

Tadei, F. (2020). 'Measuring Extractive Institutions: Colonial Trade and Price Gaps in French Africa'. *European Review of Economic History*, 24(1): 1–23. https://doi.org/10.1093/ereh/hey027

Voors, M. J., Nillesen, E. E. M., Verwimp, P., Bulte, E. H., Lensink, R., and Soest, D. P. V. (2012). 'Violent Conflict and Behavior: A Field Experiment in Burundi'. *American Economic Review*, 102(2): 941–64. https://doi.org/10.1257/aer.102.2.941

Walden, J., and Zhukov, Y. M. (2020). *Historical legacies of political violence.* Oxford Research Encyclopedia of Politics. https://doi.org/10.1093/acrefore/9780190228637.013.1788