Impact of Enslavement Conditions on Families: Evidence from the French Caribbeans

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Abstract

How violence during slavery might have affected families remains an empirically unanswered question. I exploit local variation in enslaved workers' exposure to coercion in two French Caribbean islands: Guadeloupe and Martinique. Using county-level data on enslaved mortality prior to abolition, I document that conditions were worse on sugarcane plantations compared to coffee, in part because of heightened competition in the sugar market. I then digitize individual data from handwritten administrative records on *all* formerly enslaved families that had children five years after abolition. My main finding is that the presence of fathers exposed to the worst conditions during slavery had a sizable negative effect on the quality of childhood environment, with 40% higher chances of child death respective to families with less coerced or absent fathers. This effect holds regardless of occupation, place of residence, or mothers' enslavement conditions. I find suggestive evidence that this could be driven by a higher likelihood of extremely coerced men to exhibit violent behavior. Taken together, my findings point to substantial inequality among descendants of formerly enslaved individuals, and highlight the importance of father-level transmission in driving said inequalities.

JEL: J12; J47; I15; O10; O54; N30; N36; Z10

Keywords: Slavery; Family Structure; Child Mortality; Violence; Sugar; Transmission

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1 Introduction

The enduring impact of slavery on long run inequality is a central policy concern, which fuelled debates regarding the implementation of reparations policies for formerly enslaved communities (Darity and Frank, 2003; Piketty, 2020; Darity et al., 2022). While economists have established a negative association between slavery and long run economic outcomes (Nunn, 2008; Acemoglu et al., 2012; Bertocchi and Dimico, 2014; Laudares and Caicedo, 2023), our understanding of slavery's enduring impact suffers from a lack of evidence on its social consequences - particularly on families. Yet, prevalence of female-headed households among formerly enslaved communities[1] has raised debates among social scientists about a potential connection between slavery and family structure (Du Bois, 1908). While these patterns may play a crucial role in perpetuating economic inequality (Black et al., 2005), identifying the causal impact of slavery on families is empirically challenging. Post-abolition institutionalized oppression, such as the Jim Crow laws in the United States, or systemic racial discrimination, might equally participate to persistent economic inequality and confound the association between slavery and post-abolition outcomes (Althoff and Reichardt, 2023).

The complexity of the issue is exacerbated by the fact that historical slavery was not a uniform experience but encompassed a spectrum of enslavement conditions. These conditions, including workload, violence, and living standards, were heavily influenced by the types of crops cultivated during the era of slavery, and were particularly worse on sugarcane relative to coffee or cotton plantations (Fogel and Engerman, 1974; Higman, 1977; Smith, 1982).

This paper studies whether and how enslavement conditions[2] determined by crop types affected the quality of childhood environment and paternal presence right after abolition. I focus on two former French Colonies - Guadeloupe and Martinique - where slavery was abolished in 1848. While nearly all families became free with little to no economic resources, differences in the experience of slavery could have affected their children in several ways: through coercion's impact on parents' mental health, their parenting practices, or family structure (McLanahan et al., 2013). In that respect, harsher conditions could have led to more absent fathers and less stable family ties (Du Bois, 1908), but may also have fostered stronger bonds between partners to overcome hardship.

[1] In the contemporary United States, 51% of Black children are raised by a single parent, compared to 30% of White children (U.S. Census Bureau, 2021). In the former slave colonies of the French Caribbean, 66% of children are born without a known father and (INSEE, 2023)

[2] Throughout this paper, I use the terms enslavement conditions and coercion intensity interchangeably to refer to the overall components of enslaved populations' living conditions during slavery. This encompasses direct violence, workload, and living standards.

Investigating the intergenerational consequences of enslavement conditions presents significant empirical challenges. The first challenge relates to the proper identification of differences in enslavement conditions. In my context, sugarcane was cultivated in nearly all counties but at varying intensities. The second challenge relates to the identification of individuals' history of coercion. The context of the French West Indies provides a unique opportunity in this regard, owing to the highly distinctive surnames assigned to formerly enslaved families. After abolition, the "Census of the Newly Freed" was conducted to assign civil identities to the 150,000 liberated individuals. Government officials guided the selection of surnames, ensuring they were unique, distinct from each other and from white settlers' surnames[3] (Durand, 2011). This provides a rare opportunity for precisely linking families to their former county of enslavement, and thereby coercion history. A final challenge faced by intergenerational studies in general lies in the selective measurement of transmission through fathers due to the inheritance of surnames. In the French West Indies, parents within the same household often have distinct last names, with children typically inheriting their mothers' surname[4]. This unique setting allows me to measure both maternal and paternal transmission.

I examine enslavement conditions' impact on families in two main steps. I first examine the association between crop produced and enslavement conditions, using a novel dataset of enslaved mortality at the county level in the decade prior to the abolition of slavery (1848). I then turn to the post abolition period and compile a novel individual level dataset on all formerly enslaved families who had a child between 1852 and 1856. To do so, I undertake a large-scale digitization effort of nearly 50,000 pages of handwritten administrative data, and develop an open-source Optical Character Recognition Pipeline specifically tailored for handwritten documents.

My baseline empirical strategy compares families depending on their former enslavement conditions, determined by the share of sugarcane over the cultivated surface in the surnames' county of origin. I regress family-level outcomes on coercion history while controlling for p residence and year fixed effects. My key identification assumption is that, prior to abolition, enslaved workers where assigned to different crops in a quasi-random way. I verify this assumption using external sources (Vanony-Frisch, 1987), and find no significant differences in socio-demographic characteristics across crop types among the newly freed population. To net out family-based mechanisms from geographic determinants, I also adopt an alternative strategy focusing on parents who relocated from their county of enslavement: this represents 50% of my sample, with similar proportions

[3]Official guidelines recommended the use of anagrams, mythological names..

[4]Unless parents were married, which only concerned 8% of individuals.

across different coercion groups.

My first key result is that the gap in enslavement conditions between crop types widened because of heightened competition on the sugar market in the decades prior to abolition. I find that the introduction of beet sugar in mainland France lead to a 20% decline in sugarcane prices between 1834 and 1848. In response, sugar planters escalated production through increased coercion. My findings indicate that changes in prices were associated with a sizable (+124%) rise in average deaths in sugarcane-intensive counties compared to others. This quantitative evidence supports using crop-types as reliable indicators of enslavement conditions.

Another noteworthy finding of this study is that, while single-mother households are common after abolition, they did not constitute the predominant family structure: 60% of children did have a known father. I also find a potential positive effect of worse enslavement conditions on fathers' presence. Although this effect is small in magnitude and no longer significant once place of residence effects are netted out from maternal coercion history[5], this finding calls for a more nuanced approach to the idea that violence during slavery should have led to more "broken" families. Worse enslavement conditions might, in fact, have fostered stronger ties to overcome hardship.

My final key finding indicates that among present fathers, the most extremely coerced ones had a negative impact on the quality of childhood environment for their immediate descendants. Their presence increased the risk of child mortality by 40%, compared to families with less coerced fathers. Differences in mothers' former coercion exposure had no effect. In contrast with my previous result, I find that the effect of fathers on child mortality is not captured by location-specific factors. It also holds regardless of fathers' occupation or mothers' characteristics (occupation, coercion exposure). A potential explanation is that extremely coerced men might have been more violent. I find suggestive evidence that formerly enslaved men exposed to worse conditions committed more violent crimes, and in particular more sexual assaults. Considering that child mortality is an extreme measure of poor health, and that experiencing a child death could have important negative spillovers on family members, my findings point to substantial inequality among descendants of formerly enslaved individuals. These findings also underscore large gender differences in response to extreme coercion, and the importance of father-level transmission to understand post-abolition inequality among the formerly enslaved community.

This paper enhances our understanding of the channels through which coercion exerts a per-

[5]Using the alternative specification, which focuses on mothers who moved from their county of enslavement.

sistent impact. Acemoglu et al. (2001), Dell (2010), Dell and Olken (2019) and Blouin (2022) emphasize the significance of coercive institutions for regional development. I contribute to a burgeoning literature on the impact of coercion on individual families (Althoff and Reichardt, 2023), which allows for measuring coercion's effect even when families move and to net out the specific role of families as a transmission channel of persistence. While studies are often restricted to measuring paternal transmission, my unique context and novel dataset allow for the measurement of both maternal and paternal enslavement conditions, revealing substantial gender differences in responses to coercion.

This research specifically advances our understanding of the legacy of slavery and the mechanisms behind its persistent impact. Most of the literature has looked at slavery's impact at the country or regional level, and showed a strong negative correlation between historical exposure to slavery and post abolition income inequality, education, trust, and economic development (Nunn, 2008; Acemoglu et al., 2012; Bertocchi and Dimico, 2014; Acharya et al., 2018; Laudares and Caicedo, 2023). Using individual level data on Black families' location after abolition in the United States, Althoff and Reichardt (2023) argue that exposure to discriminatory policies rather than slavery is the main driver of persistent racial inequality in the US. While their setting doesn't allow for isolating the precise role of enslavement conditions, my findings suggests that they actually can have large consequences on descendants. I thereby contribute to the sociological and historical debates on the social consequences of slavery (Patterson, 1982), more specifically on families (Du Bois, 1908; Higman, 1975, 1977; Trevon D. Logan, 2018), and provide the first empirical evidence on the interplay between enslavement conditions, family structure and child mortality.

My findings thereby expand on our understanding of the effects of parental inputs at early ages of children (Heckman et al., 2013). Prior research has stressed that the lack of inputs from one parent (because of divorce, incarceration, death) can have important negative consequences for affected children (Gay Painter and David I. Levine, 2000; McLanahan et al., 2013; Kalil et al., 2016; Dupraz and Ferrara, 2023). I offer the first analysis of fathers' influence for early childhood development within a coercive context. My historical findings align with recent causal evidence presented by Norris et al. (2021), who found that the imprisonment of fathers can in fact have positive effects on children, particularly when there is a risk of abuse.

Considering within-slavery variation for post-abolition trajectories is especially relevant in the Caribbean, where 70% of the overall populations were enslaved at the times of abolition (Enger-

man and Higman, 2003). I confirm the established narrative that crop type determined enslavement conditions (Fogel and Engerman, 1974; Higman, 1977; Smith, 1982), and show that the coercion gap actually *widened* following a plausibly exogenous shock on the sugar market. I thereby contribute to our understanding of the consequences of economic shocks in coercive settings (Pamuk, 2007; Naidu and Yuchtman, 2013). In a closely related context Dippel et al. (2017) found that the decrease in sugar prices had a differential impact across the British West Indies. In the most sugarcane intensive islands, coercive institutions remained unchanged and workers' conditions did not improve. I leverage within-island variation and reveal that enslaved workers' conditions actually deteriorated in the most sugarcane-intensive areas, potentially having significant consequences for their immediate descendants.

Finally, the OCR pipeline developed for this project contributes to scholars effort to provide free and reproducible document processing technologies such as the *layout-parser* developed by Melissa Dell and co-authors (Shen et al., 2021)). While existing solutions perform well for printed text, they typically fall short when dealing with handwritten and archival documents. I intend to release the pipeline in open-source and to provide instructions on how to adapt it to other languages.

2 Historical Background

This section provides historical context on the slave economy and the enslavement conditions in the different crop types.

2.1 The Sugar Economy

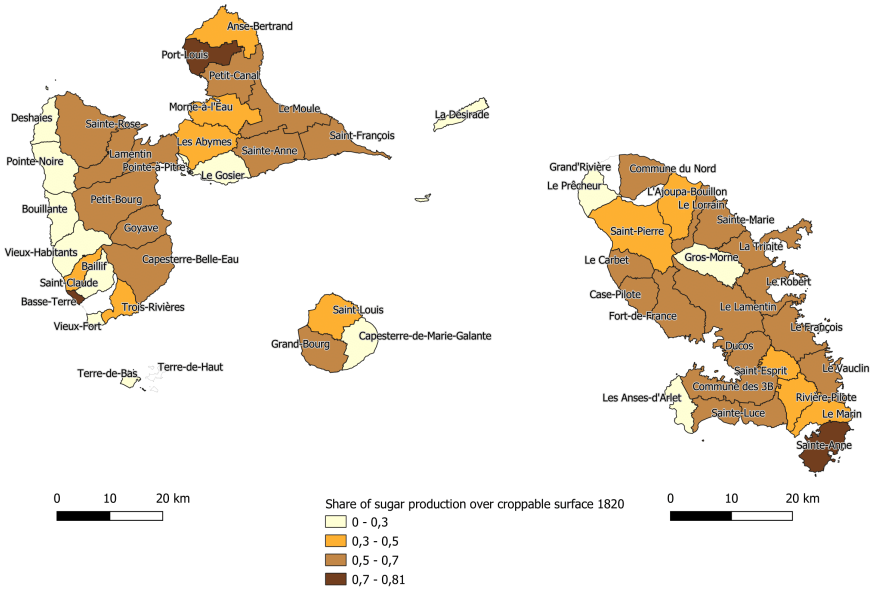
Guadeloupe and Martinique are two former French colonies that are now amongst the poorest provinces (*départements*) in France[6]. Each island is composed of approximately 30 counties, and are typical examples of extractive colonies set up by European countries in the Caribbean. African slaves were imported massively between the 17th and 19th century to serve as labor in plantation systems, and made up 70% of the total population at abolition (Engerman and Higman, 2003). Slavery was abolished in 1848 in a context of political crisis, with the re-establishment of the Republic that followed the revolution against the July Monarchy. By that time, the islands' population amounted to nearly 200,000 inhabitants.

The economy of the French West Indies centred on the production of exportable crops: sugar-

[6] INSEE

cane, coffee, cocoa, indigo. In the 19th century, sugarcane accounted for 50% of cultivated land, against 15% for coffee and 35% for other crops (cocoa, indigo and subsistence agriculture for local consumption) (Fig A 1). The distribution of enslaved workers across different crops remained relatively stable over time, with 60% attached to sugarcane, 30% to secondary crops, and 10% attached to city dwellers (Schnakenbourg, 1977). Sugarcane was cultivated in nearly all counties but with varying intensities in areas with similar geographic characteristic. An important determinant of the intensity of production was the wealth of sugarcane planters, and their ability to purchase larger terrains[7].

Figure 1: Share of Sugarcane Over Cultivated Surface in 1820, in Guadeloupe (left) and Martinique (right)



Note: Share of sugarcane over cultivated surface as per 1820 census data, **Source:** Ministère de la Marine et des Colonies

The economic unit of production was the plantation. Its activity was ruled by the "Exclusivity Regime": planters were only allowed to export production to the mainland, and in return were granted preferential tariffs and the guarantee that their production would be purchased (Fallope, 1983). Communication and relations between each plantations were minimal, with little internal exchanges of enslaved workers even after the ban on slave trade in 1831 (Schnakenbourg, 1968).

[7]Initially, local level differences in climate, soil and elevation mattered for the distribution of crops : sugarcane typically thrives in hot and exposed areas, while coffee typically grows best at high altitudes with humid and fertile soil. Progressively, sugarcane became produced in nearly all countries. Subsistence agriculture, cocoa and indigo production were less terrain-dependent than coffee, and also spread out in the islands

These entities operated with considerable administrative and economic autonomy, with very little intervention from the authorities. The larger plantations had their own hospitals, prisons, and chapels.

2.2 Enslavement conditions

> *"The planter [...] is the sole arbiter of the law over the actions of his servant. He judges and condemns as a sovereign feudal lord; he administers justice on his lands, and his judgments remain without appeal. Refusal to work, breaking doors, theft – everything falls under his jurisdiction [...] What are we to think of a social state in which a man of human inclinations takes the whip himself and strikes a woman until she bears twenty bleeding wounds on her body!! If the righteous can stoop to such a level, imagine what the wicked will devise." (Victor Schoelcher, 1842, p40, p68)*

Testimonies of the time provide an appalling picture of living and working conditions on plantations. Victor Schoelcher, an advocate for abolition in the early 19th century, described the enslaved population as malnourished, overburdened, inadequately dressed, and neglected[8].

Crop and enslavement conditions. Using anecdotal evidence and cross country comparison of mortality patterns (Smith, 1982), historians argued that enslavement conditions might have been worse on sugarcane plantations compared to coffee or cotton. Work on sugarcane plantations was indeed more physically demanding than for secondary crops, particularly during the harvest[9]. The manufacturing process following the harvest also posed risks with numerous accidents: crushed limbs during the cane breaking process, or fatal burns during the cooking of cane juice. The heavier workload and injuries directly impacted the nutrition of enslaved individuals, as planters compelled workers to grow a significant portion of their own food (Schnakenbourg, 1977).

Both harvesting and manufacturing on sugarcane plantation required a large labor force and substantial capital investments. In contrast, secondary crop production did not involve extensive

[8] In addition to the workload, enslaved individuals were responsible for producing a significant portion of their own food by cultivating small garden plots. The constant fear of physical punishment ensured that slaves continued to work despite exhaustion. Planters held absolute power, and crimes against enslaved workers were more than often went unpunished. Planters often justified torture or death of slaves by accusing them of poisoning cattle (Victor Schoelcher, 1842)

[9] Sugarcane involved a lengthy harvesting season followed by various manufacturing steps to transform the cane into raw sugar. The more demanding step consisted in land preparation before planting the new canes. Unlike coffee or cocoa production, which required planting only when the trees were no longer productive, sugarcane had to be replanted every year

manufacturing, and the harvesting process was less labor-intensive. As a result, sugarcane plantations were larger, averaging around 70 slaves on the eve of abolition, compared to an average of 30 slaves on coffee plantations. The ratio of enslaved individuals to non-slaves was also higher on sugarcane plantations. Sugar plantation owners could therefore be more prone to resort to physical abuse to prevent potential collective action. Larger plantation size and proximity to livestock also made sugarcane plantations a more disease prone environment.

These differences in labor and capital investments reflected on the profiles of planters, who tended to be more wealthy in sugarcane plantations (Lasserre, 1952). The need for a stronger workforce, together with the wealth advantage, may have driven sugarcane planters to acquire the "strongest" and more expensive enslaved individuals. However, studies of plantation notary records conducted by historians show no systematic differences in selection on gender, ethnicity, age or price depending on plantations type (Debien, 1974; Vanony-Frisch, 1987).

Families. The institution of slavery constrained men to a limited role as fathers, as children automatically belonged to their mothers' enslavers. Additionally, women were attached to maintaining their independence in a context where they were at risk of sexual violence from both planters and enslaved men (Gautier, 2010; Davis, 1983). The combination of these factors did not favor fathers' active involvement in families. Nonetheless, historical records indicate that cohabiting couples were not uncommon on Caribbean estates (Higman, 1975). How within-slavery variation should matter for family structure is not straightforward. On one hand, harsher conditions could have led to more absent fathers, less stable family ties, more violence of enslaved men towards enslaved women, and women seeking more autonomy from men (Du Bois, 1908; Gautier, 2010). On the other hand, adverse conditions could have fostered stronger bonds between partners to overcome hardship. Differences in family structure related to absent fathers might, in turn, affect the quality of the childhood environment, with absent fathers potentially having a negative influence on children's outcomes (McLanahan et al., 2013). Recent evidence suggests, however, that the absence of fathers could have positive effects, particularly when men exhibit violent behaviors (Norris et al., 2021).

2.3 When Competition Hardens Coercion

The existing gap in coercion intensity between sugar and non-sugar plantations likely widened in the decades preceding the abolition of slavery because of a new competitor on the sugar market.

In 1815, Napoleon pushed for the introduction of beet sugar to meet the internal sugar demand while France was under embargo. Beet sugar presented obvious competitive advantages compared to sugarcane: it was cheaper, more efficient, and could be produced locally. Political turmoil stemming from the Napoleonic wars and aggressive lobbying from west indies colonists tamed its pressure on the sugarcane market up to 1830 (Laloux, 2019). Nevertheless, French sugarcane prices progressively decreased from 1834 to 1848 by 20% (Figure A6). As a response, colonists increased sugarcane production to maintain revenues (Schnakenbourg, 1977, 1987; Villeneuve, 1960)[10].

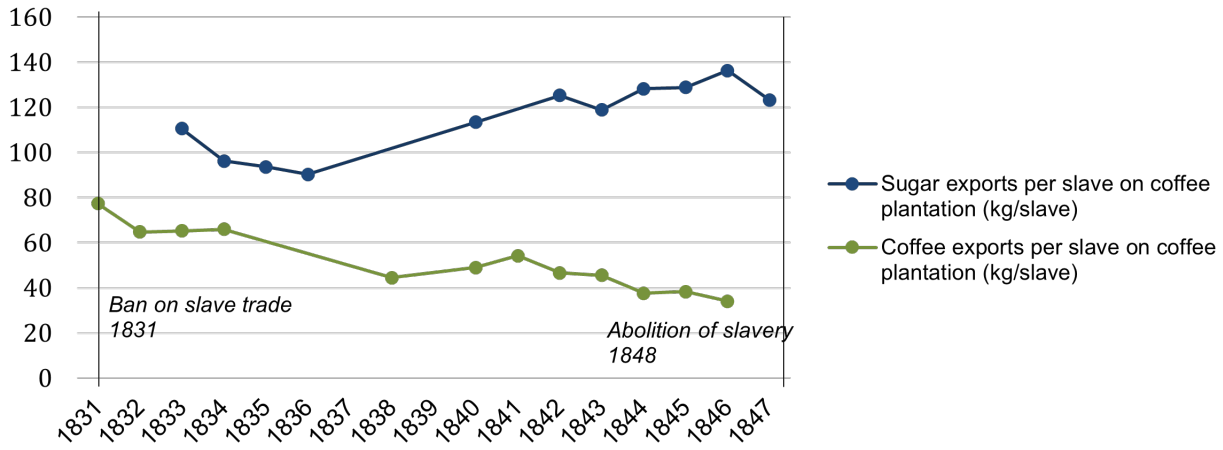
This increase in production could, however, only be done through an increase of the workload. Indeed, the 1831 ban on slave trade caused a decrease of the total enslaved population (Figure A5). Back of the envelope calculations suggest this resulted in an aggregate +12% increase in the workload of enslaved workers on sugarcane, compared to those on coffee plantations (Figure 2). This suggests that the labor coercion gap between sugarcane and non-sugarcane workers widened in the decades preceding abolition.

3 Crop as Measure of Enslavement Conditions

Until now, examination of the link between crop produced and enslavement conditions has relied on cross-country comparisons or context-specific anecdotal evidence. I add within-island quantitative evidence to this discussion and investigate whether changes in the sugarcane market prior to abolition might have widened the coercion gap between sugarcane and non-sugarcane enslaved workers.

[10]Sugarcane planters initially responded to this new competitor by actively lobbying for the introduction of new taxes on beet sugar products while simultaneously reducing import tariffs for sugarcane. This strategy proved to be efficient for a while, but beet sugar production surged again from 1843 onwards. In 1837, their lobbying efforts led to the imposition of heavy taxes on beet sugar producers and the subsequent closure of several recently established factories in mainland France. This move faced strong opposition from private investors who had injected significant capital in beet sugar production. Additionally, cultivating sugar beets was found to provide highly nutritious livestock feed, creating promising economic opportunities for the development of French livestock farming As a result, the economic arguments put forth by the colonists to prevent the development of beet sugar became increasingly difficult to sustain. In 1843, the preferential import tax system that had benefited sugarcane planters came to an end. This prompted a significant surge in beet sugar production, which accounted for 50% of sugar imports by 1847

Figure 2: Workload per Enslaved Worker from 1831 to 1847, by Crop Type: on Sugarcane Plantations (Blue) and Coffee Plantations (Green)



Notes: This figure displays the yearly aggregate exports in sugarcane (resp. coffee) in kg divided by the total number of enslaved worker attached to sugarcane (resp. coffee). This back of the envelope calculation provides suggestive evidence of the evolution of the workload per enslaved worker on plantations, depending on crop types. Yearly exports and enslaved workers size were taken from Schnakenbourg (1977)'s collection of official statistics (*Tableaux Statistiques du Ministère de la Marine*

3.1 Data

In 1834, the French government introduced the mandatory registration of death and birth of enslaved workers[11]. These civil records provide a unique opportunity to approach their living and working conditions through the lens of demographic events. I construct a county level dataset on the number of enslaved deaths and births by county and year from 1834 to 1848 (252 observations)[12]. For each county, I collect information on land use in 1820 from the Statistical Bulletin of the Ministry of the Colonies[13] I also collected yearly series on sugarcane prices and beet sugar production to examine the relationship between pressure on the sugarcane market and enslavement conditions, going through the yearly statistical bulletins from the French National Statistics Institute (INSEE, *Résumés retrospectifs*).

[11]Planters had to pay taxes according to the number of their enslaved workers, but could easily hide this information from the government. This mandatory registration was done to keep track of this tax base, and as a way to introduce more control over plantations. Incentives to declare enslaved deaths were high, as taxes were proportional to the size of enslavers' labor force.

[12]For each county, registries were usually not available for all years. I exclude counties which had less than four available years between 1834 and 1848.

[13]As land use was likely endogenous to events affecting the sugar market, I use information as close as possible to the introduction of beet sugar in France : 1820 for Guadeloupe, 1818 for Martinique.

3.2 Descriptive results

I now explore how death patterns evolved in the decade prior to abolition, depending on the sugarcane intensity of the counties of enslavement. I define the sugarcane intensity as the share of sugarcane over cultivated surface in 1820. When dividing counties along the median value of sugarcane intensity(54%, see Table A4), plot of the average yearly deaths in Figure 3 displays a clear difference in average death patterns with sizable increase in average yearly deaths in sugarcane intensive counties. I measure whether changes in death patterns in sugarcane intensive areas are correlated with changes in the pressure on the sugarcane market - measured in yearly prices or beetsugar production - in appendix C. I find a strong association between changes in deaths and changes in the pressure on the market. More specifically, when comparing a non-sugarcane intensive county (40% of sugarcane over cultivated surface in 1820) and a sugarcane intensive county (60% of sugarcane over cultivated surface in 1820), I find that the decrease in sugarcane prices between 1834 and 1848 (-20%) was associated with a +134% increase in deaths over the 15-year period preceding abolition[14]. I find no effect on enslaved births, which suggests that changes in mortality patterns are not driven by population changes between and within counties. Results are robust to including terrain characteristics, secondary crop production, county population, or using beetsugar production as treatment measure of market pressure. This suggests that the shock on the sugar market and subsequent increase in sugarcane production might be responsible for the large increase in enslaved mortality prior to abolition.

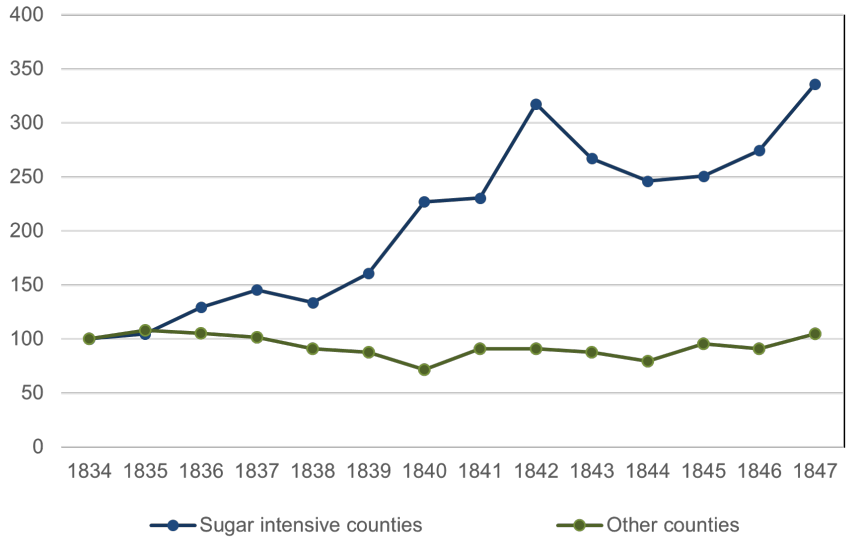
3.3 Discussion

I discuss in more details in Appendix C whether this large increase in deaths should be attributed to increased coercion, or alternative explanations such as natural disasters, illegal slave trade, selection, etc. I find suggestive evidence that coercion is the most likely driver of my results.

Facing lower revenues, sugarcane planters could have cut spending on the enslaved labor force (food, clothes), and/or change the level of production - with aggregate statistics suggesting an overall increase in the workload per individual. Both decisions could have affected enslaved mortality through: (i) worse nutritional intake because of budget cuts, or because enslaved individuals have less time to grow food; (ii) exhaustion and degradation of health; (iii) physical abuse to maintain the work pace and prevent rebellious actions; (iv) accidents in the manufacturing process, which

[14]Considering that the value of the interaction coefficient between sugarcane prices and sugarcane intensity is equal to -6.6%. When multiplying this effect by the overall decrease in prices registered over the time period (-20%), we find a +134% increase in the number of deaths between 1834 and 1847

Figure 3: Average Number of Enslaved Deaths in Sugarcane Intensive Counties (Blue) and Non-Sugarcane Intensive Counties (Green), 1834-1847



Notes: This figure displays the average number of enslaved deaths registered in sugarcane intensive counties (resp. non sugarcane intensive counties), normalized at 100 in 1834. Sugarcane intensive counties are those whose share of sugarcane over cultivated surface is above the median (54%). Regression results estimating the association between yearly changes in sugarcane prices and yearly changes in deaths, depending on the sugarcane intensity of counties of enslavement, are displayed in Appendix C

were much more frequent on sugarcane plantations and more likely to happen when individuals were exhausted. All aspects of living and working conditions were determined by the planters. I therefore interpret a worsening of any of said conditions as an intensification of exploitation of enslaved individuals.

Pushing some of the slaves to exhaustion might have been a profit maximizing decision for sugarcane planters in a context where their dominion on the French sugar market was coming to an end. First, because words of abolition started to reach the islands starting the 1830's. Second, because sugarcane prices were collapsing worldwide while beet sugar production was gaining terrain (Ward, 1978). In this context, a short-term strategy which consisted in producing as much as possible likely allowed them to limit revenue losses or, for some, increase revenues.

4 Measuring Past Enslavement Conditions

4.1 Data collection

After this empirical assessment of crop's reliability as measure of coercion intensity, I study enslavement conditions' intergenerational impact on descendants after abolition between 1852 and 1856.

4.1.1 Data sources

To do so, I compile a novel dataset on *all* formerly enslaved individuals who had children after abolition (18,000 newborns) using two administrative archival sources.

Census of the Newly Freed, 1848: The "Census of the Newly Freed" was conducted between 1848 and 1852 to give civil identities to 150,000 freed individuals. Government officials recorded individuals' basic demographic characteristics, former place of enslavement, and assigned them surnames. Official guidelines prohibited the use of white settlers' surnames, and recommended mythological names, name transformation - anagrams, letter intercession – to ensure that surnames would be distinct from each other (Durand, 2011). As a result, family names given to newly freed individuals were highly distinguishable, providing a rare opportunity for tracking families using surnames as a quasi-perfect identifier of an individual's ancestry. Own data collection effort, transcriptions from genealogists ("Anchoukaj") and the Departmental Archives of Martinique and Guadeloupe, allowed for the collection of nearly 110,000 registries covering 70% of the newly freed population, with 45,000 distinct surnames. 90% of these surnames were given to less than 6 individuals[15] (Figure 4). I exploit this unique dataset to assign a given surname to a county of origin. For surnames given to several counties (5% of the family names), I consider the county with the majority of individuals bearing the surname as the county of origin. I then use the share of sugarcane over cultivated surface in the counties of origin to determine surnames' exposure to coercion intensity prior to 1848.

Birth and Death records, 1852-1856: I study coercion's impact on family environment along two dimensions: family structure (absent fathers), and child development (child mortality). To do so, I use never yet digitized civil records covering all birth and death events in the French

[15]Individuals sharing the same surnames typically referred to a mother and her children. Indeed, marriages were uncommon, and children usually bore the surname of the mother

West Indies population from 1852 to 1856. I digitized 30,000 birth records and 25,000 death records with information on date, place of registration, name and gender of newborn or deceased and parents (name, age, occupation, place of residence). Death records were exclusively used to identify children who died before 1857[16]. I identify birth records referring to formerly enslaved mothers, and match mothers' names with the census to retrieve its former enslavement conditions. I am able to achieve a 80% matching rate. Using only the matched birth records of formerly enslaved mothers, I then identify fathers' former coercion exposure using the same matching process [17]. I provide further details on the matching procedure in Appendix, section A.2. The final birth sample comprises 18,000 births, born of 15,000 mothers, with 9,000 who had more than one child. These mothers represent 60% of the female population aged 17 to 40 years old in 1848.

Criminal records. I use additional data sources to investigate mechanisms and explore the link between historical coercion and post-abolition behaviors. Using the Overseas French National Archives search engine[18], I compiled a list of *all* French convicted criminals sent to the French colony of Guyana between 1850 and 1950, totaling 100,000 individuals. Within this comprehensive list, including convicts from both the French mainland and the colonies, I identified 3,500 surnames unique to the French West Indies. I employed this newly collected data to examine whether surnames originating from these areas were disproportionately represented among transported criminals. In addition to the surname dataset, I digitized the records of 700 individual convicts residing in the French West Indies (see Image A3 for an example). These convicts belonged to the specific category of "réclusionnaires," sent to labor camps in Guyana with the possibility of returning after serving their sentences. Among this group, 300 were formerly enslaved on the islands, and had information on their county of birth. I use this subsample of detailed criminal records to explore differences in the type of crime commited.

4.1.2 Data collection tool

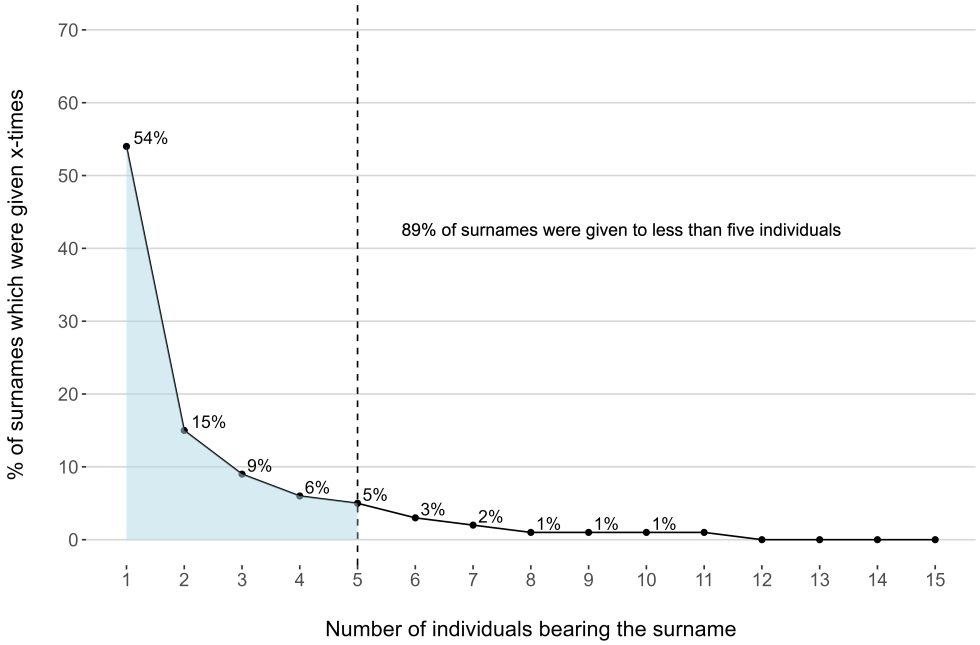
The large number of handwritten pages that I processed called for an automated approach. Accessible and reproductible solutions involving Optical Character Recognition are often well suited for printed text, but fall short when dealing with handwritten documents - even more so for archival

[16] In some counties, death records were not available - this was the case for Pointe a Pitre, the main city of Martinique

[17] 4,000 children had a formerly enslaved mother, and a father whose former exposure to coercion could not be determined. When analyzing the conjunct effect of mothers and fathers' coercion exposure, I remove these observations from the analysis.

[18] Accessed via "Registres des bagnards" with surname-based search available at IREL

Figure 4: Distribution of Surnames given to the Newly Freed Population in 1848, According to Number of Times they were Given



This figure displays the distribution of surnames given to the newly freed population, according to the number of times the surname was assigned to a newly freed individual in the census. We can read on the figure that 89% of these surnames were given to less than 6 individuals. Most of the time, these individuals were from the same family. This visual shows that formerly enslaved surnames are highly unique.

documents. Despite thriving research in document processing techniques published in open source, researchers often face high costs when dealing with archival documents. With the support of the STEG-CEPR PhD Grant Scheme, I have developed a comprehensive pipeline designed to digitize scanned archives from the 19th century. I leverage on machine learning techniques, including Optical Character Recognition (OCR) and the use of a Large Language Model (LLM) to extract key information from OCRed text. The pipeline encompasses three stages:

- Parsing Layout: The initial stage involves layout parsing, wherein global images are segmented into smaller units, each containing a single line of text.
- Optical Character Recognition (OCR) Module: Following layout parsing, the OCR module takes center stage, transcribing individual images into text.
- Named Entity Recognition (NER) Module: In the final stage, the Named Entity Recognition module extracts key information from the transcribed archival content.

The OCR module is the most notable contribution of this pipeline: I developed a model of text

recognition tailored for French handwritten text from archival records. It is a special case of the TrOCR (transformer OCR) (Li et al. 2022), which I adapted to French handwritten text using archival records from enslaved and formerly enslaved civil records. More details on each step of the pipeline and use cases are given in appendix, section B.

4.2 Main outcomes of interest

Presence of father in birth record. Birth records provide precise information regarding the identification of a child's parents, with statements such as "Mr. X acknowledges himself as the father." While maternal details are consistently recorded, paternity is unspecified in more than half of these registries. As official birth records serve as legal evidence of a child's lineage, the omission of paternal information implies that, legally, the child lacks a recognized father.

Child mortality. Children who did not survive prior to 1857 were identified by matching birth and death records using date of birth, age of the child at death, name of the child, and parents information (name, age, occupation). The recording of dates of birth and death allows for precise measurement of children's survival at the monthly level.

4.3 Empirical Strategy

I use parent's former place of enslavement, which I determine based on their surnames, as a plausibly exogenous variation in enslavement conditions to identify the effect of slavery on family structures and child mortality.

Treatment. For each parent, treatment is defined as a categorical variable, where exposure to the most extreme conditions will be distinguished from low and high coercion exposure. This allows me to identify whether enslavement conditions have a non-linear effect.

- Lower Intensity: Sugarcane production surface over cultivated surface below the median (30 counties, for 7,325 mothers and 2,398 known fathers)
- High Intensity: Median to 80th percentile (18 counties, for 7,450 mothers and 2,159 known fathers)
- Extreme Intensity: 80th to 100th percentile; (12 counties, for 3,421 mothers and 1,349 known fathers)

General Specification. I estimate the effect of enslavement conditions on absent father using a probit model, and estimate the risk of child death using a survival model (Cox Proportional Hazard, Cox (1972)). In both cases I consider parents' former enslavement conditions as treatments and use two-way fixed effects to control for unobserved heterogeneity at the county and year level. I consider the general specification:

$$Y_{i,m,f,c,y} = \alpha + \beta_m T_m + \beta_f T_f + \gamma_i X_i + \gamma_m X_m + \gamma_f X_f + \gamma_c + \theta_y + \varepsilon_{i,m,f,y,c} \quad (1)$$

Where $Y_{i,m,f,c,y}$ represents the outcome for the child i, born to mother m and father f, in year y, and county c. γ_c are county of residence fixed effects, and θ_y year-fixed effects. X_m, X_f are vectors of characteristics of mother m and father f (occupation, residence, age). The inclusion of these variables allows for netting out the enslavement condition effect from income or demographic characteristics. T_m (resp. T_f) is my treatment indicator of mother's (resp. fathers') enslavement conditions, which I determine based on each of the parents' surnames. In all specifications, standard errors are clustered at the island and county level.

Exogeneity assumption *Enslaved workers were not selected into different crop types*

As per external sources, there was no apparent evidence of selection bias across crop types concerning ethnicity, gender, or age composition (Fallope, 1983, 1987). In addition, the population composition at the time of abolition appears to be relatively comparable in terms of age, sex-ratio and family size (Figure A8). Finally, since labor conditions were more demanding on sugar plantations and sugar planters tended to be wealthier, I expect that any selection bias on enslaved workers' health should be positive. A negative effect of enslavement conditions on child health should, therefore, be interpreted as a lower bound of the actual impact of coercion on the quality of childhood environment.

Alternative Specification on Movers. To net out family-based mechanisms from geographic determinants, I also adopt an alternative strategy focusing solely on parents who relocated from their county of enslavement: this represents 50% of my sample, with similar proportions across different coercion groups (see Table 1 and A5).

Table 1: Descriptive Statistics on Mothers Who Had a Child between 1852 and 1856, According to Former Coercion Exposure

	Former Exposure to Coercion		
	Low	High	Extreme
N	7,325	7,450	3,421
Birth in plantations	0.55	0.60	0.63
Child deaths	0.10	0.08	0.11
Mother, Age	27.53	27.26	26.97
Mother, Moved	0.53	0.57	0.53
Mother, number of births	1.39	1.36	1.39
Mother, Field worker	0.71	0.70	0.74
Mother, Domestic worker	0.07	0.06	0.06
Mother, Trader	0.10	0.12	0.08
Mother, Skilled worker	0.02	0.02	0.01
Mother, No occupation	0.10	0.11	0.10
Absent Father	0.42	0.46	0.33
Characteristics of fathers with whom mothers had children			
Father, Age	34.40	34.58	34.42
Father, Moved	0.50	0.55	0.48
Father, Lower Coercion	0.27	0.10	0.15
Father, High Coercion	0.11	0.24	0.10
Father, Extreme Coercion	0.07	0.04	0.30
Father, Field Worker	0.64	0.59	0.63
Father, Skilled worker	0.17	0.19	0.19
Father, Trader	0.04	0.05	0.04
Father, Employee	0.02	0.02	0.02
Father, Landlord	0.11	0.13	0.10

Notes: Average statistics computed on the sample of formerly enslaved mothers who had a child between 1852 and 1856. Descriptive Statistics on fathers are presented in a similar way in Appendix, Table A5

5 Effect of Enslavement Conditions on Families

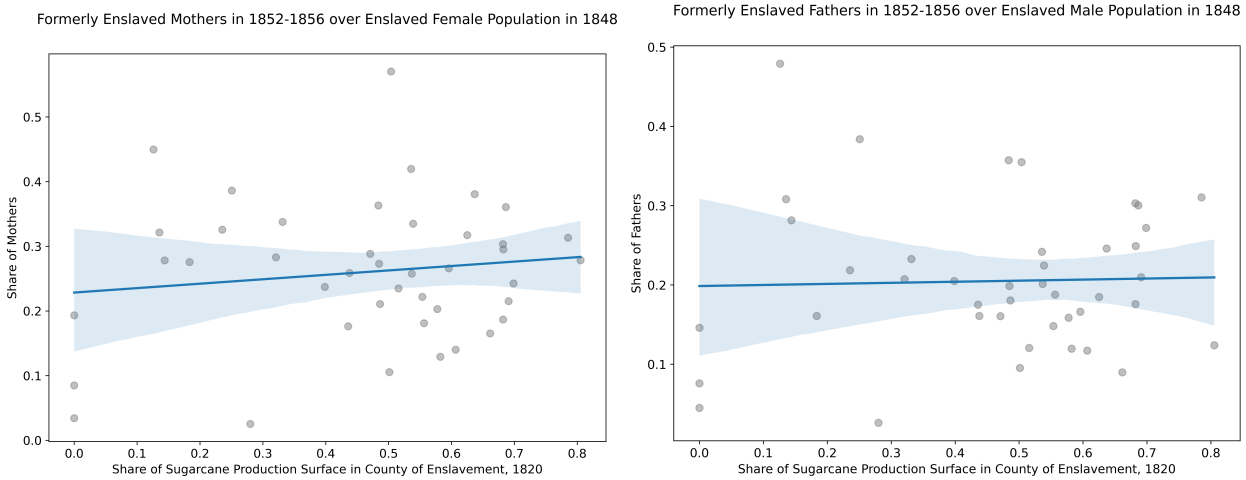
5.1 Checking for selection into parenthood

Who becomes a parent. Descriptive statistics on parents who had a child between 1852 and 1856 depending on their former coercion exposure are displayed Table 1 for mothers, and Table A5 in Appendix for fathers. I find that both mothers and fathers are similar in terms of age in 1852, number of children between 1852 and 1856, and occupation. I also find that around half of the parents moved from their county of enslavement after abolition, with similar proportion of movers in the different coercion groups.

Fathers' presence and observed couples. Post abolition mobility led to the formation of mixed-couples with differing levels of coercion exposure. I find that between 17% and 25% of previously enslaved mothers had a child with a father exposed to a different degree of coercion, allowing for investigating differences in the effect of *paternal* and *maternal* transmission.

Paternal Presence and Child Mortality. Overall, I find that parents have comparable characteristics across different coercion exposure. I note however that families seem to differ on two key aspects: the absence of fathers, which is lower among the most extremely coerced mothers (30% against 40% for the other mothers); and child mortality: while the share of mothers who experienced child death is relatively similar across coercion groups, I find that 14% of families involving extremely coerced fathers experienced child death, against 8% in families involving low coercion fathers. I now formally investigate the extent to which these observations do reflect systematic patterns imputable to coercion history.

Figure 5: Selection into Parenthood Depending on Former Enslavement Conditions



Note: These figures are binned scatterplots relating the share of formerly enslaved individuals who became parents between 1852 and 1856, with the share of sugarcane over cultivated surface in their former county of enslavement. The share of sugarcane reflects the intensity of coercion exposure. Each point represents a county. For a given county, the y-value is equal to the number of mothers (resp. fathers) who were enslaved in this county, divided by the total formerly enslaved female (resp. male) population aged 17-40 (resp. 17-65) enslaved in this county as per the 1848 Census. The blue line is a linear fit of the relationship between share of parents and sugarcane intensity, the shaded area represents 95 percent confidence bands.

Table 2: Probability of Absent Father in Birth Record Between 1852 and 1856

	Baseline Estimates *Full Sample*			Alternative Estimates *Mothers Moved*		
	(1)	(2)	(3)	(4)	(5)	(6)
High coercion vs. Low	−0.07	−0.07*	−0.05	−0.04	−0.05	−0.03
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.06)
Extreme Coercion vs. Low	−0.12**	−0.13**	−0.09	−0.03	−0.05	−0.04
	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)	(0.08)
Mother's age		−0.13***	−0.14***		−0.14***	−0.19***
		(0.03)	(0.04)		(0.05)	(0.05)
Male birth		−0.03***	−0.03***		−0.03***	−0.03***
		(0.003)	(0.003)		(0.004)	(0.004)
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mother's occupation	No	No	Yes	No	No	Yes
Mean	0.42	0.43	0.44	0.41	0.42	0.43
Observations	18,196	16,508	15,337	9,703	8,609	7,876
AIC	22,736	20,368	17,946	12,431	10,918	9,283

Notes: This table shows the effect of mother's former enslavement conditions (taking as reference group those exposed to the lowest coercion intensity) on the probability that no father would be mentioned in the birth record of her child. The omission of paternal information implies that, legally, the child lacks a recognized father. Baseline estimates are calculated over the full sample of newborns (specifications 1 to 3). Alternative estimates are calculated over the restricted sample of newborns whose mother moved from their county of enslavement. The number of observations changes from specification (1) and (2) because fathers whose former enslaved status could not be determined are removed from the regressions. Some observations are also lost because of missing values (on age of mother, occupation, etc.). Coefficients displayed are probit estimated odd-ratios. For λ a coefficient, an increase in one unit of a covariate is associated with an increase of (exp(λ)-1)% in the outcome. $^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

5.2 Absent Fathers

I follow the general empirical specification detailed in Equation 1and estimate the probability of fathers being absent from birth records depending on the mother's exposure to coercion intensity[19]. Baseline results using the sample of all mothers are displayed in the first three specifications of Table 2. I find a positive and significant effect (+20%) of worse enslavement conditions on fathers' presence. When turning to the alternative specification which focuses on mothers that moved from their county of enslavement, I find that the effect of maternal coercion is still positive, but much smaller in magnitude and no longer significant (last three specifications in Table 2). This suggests

[19]I use the general specification for binary outcomes, which is a generalized least squares model with binomial family and account for clustered standard errors at the island, county and year levels

that residence in the most sugarcane intensive areas is an important driver of fathers' presence - perhaps through residence on large plantations, where women and men worked closely (Miller, 2018). The fact that coefficients associated with high and extreme coercion remain positive even among movers could also reflect that worse enslavement conditions could have fostered stronger ties to overcome hardship.

5.3 Child Mortality

Table 3: Risk of Child Death Before 1857, Depending on Coercion Exposure of Parents

	Baseline Estimates on Full Sample			
	(1)	(2)	(3)	(4)
Mother: High coercion vs. Low	−0.04	−0.08	−0.08	−0.07
	(0.07)	(0.08)	(0.09)	(0.09)
Mother: Extreme Coercion vs. Low	0.01	−0.06	−0.03	−0.04
	(0.09)	(0.10)	(0.11)	(0.11)
Father: High coercion vs. Low		−0.02	0.02	0.04
		(0.12)	(0.13)	(0.13)
Father: Extreme Coercion vs. Low		0.28**	0.30**	0.33**
		(0.13)	(0.13)	(0.14)
Father: Absent vs. Low		0.09	0.07	0.07
		(0.09)	(0.10)	(0.10)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes
Mother's age	Yes	Yes	Yes	Yes
Mother's occupation	No	No	No	Yes
Mean	14.15	14.14	13.99	14.02
Observations	16,484	12,236	11,233	10,545

Notes: This table displays the estimated effect of parental exposure to coercion on children's risk of death before 1857 for children born between 1852 and 1856. Coefficients are estimated using a Cox Proportional Hazard model over the full sample of newborns. For λ a coefficient, an increase in one unit of a covariate is associated with an increase of (exp(λ)-1)% in the outcome.$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

Parental exposure to coercion's effect on child mortality. I estimate children's risk of death using a Cox Proportional Hazard Model (CoxPH) (Cox, 1972), which is a specific class of survival models. It estimates age-specific hazard-functions (probability of failure at age t conditional on having survived at $t-dt$), while taking into account data censoring: that is, when the hazard (death)

can only be observed up to a certain date, which is the case in my setting (I am able to observe children's death up to the 31st of December 1856).

The empirical specification used to estimate the effect of parents' former enslavement conditions on child mortality is the following:

$$\lambda_i(t) = \lambda_0(t) \cdot \exp(\beta_m T_m + \beta_f T_f + \gamma_i X_i + \gamma_m X_m + \gamma_f X_f + \gamma_c + \theta_y + \varepsilon_{i,m,f,y,c}) \tag{2}$$

Where $\lambda_i(t)$ is the hazard rate for individual i at time t. $\lambda_0(t)$ is the baseline hazard rate, in comparison to which the coefficients of the model are estimated in relative terms[20]. Variables included in the model are the same as the general specification 1: β_m and β_f represent the average effect of mothers and fathers' coercion exposure on age-specific risk of death.

Baseline estimates are presented Table 3. I find that mother's differential exposure to coercion has a null effect on a child's risk of death, which holds when controlling for age, gender of the birth, occupation and paternal exposure to coercion. I find, however, that paternal exposure to coercion has a significant impact on child mortality. More specifically, I find that presence of *extremely coerced fathers* increases the probability of child mortality before 5 years old by 35% respective to low coercion fathers[21]. This is equivalent to a 5 percentage points (pp) increase relative to the average child mortality (14%).

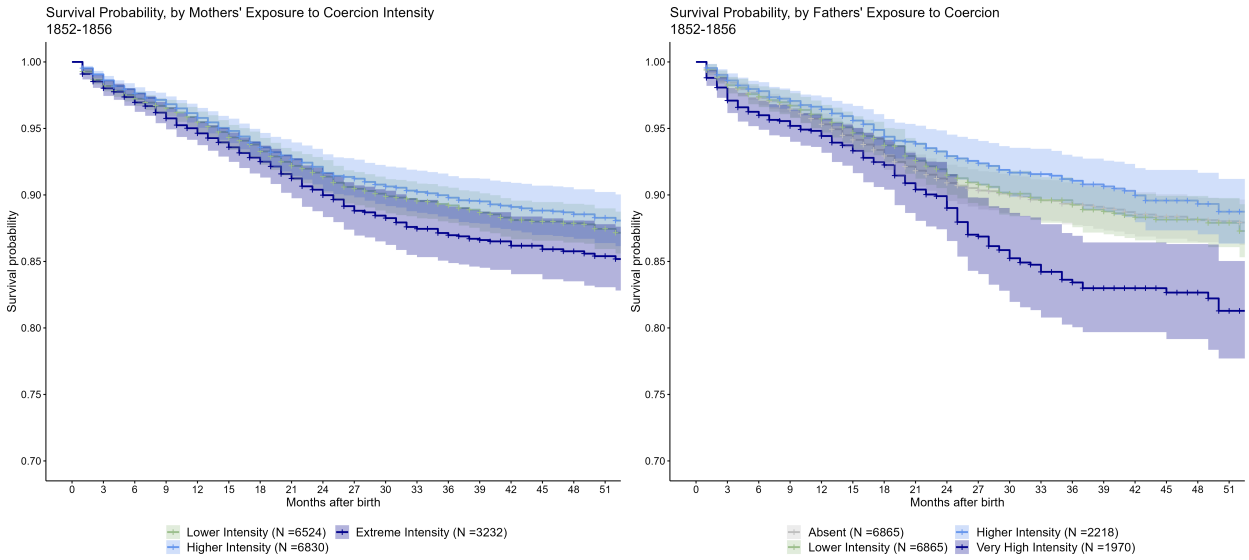
Alternative Non-Parametric Estimation. An important assumption of the CoxPH model is that the effect of each covariate on the risk of death should be constant at each age. While children's health has been shown to be primarily determined by mothers' inputs in the first months of life (Lee, 2005; Zhao et al., 2017) broader inputs (environmental, paternal) start having a more prominent role when children start walking or stop being breastfed. To account for the possibility that paternal inputs might not have a constant effect overtime, and to visualise changes in survival probabilities by month of age, I use the non-parametric Kaplan-Meier probability function[22]. I es-

[20]The baseline hazard represents the hazard at time t for a reference group (e.g., individuals with all covariates set to zero). It is not directly estimated by the model, but represents the reference point against which all other hazard rates are compared. It allows to evaluate the effect of covariates on the relative hazard without having to specify a parametric form for the baseline hazard.

[21]For an estimated coefficient of 0.28, the effect of paternal exposure to extreme coercion corresponds to an increase of $exp(0.28) - 1$ in the probability of child death.

[22]The Kaplan-Meier function calculates the product of the conditional probabilities of survival up to time t for all distinct event times t_i that are less than or equal to t. $S(t) = \prod_{i:t_i \leq t} \left(1 - \frac{d_i}{n_i}\right)$ Where: $S(t)$ is the survival probability at time t; t_i represents the distinct event times observed in the dataset; d_i is the number of events (e.g., deaths) that occur at time t_i, n_i is the number of individuals or subjects at risk of experiencing an event at time t_i. I estimate the Kaplan

Figure 6: Monthly-Survival Probability of Children, Depending on Mothers' (left) and Fathers' (right) Former Coercion Exposure



(a) Mothers (b) Fathers

Notes: These figures display the Kaplan-Meier Non-Parametric survival probabilities of children born between 1852 and 1856, which are estimated separately depending on the coercion history of the mothers (left) and the fathers (right). Shaded areas represent robust 95 percent confidence bands.

timate the survival probability separately for groups defined by parents' coercion exposure, while accounting for county clustering. Graphical visualizations are presented in Figure 6. Visuals show that children with more coerced mothers exhibit a lower, although statistically non-significant, survival probability. When turning to fathers, I find that children whose father was extremely coerced have a significantly lower survival probability relative to a less coerced father.

6 Mechanisms

I now delve into the potential underlying mechanisms contributing to elevated child mortality within households where fathers experienced extreme coercion. I first examine the possibility that the measured effect of extremely coerced fathers' presence on child mortality could, in fact, be due to confounding factors which are unrelated to fathers' coercion exposure per se (geographic characteristics, mothers' characteristics, income).

Meier estimator for each value of mothers' coercion exposure, and fathers' coercion exposure, separately.

6.1 Spatial Sorting

I use the alternative specification and focus on movers to net out the effect of geographic factors from family-level mechanisms. Results presented in the first four specifications of Table 4 display a stronger effect of paternal exposure to extreme coercion, equivalent to a 7pp increase in the risk of a child death. This suggests that coercion estimates are not confounded by place of residence specific-factors which could affect mortality.

It could still be, however, that extremely coerced fathers that moved might have all gone to counties in which overall environmental or economic conditions were poor. As shown in Table A6, extremely coerced fathers were spread across the different counties, but at varying degrees. When excluding from the analysis the counties where extremely coerced fathers are present in 30% of families, I still obtain a large and positive impact of extremely coerced fathers on child mortality (see the last four specifications of Table 4). This suggests that concentration of fathers into high mortality areas once slavery was abolished is not driving my results.

6.2 Income

I then examine whether extremely coerced fathers' effect on child mortality could be due to income. To rule out this possibility, I conduct an analysis on higher-income fathers only (i.e., those not employed as field workers). Results are presented Table A8 in Appendix. The effect remains positive and of similar magnitude, though statistical significance varies across specifications, possibly due to sample size.

Presence of an extremely coerced fathers could have a differential impact depending on income. Heterogeneity analyses (see Figure A11) of the effect of paternal exposure to extreme coercion analyses interacted with parental occupation do suggest a stronger effect when fathers are field workers, i.e when they belong to the lowest income group. This effect is however only significant among fathers who moved from their county of enslavement.

6.3 Maternal Attributes

Another potential explanation could be that extremely coerced men systematically match with women that have less resources to care for children (either economic, social or emotional). Heterogeneity analyses display no differential impact of paternal exposure to extreme coercion depending on mothers' own coercion history (see Figure A11), or when controlling for their socio-

demographic characteristics. This suggests that the effect of paternal exposure on child mortality stems from fathers' themselves[23].

6.4 Union Stability

I explore the possibility that the adverse impact of extreme paternal coercion on child health could be linked to a removal of fathers' inputs into children's environment, either because of death or separation with the mother during children's early years of life. To do so, I focus on women who had several children between 1852 and 1856, and where the father of the first child is known (N=643). I use this subsample to estimate the probability that fathers of subsequent children would be different than the first one or unknown, depending on the coercion exposure of the first father, and that of the mother. Baseline estimates are presented in appendix, Table A9. I find that extreme coercion exposure of the first father has a large but non significant effect on the probability that next fathers would be different or missing, relative to less coerced fathers. This could reflect the fact that extremely coerced fathers tend to disappear more, which could cause an income (or emotional) shock that might partially contribute to the deterioration of the quality of childhood environment. Since only 8% of the mothers with several children have them with different fathers, this explanation can only provide a partial explanation for my results[24].

These findings indicate that the significant negative effect of the presence of extremely coerced fathers on child health cannot be accounted for by income, geographical location, maternal attributes, or fathers' disappearance. This suggests that extreme coercion exerts a discernible influence on what fathers pass on to their children. This leads to the crucial question of identifying the specific factors that contribute to this adverse influence.

6.5 More Coerced Men Could Be More Violent

Previous research on Holocaust survivors' suggest that men may be less successful at shielding their parenting practices from the impact of trauma compared to women (Levav et al., 1998;

[23] Another possibility could be that women might be systematically more vulnerable on unobserved characteristics. If this were solely driven by mothers, I would anticipate differences in infant survival across coercion groups to show from birth, when child survival primarily depends on maternal factors. However, visuals displayed Figure 6 show that the effect of extreme paternal coercion becomes more evident starting at the age of two and beyond, when children are exposed to a broader range of environmental factors, including potential interactions with their fathers.

[24] I also note that Mothers' coercion exposure has a positive effect on the probability of fathers to be different, although extremely coerced mother actually appear *less* likely to have children with several fathers relative to high coercion mothers.

Table 4: Risk of Child Death Before 1857, Robustness Checks to Account for Spatial Sorting of Fathers

	All Fathers Who Moved				Fathers Moved where Low Presence of Extremely Coerced Fathers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reference category: Low coercion exposure								
Mother: High coercion	0.25	0.24	0.31	0.41	0.35	0.33	0.37	0.31
	(0.17)	(0.18)	(0.19)	(0.21)	(0.18)	(0.19)	(0.20)	(0.21)
Mother: Extreme Coercion	0.22	0.16	0.26	0.40	0.31	0.23	0.25	0.27
	(0.20)	(0.20)	(0.21)	(0.24)	(0.23)	(0.24)	(0.25)	(0.26)
Father: High coercion		−0.03	0.02	0.10		−0.02	0.02	0.15
		(0.17)	(0.18)	(0.19)		(0.25)	(0.26)	(0.28)
Father: Extreme Coercion		0.35*	0.39**	0.46**		0.45**	0.48**	0.59**
		(0.18)	(0.19)	(0.20)		(0.20)	(0.21)	(0.23)
Father: Absent			0.25	0.20			0.29	0.25
			(0.14)	(0.16)			(0.16)	(0.17)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother's occupation	No	No	No	Yes	No	No	No	Yes
Father's occupation	No	No	No	Yes	No	No	No	Yes
Mean	14.3	14.3	14.03	14.11	14.36	14.38	14.13	14.29
Observations	2,744	2,744	2,427	2,070	2,389	2,364	2,105	1,909

Notes: This table displays the estimated CoxPH effect of parental exposure to coercion on children's risk of death before 1857 for children born between 1852 and 1856, on the subsample of children whose father moved from their county of enslavement. The first four specifications present estimates for all children whose father moved. The last four specifications focus on children whose father moved in counties where the presence of families with extremely coerced fathers is low (less than 30% of families). For λ a coefficient, an increase in one unit of a covariate is associated with an increase of (exp(λ)-1)% in the outcome.$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

Kestenberg, 1980; Harkness, 1993). They are also more likely to resort to violence when under stress (Card and Dahl, 2011). I argue that fathers' limited contributions to child care or inattention to children are not the primary drivers of fathers' effects on child mortality. If this were the case, I would expect the impact on child health to be similar to that of absent fathers. However, our observations demonstrate that children's survival probability is significantly lower when fathers are extremely coerced, indicating that these fathers actively worsen the child's environment.

A probable explanation for the large detrimental effect of paternal exposure to extreme coercion could be that extremely coerced men are more prone to violence. I expect this mechanism to have large effects on child mortality, as previously shown in various contexts, whether developed or developing (Aizer, 2011; Bhalotra and Rawlings, 2011; Currie et al., 2022).

To test this hypothesis, I examine descriptive evidence on the types of crime committed by prisoners who were formerly enslaved, and were sent to the penal colony of Guyana between 1850 and 1890 (300 observations) . I plot the share of convicted prisoners per 1000 formerly enslaved individuals[25] according to the sugarcane intensity in their former county of enslavement in Figure A13. Interestingly, while the relationship between overall crime rates and harsh enslavement conditions is negative, it becomes positive when I focus on violent crimes, and more specifically sexual crimes. I do a similar exercise using the list of all 100,000 French transported criminals between 1850 and 1900, and plot the share of surnames found among transported individuals, by county of origin of the surname in Figure A12. I also find a positive association between a surname' coercion history, and its prevalence among transported criminals. Although both analyses are descriptive and do not allow for a causal link, this descriptive evidence suggests a potential connection between the two.

7 Conclusion

In this paper, I provide the first empirical evidence on the influence of enslavement conditions and family-level transmission in shaping post-abolition inequality in childhood environment. Unlike previous studies that relied on regional-level variations in coercion exposure, the unique context of my study and the comprehensive dataset I have compiled allow me to *precisely associate* individuals to their former coercion exposure, and to *effectively disentangle* coercion effect from local institutional or income-related factors.

[25] I use the population data from the 1848 Census to calculate crime rates by former place of enslavement

My main finding is that extremely coerced men had a significantly adverse impact on child health, potentially due to instances of violence, compared to less coerced fathers. As child mortality is not only an extreme marker of poor childhood environment but can also have significant negative spillover effects on family members, this results reflects substantial inequality among children of formerly enslaved parents. The ability to differentiate between maternal and paternal transmission allows me to reveal significant gender differences in response to coercion, with men displaying potentially less resilience mechanisms than women.

Another noteworthy finding of this study is that, while single-mother households are common after abolition, they did not constitute the predominant family structure following abolition. My research also points to a potential *positive* effect of worse enslavement conditions on fathers' presence. This finding calls for a nuanced approach to the previously made link between violence during slavery and "broken" families under the form of absentee fathers.

This research has limitations which I aim to address as part of a broader research agenda on the social consequences of slavery. First, my analysis is limited to immediate descendants of the formerly enslaved. I am currently digitizing the complete set of civil records from 1848 to 1905 to gain a dynamic perspective on the importance of family-level transmission relative to place of residence determinants, in driving post abolition outcomes. Second, my examination of post-abolition inequality is restricted to formerly enslaved families. One of my upcoming projects will focus on identifying white families' surnames from pre-1848 civil records and studying interracial marriages, which was a key access point to capital after slavery ended.

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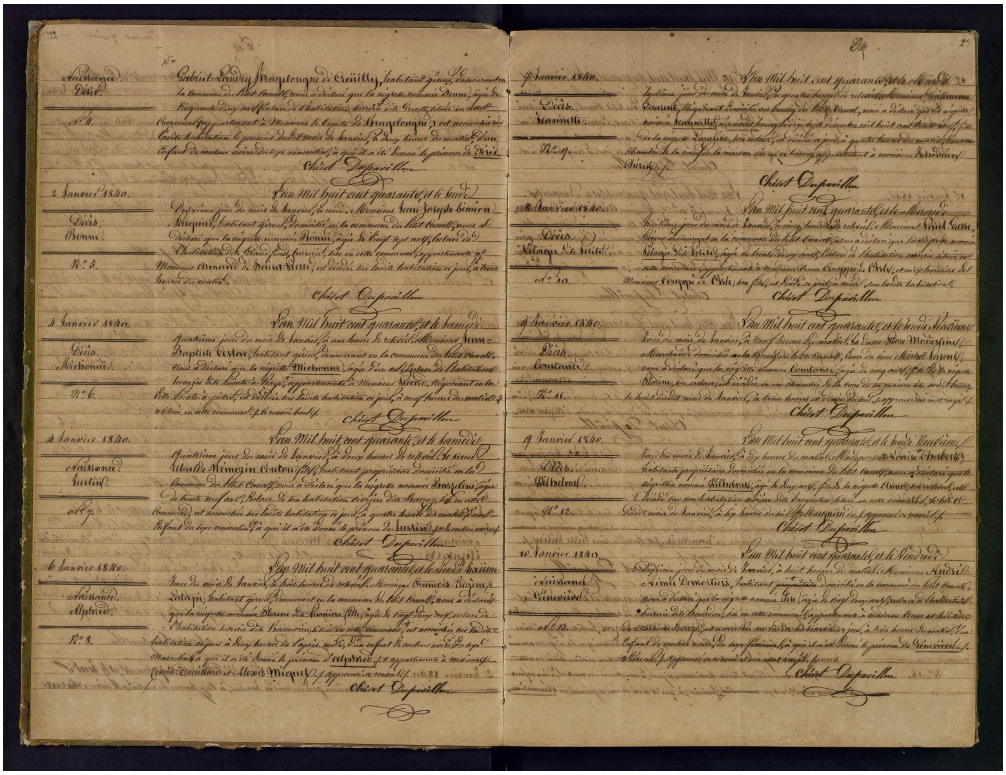
Table of Contents

A Archives

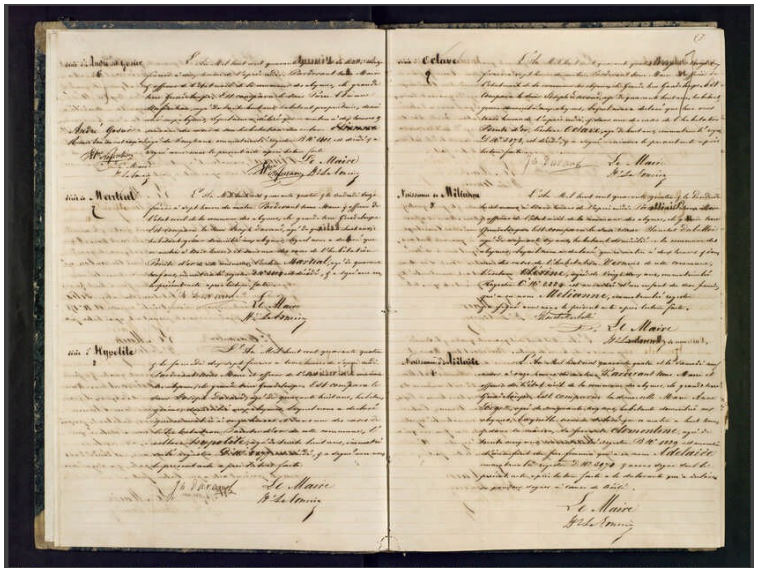
A.1 Data sources

Figure A1: Example of census of the Newly Freed record



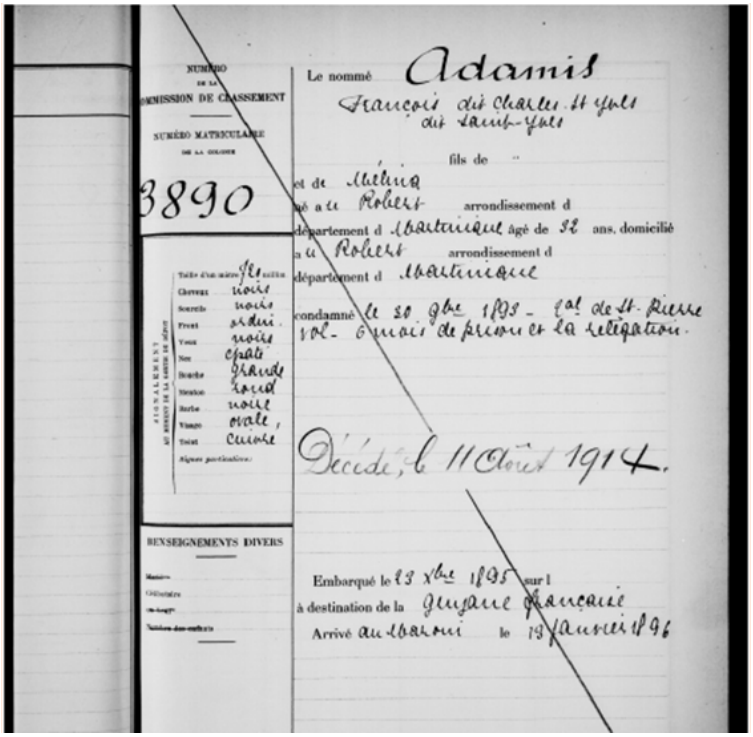
Source: French Overseas National Archives, *Registres des Nouveaux Libres*

Figure A2: Example of post abolition civil registries



Source: French Overseas National Archives, *Registres d'Etat civil*

Figure A3: Example of convicts' record



Source: French Overseas National Archives, *Registres des bagnards*

A.2 Matching procedure

For each birth record, I matched the surnames of both mothers and fathers with the Census of the Newly Freed to determine parents' former place of enslavement. To achieve this, I first isolated the surname from the parents' full names. In 20% of cases, the parents' full names only included common names (e.g., Marie Louise Elizabeth), making it difficult to pinpoint the surname. To ensure accurate matches, I excluded most common names from parents' full names using official statistics on names given at birth in the French West Indies between 1870 and 1910 (French National Statistics Institute, INSEE).

Next, I matched the remaining components with the surname database of the Census of the Newly Freed, employing Fuzzy matching techniques. I used the Levenshtein distance which quantifies the minimum number of single-character edits needed to transform one string into another. I considered as a potential match surnames where the similarity exceeded 90%, meaning that the share of single-character edits over the string's length did not surpass 10%. In cases of multiple matches for a given name, I selected the one with the highest similarity ratio. If several matches still existed, I chose the one who originated from the county closest to the parents' current residence. In total, I was able to match 50% of the births to an enslaved mother in the census. Considering that 30% of non-matched births likely originate from non-formerly enslaved mothers[26], this represents a matching rate of 80%.

The remainder of unmatched surnames could stem from spelling disparities between census and civil records that exceeded the 10% matching threshold, along with incomplete records in the Census of the Newly Freed. Given the impossibility to identify unmatched parents as either non-former slaves, unregistered slaves, or former slaves with incorrect surnames, I exclude these observations from my analyses.

[26] 30% of the total population were not enslaved in 1848

B Data Collection Tool

Enhancing Historical Archive Structuration Using Machine Learning: A Case Study on 19th Century French Archives.

Marie Beigelman, Arnault Gombert

This documentation presents a comprehensive pipeline designed to structure scanned archives from the 19th century. Leveraging machine learning techniques, including Optical Character Recognition (OCR) and the utilization of a Large Language Model (LLM), we successfully extracted valuable data from historical scans, facilitating its utilization by economist researchers. Our key contributions encompass the following:

- Open-Source Handwritten Data Processing Model: We introduce an open-source model tailored for the processing of images containing handwritten French text. This model enables efficient extraction of handwritten content from scanned documents.
- Manually French Labeled Handwritten Dataset: To train our model effectively, we curated a meticulously labeled dataset of handwritten data. This dataset serves as a crucial resource for training and validating the model's accuracy.
- Reproducible Research Notebooks: In an effort to promote transparency and enable further research, we provide a set of comprehensive notebooks that allow researchers to reproduce our work. Additionally, these notebooks can be adapted to accommodate other languages, thereby extending their utility beyond the scope of French archives.

Adapting the TrOCR model for French text recognition, especially handwritten text from historical archives, has the potential to greatly improve document digitalization for the French-speaking world. By leveraging the power of Transformer-based architectures and incorporating a diverse training dataset, we have achieved promising results. The successful extension of the TrOCR model to French demonstrates its adaptability and potential for multilingual applications. As we continue to refine and expand this model, we anticipate further advancements in OCR technology for languages beyond English, facilitating more efficient and accurate text recognition for a wide range of academic and practical use cases.

B.1 Overview of Pipeline Components

In this section, we provide a concise overview of the primary components comprising the pipeline for archival data processing. The pipeline encompasses three fundamental stages:

1. Parsing Layout: The initial stage involves layout parsing, wherein global images are segmented into smaller units, each containing a single line of text.

2. Optical Character Recognition (OCR) Module: Following layout parsing, the OCR module takes center stage, transcribing individual images into text.

3. Named Entity Recognition (NER) Module: In the final stage, the Named Entity Recognition module extracts key information from the transcribed archival content.

Each of these pipeline components has been meticulously developed and optimized independently to ensure minimal interference with other elements. Our overarching goal is to foster modularity, allowing for the replacement or enhancement of individual components without disrupting the overall input/output pipeline.

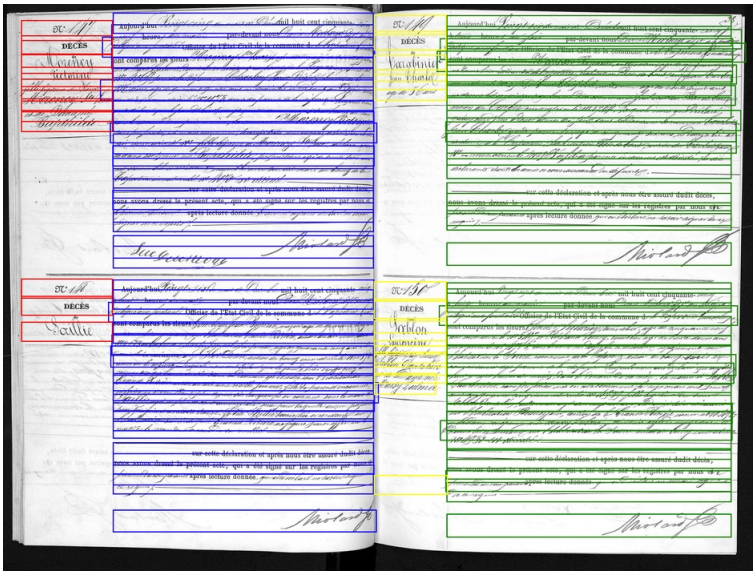
In the subsequent sections, we delve into a more detailed exploration of each pipeline component. We invite the community to actively engage in improving these components and sharing their advancements, thus contributing to the continuous enhancement of this open-source pipeline for the benefit of all.

B.2 Parsing Layout

Layout parsing is a document processing method that segments documents or images into distinct regions, enabling the analysis of their structure and arrangement. It plays a pivotal role in tasks like OCR and information extraction by categorizing content elements based on spatial relationships and visual traits, facilitating the automated understanding and indexing of diverse document types.

In this context, the LayoutParser library, introduced by Melissa Dell and her team (Shen et al., 2021), is a notable contribution. It is very useful for printed documents with clear visual delimitations between text components, but complex layout. Our specific research in digitizing 19th-century French archives presents unique challenges that called for a different approach. Our historical documents typically feature one or two pages of text with distinct margins and a single text column per page. Accurately identifying these columns is crucial for effective content consolidation, as content from different columns at the same vertical position may be unrelated.

Figure A4: Example of layout-parsing on civil registries



To facilitate document segmentation, we harness the research conducted by (Grüning et al., 2019), which presents a two-stage method using the ARU-Net neural network for detecting text lines in historical documents. The ARU-Net framework is available as an open-source resource for further research in this domain. Additionally, we make use of the open-source implementation available at this GitHub repository, which aligns with our segmentation objectives.

We customized the existing methodology to suit the characteristics of 19th-century French archives. These historical documents typically consist of one or two pages of text with distinct margins and one text column per page. Identifying these columns accurately is crucial for consolidating the text effectively, as content from different columns at the same vertical position may be unrelated. Therefore, we chose to build upon the outputs of the ARU-Net model to determine the boundaries of each column, essentially dividing the final document into these columns. We employed statistical analysis to identify areas of high text density within the ARU-Net's XML outputs. Once we pinpointed the column boundaries, we focused on parsing each line consistently, ensuring lines of the same height were processed together to enhance the accuracy of our results.

As part of our ongoing research endeavors, we intend to develop a tailored parser that is specifically optimized for historical archive documents, such as civil records, or census tables. Our aim is to enhance its capacity to accurately identify the precise regions within these documents where textual content is located. We also plan to link our pipeline with Melissa Dells' layout parser tool for researchers dealing with complex document structure.

B.3 TrOCR French Handwritten Model

TrOCR (transformer OCR) is a technology and methodology used for Optical Character Recognition (OCR) tasks. It employs large transformer-based neural networks to extract text content from images, making it particularly effective for recognizing and transcribing text in scanned documents, images, or other visual media. The TrOCR handwritten model for the French language has not been officially released as of yet. To address this gap, we undertook the task of training a French model for proof-of-concept (PoC) purposes. The development of this model highlights the necessity of acquiring additional data for potential improvements, including further training in the initial stage or fine-tuning in the secondary stage. This French model is a specialized iteration of the English large handwritten TrOCR model, originally introduced by (Li et al., 2022). The English model was initially made available in the official repository as a TrOCR model fine-tuned on the IAM dataset.

Fine Tuning Process

The fine-tuning process for the TrOCR French Handwritten Model was conducted in two distinct phases, each employing specific datasets:

Dataset Generation. To adapt to the French vocabulary and incorporate names, surnames, occupations, cities, numbers, and text variations, we initiated the process by creating a dataset containing 70,000 lines. This dataset was generated using a combination of predefined lists and the Text Data Generator. Subsequently, we conducted ten epochs of training exclusively on this dataset to specialize the model for French text patterns.

Fine-tuning with Handwritten Datasets. In the second phase, we fine-tuned the model over 20 epochs using two distinct handwritten datasets: a French Census dataset sourced from Constum et al. To facilitate access, we have also made this dataset available on the Hugging Face Hub. An additional dataset comprising 11,000 lines from French civil records, which has been manually annotated. The development and fine-tuning of this TrOCR French Handwritten Model represent a crucial step toward enhancing optical character recognition capabilities for the French language, with potential applications in various domains.

Model Description

The TrOCR model is a sophisticated architecture, characterized by its encoder-decoder design. It incorporates an image Transformer serving as the encoder and a text Transformer functioning as the decoder. The initialization process for this model involves the utilization of two distinct pre-trained models: the image encoder is initialized from the weights of BEiT, whereas the text decoder is initialized from the weights of RoBERTa. In the TrOCR model, images are presented as a sequence of patches, each having a fixed size (16x16 resolution). These patches are linearly embedded to facilitate processing. Additionally, absolute position embeddings are introduced into the sequence before it undergoes transformations within the encoder layers of the Transformer. Subsequently, the Transformer text decoder operates in an autoregressive manner to generate textual tokens.

Intended Uses & Limitations

The TrOCR model is primarily designed for optical character recognition (OCR) tasks, specifically tailored for single text-line images. It exhibits optimal performance when applied within the context of these use cases. However, it's important to note that the model's capabilities are limited to single text-line OCR and may not be suitable for more complex image analysis tasks or multi-line text recognition.

Technical details

Parameters. In our experimentation, we employed heuristic parameters without undergoing a distinct hyperparameter tuning process. The key parameters utilized in training the model include:

Parameter	**Value**
Learning Rate	4e-5
Epochs	20
Mixed Precision	True
Max Sequence Length	64
Batch Size	128
Train/Dev Split	90/10

Metrics on development set. We evaluated the performance of the model on both the development (dev) and test sets, yielding the following results:

- Set Size: 700 examples from the French Census dataset and 1600 from our own dataset (historical civil records from the French West Indies, 19^{th} century)
- Character Error Rate (CER): 0.0575
- Word Error Rate (WER): 0.1651
- Loss: 0.5768

Metrics on test set.

- Set Size: 730 examples from the French Census dataset and 950 from our own dataset.
- Character Error Rate (CER): 0.09417
- Word Error Rate (WER): 0.23485
- Loss: 0.8700

Usage Instructions

The model is not yet published in public but will be released shortly. Below are the steps which will allow for using this model within the PyTorch framework:

```
from transformers import TrOCRProcessor, VisionEncoderDecoderModel, AutoTokenizer
from PIL import Image
import requests
from io import BytesIO

# Define the URL of the image to be processed
url = "mydesk/main/sample_imgs/5.jpg"

# Fetch the image data from the URL
response = requests.get(url)
img = Image.open(BytesIO(response.content))

# Initialize the TrOCR processor, model, and tokenizer
processor = TrOCRProcessor.from_pretrained('microsoft/trocr-large-handwritten')
model =
    VisionEncoderDecoderModel.from_pretrained('MarieBgl/trocr-large-handwritten-fr')
```

```
tokenizer = AutoTokenizer.from_pretrained('MarieBgl/trocr-large-handwritten-fr')

# Prepare the image data for input
pixel_values = processor(images=img, return_tensors="pt").pixel_values

# Generate textual output
generated_ids = model.generate(pixel_values)
generated_text = tokenizer.batch_decode(generated_ids,
    skip_special_tokens=True)[0]
```

By following these steps, users will be able to effectively use the TrOCR model to perform optical character recognition (OCR) on images using PyTorch: simply provide the image that needs to be processed, and the model will generate the corresponding textual content.

B.4 Extract entities from texts

Named Entity Recognition (NER) is a natural language processing technique that involves identifying and classifying specific named entities or entities of interest in text data. These entities can include names of individuals, organizations, locations, dates, monetary values, and more. NER plays a crucial role in information extraction and text analysis, enabling automated systems to recognize and categorize key information within textual data, facilitating tasks such as data structuring, sentiment analysis, and information retrieval.

Furthermore, Large Language Model (LLM) is a deep learning model, typically based on transformer architectures, that has been pretrained on vast amounts of text data to understand and generate human-like language. These models can perform a wide range of natural language understanding and generation tasks, such as text completion, translation, and text summarization.

LLMs, can efficiently extract entities when provided with a schema parameter and a well-crafted prompt. By specifying a schema, you can guide the model to recognize and extract specific types of entities, such as dates, names, or locations, from the text it generates. A well-constructed prompt, which is a textual input or question, can further instruct the model to focus on extracting particular information, making it a powerful tool for automating entity extraction tasks in various domains, from extracting financial data to answering specific questions about a given text.

Here is an example of a final output that we obtained for a birth certificate using LLM:

```
"name": "Petrin Isabelle Marie Constance",
"sex": "femme",
"birth date": "23 Fevrier",
"birth place": "Coma section des hauteurs",
"father's name": "Setrin Vital",
"father's age": "23",
"father's job": "cultivateur proprietaire",
"father's birth place": "Abymes",
"father's residence place": "section des hauteurs",
"mother's name": "Urie Marie Antoinette Dedoise",
"mother's age": "23",
"mother's job": "sans profession",
"mother's birth place": "None",
"mother's residence place": "Abymes"
```

C Sugarcane and Enslaved Mortality Before 1848

I formally assess whether enslaved population's living conditions were affected by sugarcane planters' response to decreasing revenues. I divide counties into two groups based on the median share of land dedicated to sugarcane production over cultivated surface in the 1820's (54%). My treatment measure of pressure on sugarcane revenues is the sugarcane consumption price in France[27].I also consider an alternative measure, which are beet sugar production levels in mainland France. I interpret a decrease in sugarcane prices (resp. increase in beetsugar prodution) as intensified pressure on sugarcane revenues. I consider that a higher share of sugarcane production surface in a county in 1820 should increase workers' exposure to the competition shock (treatment exposure), which I expect should lead to an increase in the number of enslaved deaths.

Specification. I run the following log linear regressions at the county per year level:

$$LY_{c,y} = \alpha + \beta LSugarsurf_{c,1820} + \lambda LPrice_y + \lambda LPrice_y LSugarsurf_{c,1820} + X_c + \gamma_c + \theta_y + \varepsilon \quad \text{(A3)}$$

Where LY refers to the log number of deaths or birth in county c and year y; $LSugarsurf$ is the log sugarcane production surface in 1820, which I consider as treatment exposure. The continuous treatment $LPrice$ stands for the yearly consumption price of sugarcane. In alternative specifications, I use $LBeetprod$ yearly-log beet sugar production in mainland France in 1000 metric tons. The coefficient of interest, λ, measures the association between average yearly deaths (or birth) in more sugarcane intensive counties when pressure on the sugar market increases. X_c is a vector of county specific continuous variables which includes total county size, slave population size, log of coffee production surface in 1820 as well as terrain characteristics (elevation, soil type). County fixed effects are included to account for other time-invariant and unobserved characteristics likely to affect slave mortality (water quality, local infrastructure,etc.). Year fixed effects account for trends affecting mortality in all counties, which are not accounted for by the yearly treatment variation. Standard errors are clustered at the county level.

Results. Regression results display a strong association between enslaved yearly deaths and exposure to the shock on the sugar market. When comparing a non-sugarcane intensive county (40% of sugarcane over cultivated surface in 1820) and a sugarcane intensive county (60% of sugarcane

[27]Sugarcane price series are consumption prices per kg in mainland France, as published in the official historical bulletins (INSEE, "Résumés rétrospectifs") and collected by Villeneuve (Villeneuve, 1960). Beetsugar series are also collected from Villeneuve.

over cultivated surface in 1820), I find that the decrease in sugarcane prices between 1834 and 1848 (-20%) was associated with a +134% increase in deaths over the 15-year period preceding abolition[28]. I find no effect on enslaved births, which suggests that changes in mortality patterns are not driven by population changes between and within counties. Results are robust to including terrain characteristics, secondary crop production, county population, or using beetsugar production as treatment measure of market pressure. This suggests that the shock on the sugar market and subsequent increase in sugarcane production might be responsible for the large increase in enslaved mortality prior to abolition.

Table A1: Log-linear association between sugarcane consumption prices and enslaved deaths and births between 1834 and 1847

	Enslaved deaths		Enslaved births	
	(1)	(2)	(3)	(4)
Sugar surf. in 1820 (log)	-0.33^{**}	0.21	-0.32^{***}	-0.05
	(0.14)	(0.11)	(0.06)	(0.06)
Sugarcane price x Sugar surf. in 1820 (log)	-0.33^{*}	-0.35^{*}	0.04	0.05
	(0.18)	(0.17)	(0.11)	(0.11)
Total surf. in 1820 (log)	2.94^{***}	3.24^{***}	2.20^{***}	2.92^{***}
	(0.69)	(0.85)	(0.33)	(0.47)
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Terrain and soil charac.	No	Yes	No	Yes
Coffee crop surface	No	Yes	No	Yes
Population 1820	Yes	Yes	Yes	Yes
Mean	79	79	77	77
Observations	252	243	252	243
R-squared	0.91	0.91	0.91	0.91
Adjusted R-squared	0.89	0.89	0.89	0.89
F statistic	36.31^{***}	37.99^{***}	37.64^{***}	37.65^{***}
Notes:	$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$			

Interpretation. Since treatment variation occurs at the yearly level, demographic changes associated with changes in beet production could also be due to other events affecting sugarcane intensive counties more than others. I now explore alternatives explanations for the large increase in enslaved deaths in the decades prior to abolition: natural disasters, epidemics, population changes, selection.

[28]Considering that the value of the interaction coefficient between sugarcane prices and sugarcane intensity is equal to -6.6%. When multiplying this effect by the overall decrease in prices registered over the time period (-20%), we find a +134% increase in the number of deaths between 1834 and 1847

Table A2: Log-linear association between beet sugar production (1000 metric tons) and enslaved deaths and births between 1837 and 1847

	Enslaved deaths		Enslaved births	
	(1)	(2)	(3)	(4)
Sugar surf. in 1820 (log)	-1.62^{***}	-1.13^{**}	-0.26	0.01
	(0.61)	(0.64)	(0.45)	(0.45)
Beetroot prod. x Sugar surf. in 1820 (log)	0.10^{**}	0.10^{***}	-0.004	-0.004
	(0.05)	(0.05)	(0.04)	(0.04)
Total surf. in 1820 (log)	2.96^{***}	3.20^{***}	2.19^{***}	2.93^{***}
	(0.67)	(0.90)	(0.33)	(0.48)
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Terrain and soil charac.	No	Yes	No	Yes
Coffee crop surface	No	Yes	No	Yes
Population 1820	Yes	Yes	Yes	Yes
Mean	79	79	77	77
Observations	252	243	252	243
R-squared	0.91	0.92	0.91	0.91
Adjusted R-squared	0.89	0.89	0.89	0.89
F statistic	36.88^{***}	38.64^{***}	37.62^{***}	37.63^{***}
Notes:	$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$			

Two natural disasters occurred in 1843 and 1845 (forest fires, earthquake, hurricane) and caused heavy casualties in the city of Fort-de-France. I find that regression results are not sensitive to changing the timeframe to exclude the affected years (1843 onwards), or counties that were most affected by the disasters [29] (Table A3, specification 6 and 7). I searched for episodes of natural disaster, disease outbreak, and enslaved revolts that could have affected enslaved mortality in a sizeable way[30] .

The null association between changes in sugarcane prices and enslaved births suggests that overall enslaved population increase is not a likely explanation for the increased in enslaved deaths. An increase in the number of non-slave workers, such as indentured workers, would not be reflected in the enslaved population civil registries, and cannot explain our results . Internal migrations of enslaved workers could have occurred towards sugarcane plantations in need of labor. However, I would also expect these internal migrations to be reflected in a relative decrease in the number of

[29]For Martinique, this includes the counties of Le Carbet, Case-Pilote, Lamentin and Ducos. For Guadeloupe, this includes the counties of Le Lamentin, Les Abymes, Le Gosier.

[30]I searched for natural disasters and disease related words in historical sources, using key words such as “disaster”, “catastrophe”, ”disease”, ”yellow fever”, “mortality” (Alfred, 1935). I finally read through the official statistical bulletins of the Ministry of the Colonies (“Tableaux Statistiques”) from 1837 to 1848,in which major events were typically recorded. I do not find traces of such events in the Colonial Ministry’s official statistics.

Table A3: Robustness checks: Log-linear association between beet sugar production (1000 metric tons) and enslaved deaths

	Dependent variable: Log of deaths						
	(1) Main	(2) Terrain	(3) Other Crops	(4) 1840--1847	(5) Placebo	(6) 1837--1842	(7) Excluding cities
Price x Sugar surf. in 1820	-0.33^{*}	-0.35^{*}	-0.35^{*}	-0.39^{**}		-0.39^{*}	-0.39^{**}
	(0.18)	(0.17)	(0.17)	(0.18)		(0.22)	(0.17)
Price x Coffee surf. in 1820					-0.19		
					(0.20)		
Total surf. in 1820 (log)	-0.16	6.91^{***}	-0.94^{***}	-0.71^{*}	-0.87^{**}	-1.21^{**}	-0.91^{***}
	(0.24)	(1.60)	(0.34)	(0.35)	(0.36)	(0.44)	(0.34)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Terrain and soil charac.	No	Yes	Yes	Yes	Yes	Yes	Yes
Population 1820	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	252	243	243	195	243	125	208
R-squared	0.91	0.91	0.91	0.92	0.91	0.95	0.93
Adjusted R-squared	0.89	0.89	0.89	0.90	0.89	0.92	0.91
F statistic	36.31^{***}	37.99^{***}	37.99^{***}	38.48^{***}	37.29^{***}	30.44^{***}	44.17^{***}
Notes:	$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$						

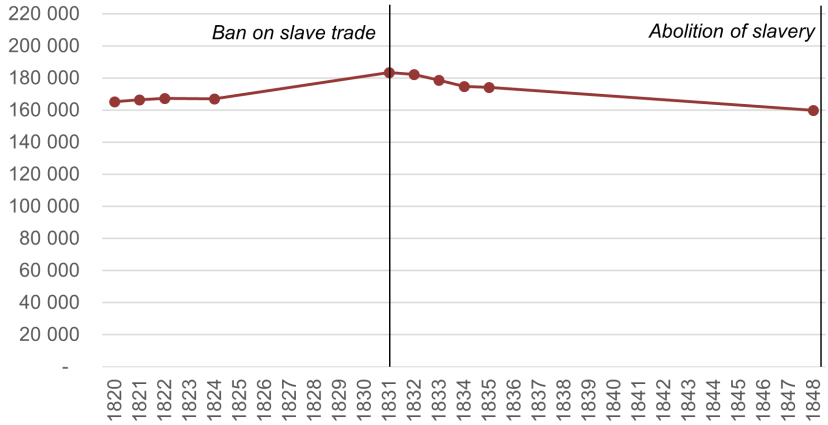
enslaved births in coffee intensive counties. External flows of enslaved workers were legally prohibited with the strongly enforced ban on slave. It is possible however that some planters managed to resort to the illegal trade route. I expect that the death of illegally purchased workers would not be reported by planters and would therefore not be reflected in the enslaved civil registries. I still check whether results are sensitive to excluding counties close to ports, where planters were more likely to have access to the illegal trade (Fallope, 1983).

Another potential explanation could be selection. Namely, that enslaved individuals would be negatively selected relative to their health in sugarcane intensive areas, respective to the others. If that were the case, events affecting the entire islands might have had a stronger impact on them regardless of coercion conditions. Although I cannot directly test this hypothesis, previous evidence from the historical literature suggests that this was not the case. On the contrary, sugarcane planters tended to be wealthier than others and could afford to buy the strongest workers. Therefore, the increase in yearly deaths that I document are likely to be lower bounds of the actual worsening of enslavement conditions in more sugarcane intensive counties relative to others.

D Additional Tables and Figures

D.1 Pre-abolition

Figure A5: Enslaved population in Martinique and Guadeloupe, from 1820 to 1848

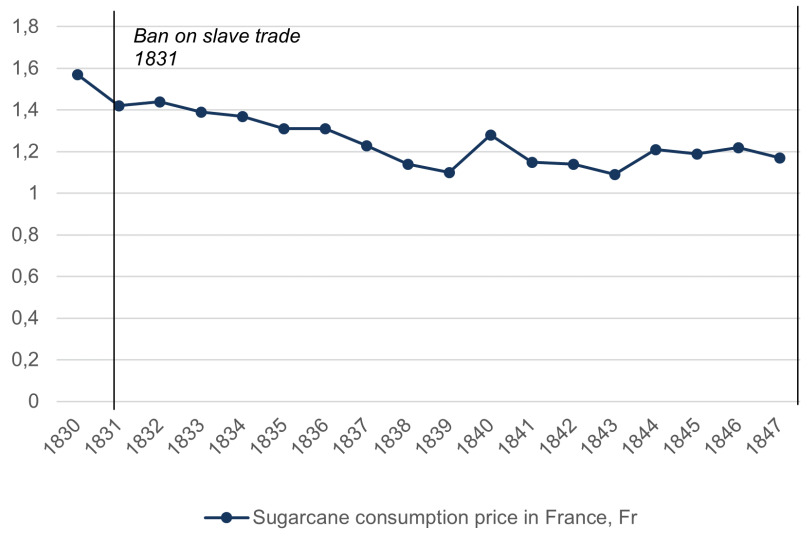


Source:1820-1835 Ch. Schnakenbourg, Statistiques pour l'histoire de l'économie de plantation en Guadeloupe et Martinique (1635-1835) ; 1848, Tableaux de population et de cultures des Colonies Françaises, Ministère de la Marine et des colonies

Table A4: Descriptive statistics on land use and cultivated surface in 1820

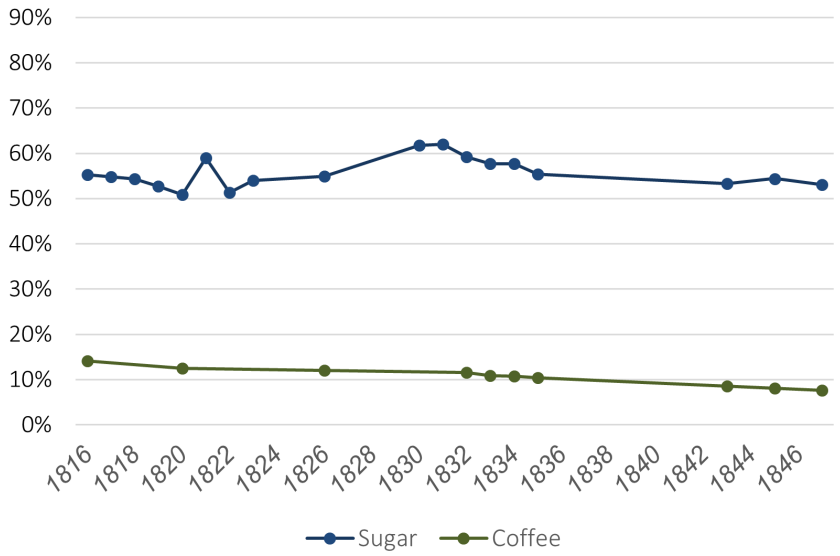
	Min	Median	Average	Std.dev	Max
Total surface	361	3053	3199	1364	8 480
Cultivated surface	105	801	1030	600	3 320
Sugarcane surface	0	342	582	417	1 980
Sugarcane surface, % of total county surface	0%	15%	16%	7%	37%
Sugarcane surface, % of cultivated surface	0%	54%	49%	16%	81%

Figure A6: Sugarcane consumption prices in France (Fr per kg)



Source:R. Villeneuve, "Le financement de l'industrie sucrière en France, entre 1815 et 1850". Note : data is not available prior to 1830

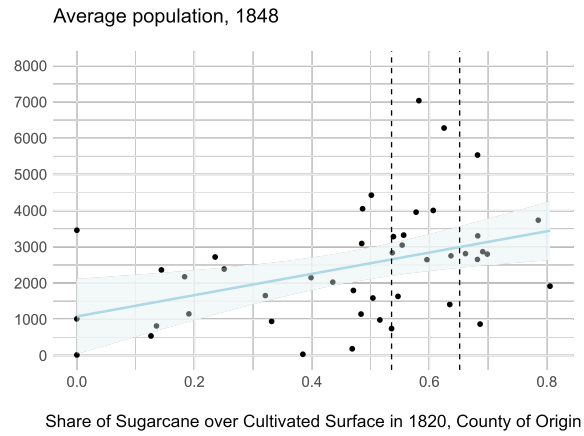
Figure A7: Sugarcane and coffee surface as share of arable surface



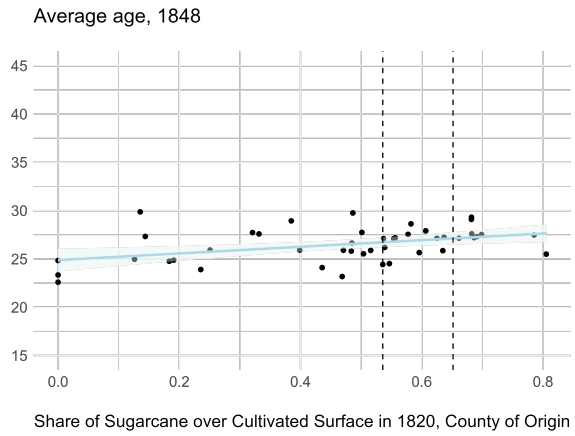
Source:1820-1835 -Ch. Schnakenbourg, Statistiques pour l'histoire de l'économie de plantation en Guadeloupe et Martinique (1635-1835) ; 1835-1848, Tableaux de population et de cultures des Colonies Françaises, Ministère de la Marine et des colonies

D.2 Census of the Newly Freed

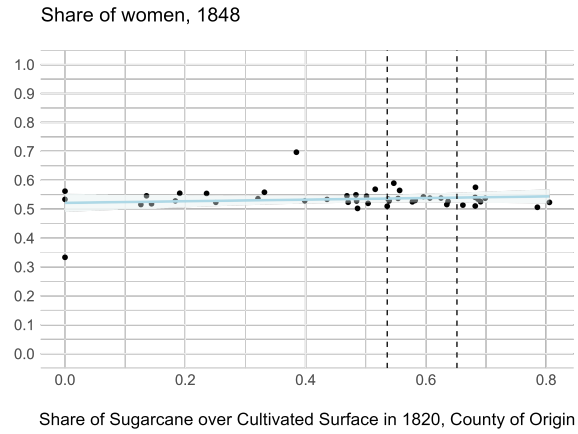
Figure A8: Descriptive Statistics on the Newly Freed Population in 1848, by Share of Sugarcane over Cultivated Surface in Former County of Enslavement



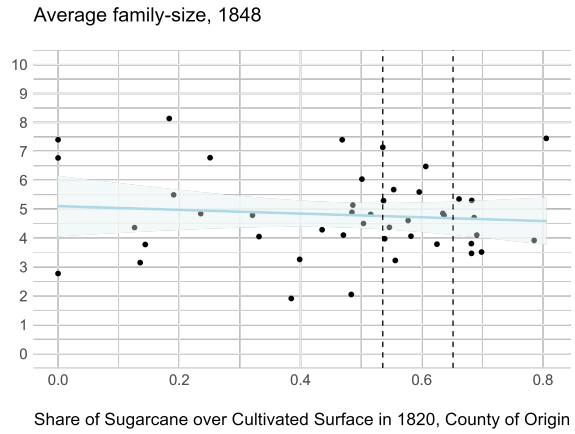
(a) Average population



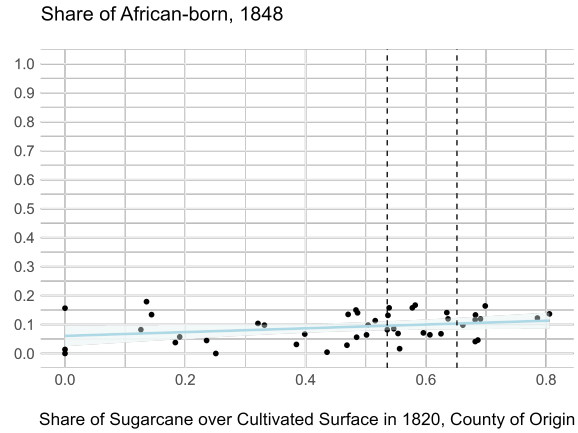
(b) Average age



(c) Share of women



(d) Average family size



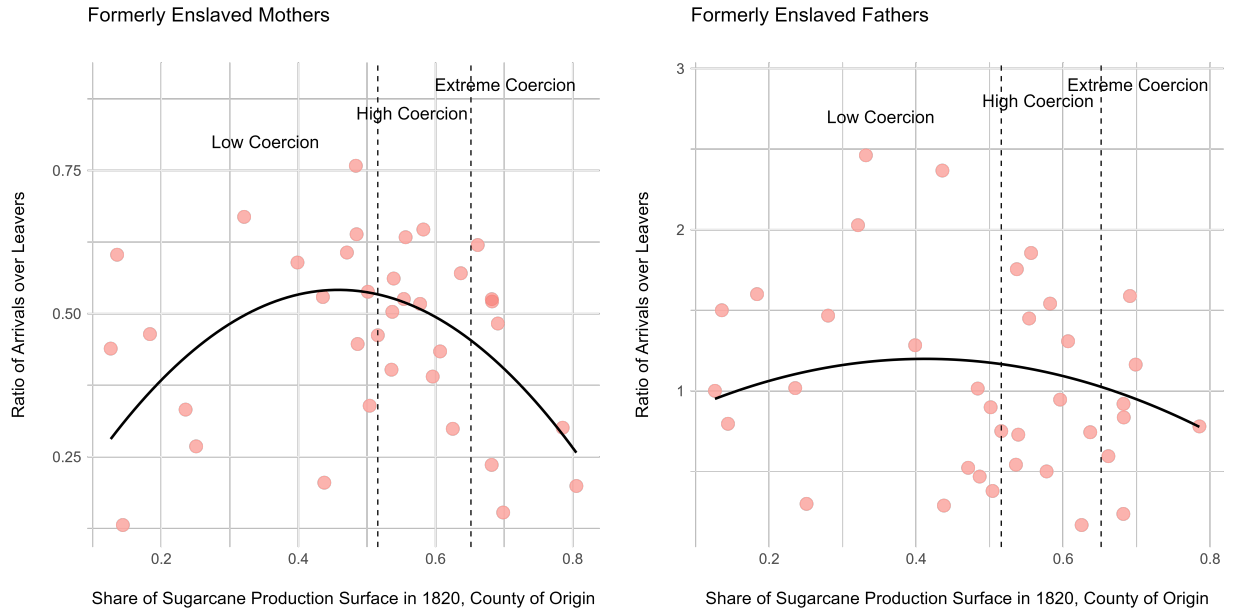
(e) Share of African born

Note: The vertical doted lines delimit the enslavement conditions categories (lower, high, extreme)

D.3 Post Abolition Parental Characteristics

Mobility. Following the abolition of slavery, around half of the parents, whether mothers or fathers, left the counties of enslavement (Table 1 and A5). The relationship between the share of new-comers[31] and the intensity of sugarcane production in the current counties of residence exhibits an inverted U-shaped curve (Figure A10). This suggests that both urban areas and counties entirely specialized in sugarcane production ("Extreme Coercion" during slavery) were less popular destinations for post-abolition migrants. Lower attractiveness of Urban Areas could be explained by the fact that more than 80% of the population were field workers upon abolition (Table 1 and A5). After slavery ended, most of them likely sought employment as field workers, rather than cities. As for the most sugarcane intensive areas, these counties were probably the most heavily affected by both the sugar crises and the abolition of slavery. In contrast, other areas with diversified crops (such as subsistence agriculture) were likely to be less affected economically and thus more appealing to post-abolition residents.

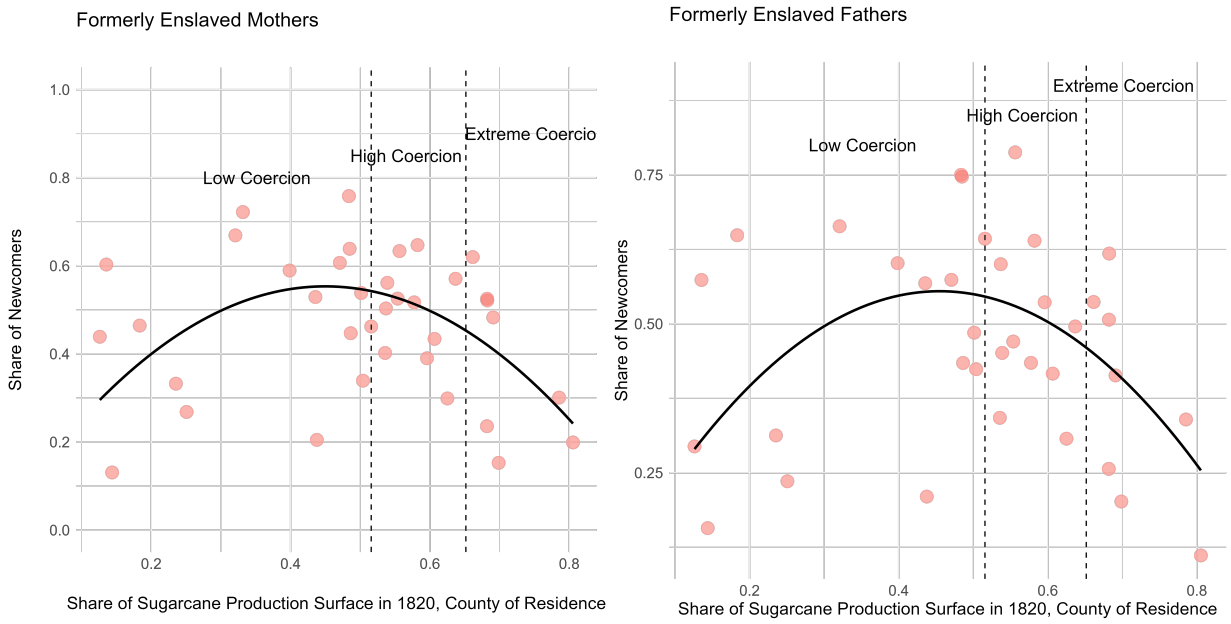
Figure A9: Ratio of emigrants over immigrants, by county of residence: Mothers (left), Fathers (right)



Note: The sugarcane intensity in the residence county is the share of sugarcane surface over total cultivated surface in 1820.

[31] Or emigrants, who left their county of enslavement to settle in the receiving county

Figure A10: Share of Emigrants by Sugarcane Intensity in Receiving County



Note: The sugarcane intensity in the receiving county is the share of sugarcane surface over total cultivated surface in 1820.

Table A5: Descriptive statistics on births with known fathers, depending on fathers' exposure to slavery, 1852-1856

	Low	High	Extreme
N	2,398	2,159	1,349
Birth in plantations	0.58	0.62	0.71
Child deaths	0.10	0.08	0.14
Father, Age	33.81	34.11	33.99
Father, Moved	0.50	0.56	0.45
Father, Field Worker	0.71	0.69	0.69
Father, Skilled worker	0.14	0.15	0.19
Father, Trader	0.03	0.04	0.03
Father, Employee	0.01	0.01	0.01
Characteristics of mothers with whom known fathers have children			
Mother, Lower Coercion Intensity	0.62	0.28	0.27
Mother, High Coercion Intensity	0.22	0.61	0.18
Mother, Extreme Coercion Intensity	0.16	0.11	0.55
Mother, Age	28.19	28.14	27.44
Mother, Moved	0.48	0.53	0.44
Mother, Number of births	1.43	1.41	1.42
Mother, Field worker	0.79	0.77	0.80
Mother, Domestic worker	0.04	0.03	0.04
Mother, Trader	0.06	0.07	0.07
Mother, Skilled worker	0.02	0.01	0.01
Mother, No occupation	0.10	0.12	0.08

Table A6: Distribution of Newborns in 1852-1856, According to the Status of their Father, By County of Residence

	Absent Fathers	Lower Coercion	High Coercion	Extreme Coercion
abymes	47.75	36.04	7.81	8.41
anse bertrand	33.49	47.27	5.46	13.78
capesterre belle eau	30.72	9.80	54.03	5.45
capesterre de mg	38.67	40.27	12.81	8.24
carbet	72.40	4.66	18.64	4.30
case pilote	80.32	1.06	16.49	2.13
commune des trois bourgs	70.80	5.40	21.60	2.20
commune du nord	53.35	4.30	38.81	3.54
commune du sud	71.35	21.15	4.62	2.88
ducos	54.37	33.24	9.58	2.82
françois	50.62	7.84	36.82	4.73
gosier	38.75	54.79	4.17	2.29
gourbeyre	30.84	31.31	18.22	19.63
grand bourg de mg	38.10	27.62	23.97	10.32
gros morne	62.76	23.98	9.69	3.57
lamentin	31.30	8.04	1.30	59.35
le lamentin	71.65	3.23	23.91	1.21
lorrain	64.93	13.72	14.60	6.75
marin	71.06	14.47	9.50	4.97
morne a l'eau	57.88	24.62	7.34	10.15
moule	37.11	20.88	34.73	7.28
petit canal	24.59	17.82	14.03	43.56
pointe a pitre	69.02	18.90	4.35	7.72
pointe noire	40.12	45.51	3.59	10.78
port louis	16.67	17.25	5.43	60.66
precheur	74.57	12.83	9.13	3.48
riviere pilote	67.38	15.41	11.97	5.25
robert	53.38	8.77	33.85	4.00
saint claude	25.83	63.74	6.87	3.55
saint esprit	72.45	12.69	13.36	1.50
saint francois	65.22	7.44	22.66	4.67
saint louis de mg	31.65	46.28	11.17	10.90
saint pierre	73.46	7.20	16.65	2.69
sainte anne	53.28	30.46	7.04	9.22
sainte luce	75.58	13.95	9.30	1.16
sainte marie	66.89	5.20	25.44	2.46
sainte rose	35.67	12.53	6.37	45.44
trinite	65.02	7.47	14.94	12.56
trois rivieres	36.97	29.70	20.61	12.73
vauclin	69.14	5.71	22.86	2.29
vieux habitants	54.62	29.23	11.92	4.23

E Additional Results

E.1 Robustness Checks

Table A7: Risk of Child Death Before 1857, For Mothers Who Were Not Extremely Coerced

	(1)	(2)	(3)	(4)
Father: High coercion vs. Low	−0.03	−0.04	−0.01	0.02
	(0.13)	(0.13)	(0.14)	(0.14)
Father: Extreme Coercion vs. Low	0.36*	0.34*	0.39*	0.40*
	(0.17)	(0.17)	(0.17)	(0.18)
Father: Absent vs. Low	0.09	0.09	0.06	0.06
	(0.10)	(0.11)	(0.11)	(0.11)
County and Year FE	Yes	Yes	Yes	Yes
Gender and Mother's age	Yes	Yes	Yes	Yes
Mother's occupation	No	No	No	Yes
Mean	14.25	14.2	14.13	14.15
Observations	9,871	9,519	9,077	8,494

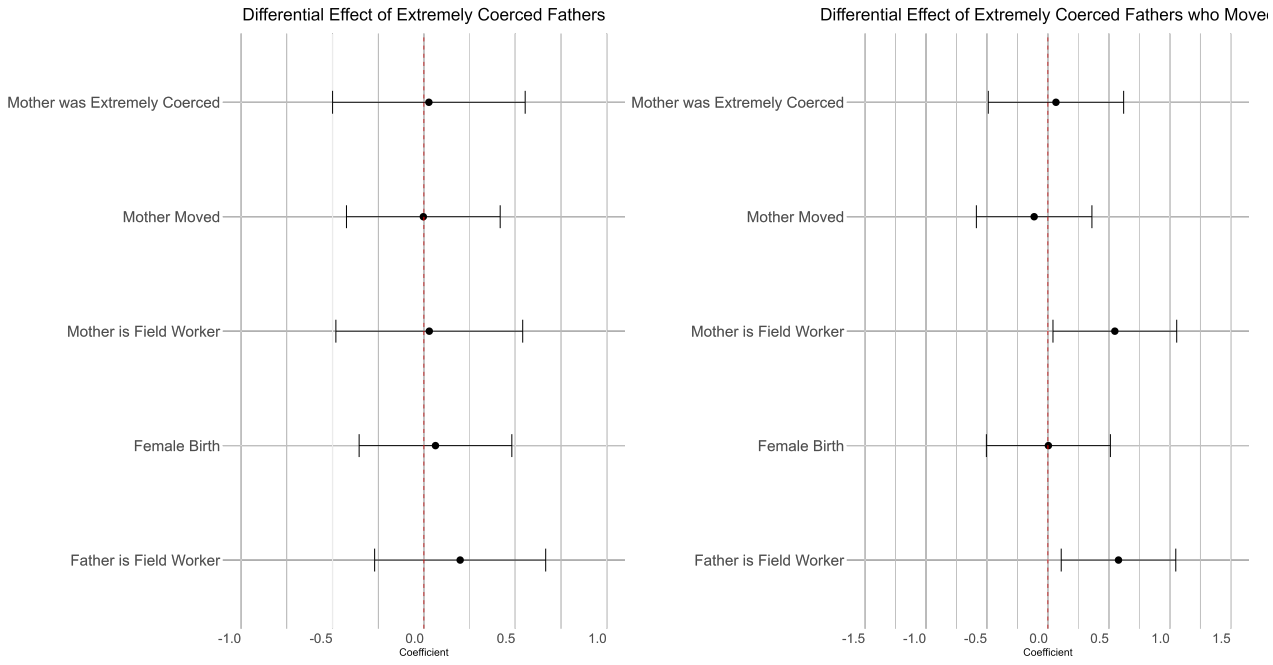
Notes: This table displays the estimated effect of parental exposure to coercion on children's risk of death before 1857, for children whose mother was not extremely coerced.

Table A8: Risk of Child Death Before 1857, For Higher Income Fathers (Non-Field Workers)

	(1)	(2)	(3)	(4)
Mother: High coercion vs. Low	0.10	0.12	0.09	0.13
	(0.24)	(0.24)	(0.25)	(0.28)
Mother: Extreme Coercion vs. Low	0.42	0.40	0.22	0.35
	(0.28)	(0.28)	(0.29)	(0.32)
Father: High coercion vs. Low		−0.02	0.02	0.15
		(0.25)	(0.26)	(0.28)
Father: Extreme Coercion vs. Low		0.33	0.43	0.59*
		(0.26)	(0.27)	(0.30)
Father: Absent vs. Low			0.32	0.31
			(0.20)	(0.21)
County and Year FE	Yes	Yes	Yes	Yes
Gender and Mothers' age	Yes	Yes	Yes	Yes
Mother's occupation	No	No	No	Yes
Mean	14.63	14.63	14.37	14.42
Observations	1,463	1,463	1,301	1,153

Notes: This table displays the estimated effect of parental exposure to coercion on children's risk of death before 1857, for children whose father was not a field worker (30% of all fathers). For λ a coefficient, an increase in one unit of a covariate is associated with an increase of (exp(λ)-1)% in the outcome.$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

Figure A11: Additional Effect of Extremely Coerced Fathers, CoxPH model



(a) Baseline

(b) Fathers who moved

Note: Cox Proportional Hazard estimated coefficients. For λ a coefficient, the effect of paternal exposure to extreme coercion has an additional effect of (exp(λ)-1)% on child mortality, respective to the reference category. Coefficients are displayed for 95% confidence intervals.

E.2 Mechanisms

Table A9: Probability for Fathers to be Different, Conditional on First Father Being Known

	(1)	(2)	(3)	(4)
First father: High Coercion vs. Low	−0.29	−0.30	−0.33	−0.18
	(0.44)	(0.42)	(0.43)	(0.43)
First father: Extreme Coercion vs. Low	0.45	0.51	0.44	0.52
	(0.39)	(0.40)	(0.39)	(0.39)
Number of Births		0.71*	0.71*	0.69*
		(0.38)	(0.38)	(0.39)
Mother's age			0.02	0.02
			(0.03)	(0.03)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Mother's occupation	No	No	No	No
Mother's coercion exposure	Yes	Yes	Yes	Yes
Mean	0.08	0.08	0.09	0.09
Observations	643	643	622	609
Akaike information criterion	401.61	400.36	400.09	394.55

Notes: The sample used to estimate these coefficients are mothers who had several children between 1852 and 1856, and where the father of the first child is known. Coefficients reflect the contribution of each covariate on the probability that father(s) would be different than the first father. Probit estimated odd-ratios. For λ a coefficient, an increase in one unit of a covariate is associated with an increase of (exp(λ)-1)% in the outcome. $^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

Figure A12: Share of surnames found among convicted criminals between 1850 and 1950, by surnames' county of origin

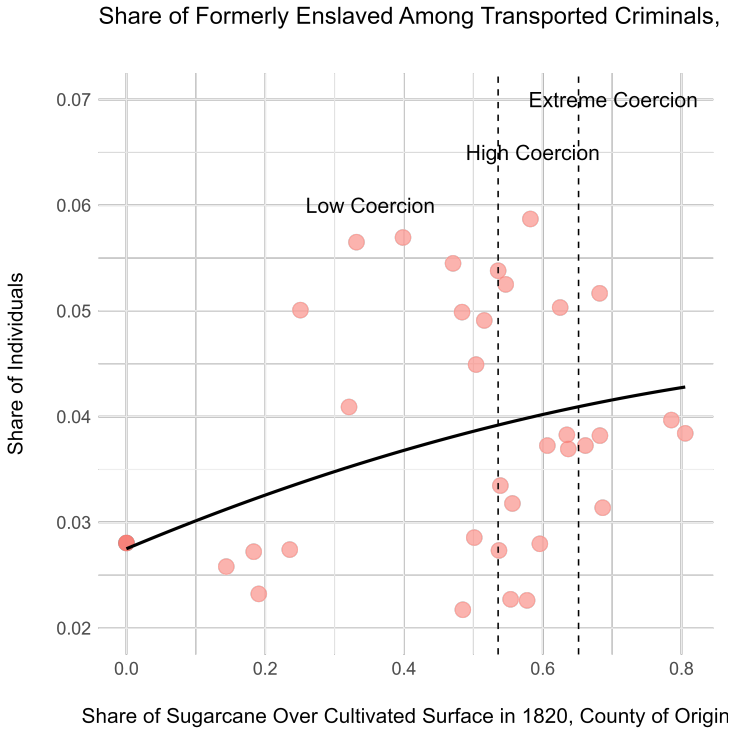
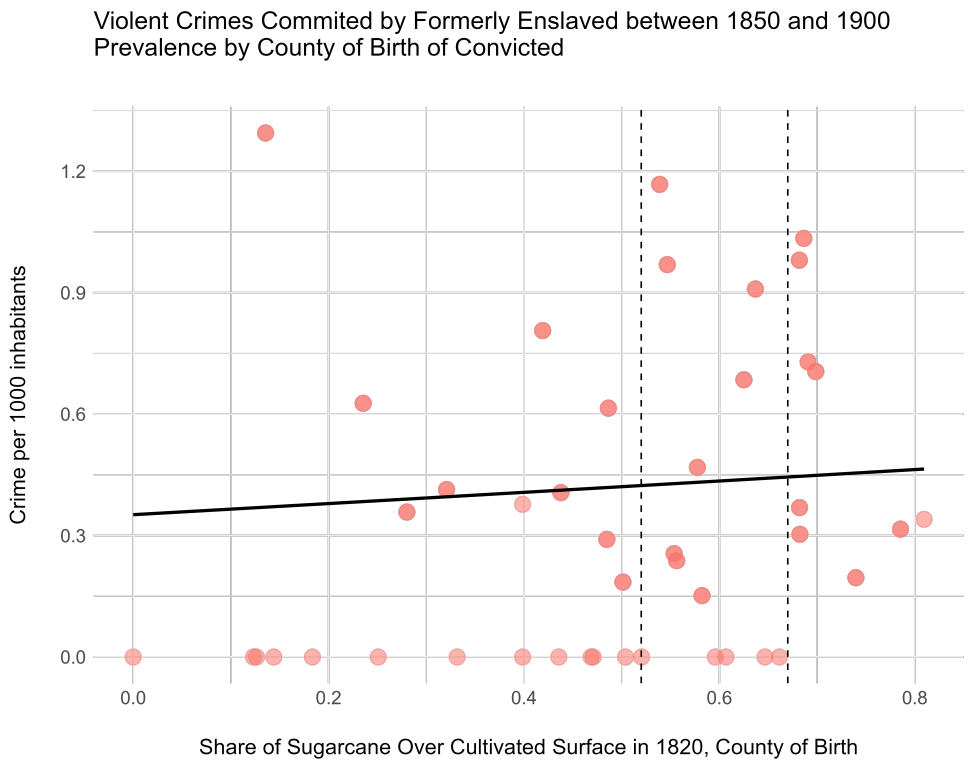
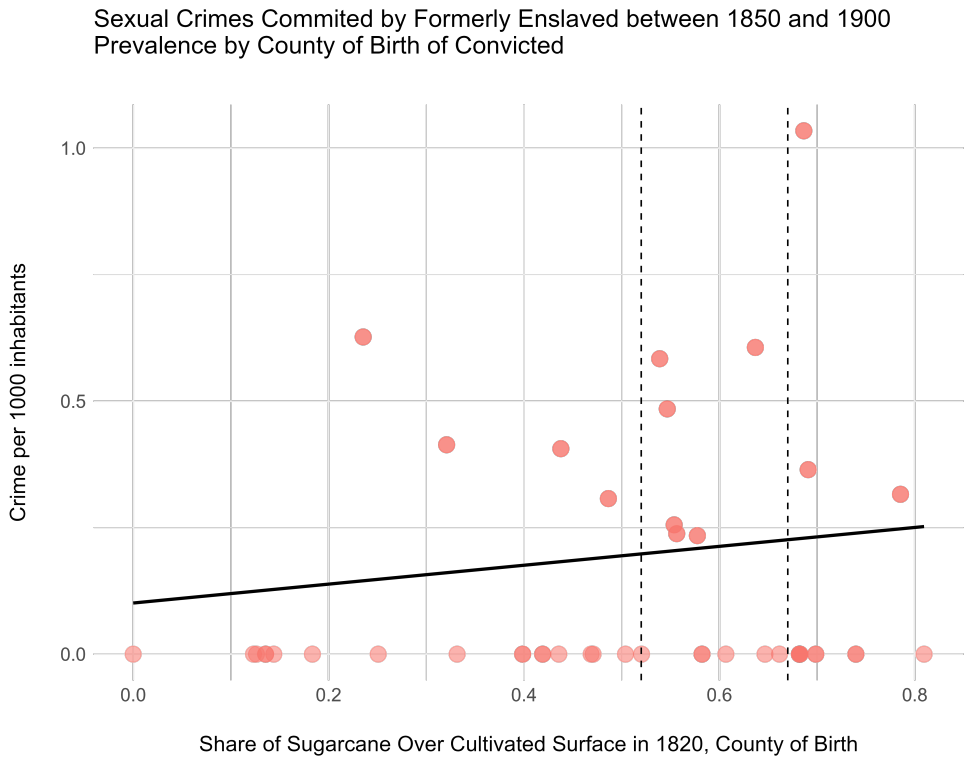


Figure A13: Prevalence of Formerly Enslaved Prisoners Sent to Guyana 1850-1890, by type of Crime and Former County of Enslavement



(a) Violent Crimes



(b) Sexual Crimes