Echoes of Colonial Repression: The Long-Term Effects of the 1947 Revolt upon Political Attitudes in Madagascar*

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Abstract

The repression of the 1947 Madagascar revolt has been regarded as one of the bloodiest episodes in the history of Colonial Africa. While some historians and anthropologists claim the brutality of this event has traumatized the population in significant ways, no systematic evidence has been provided to date to support these hypotheses. In this article, we undertake an empirical strategy that combines recent individual-level survey data with geographic and ethnographic information about the rebellion to estimate the long-term effects of this event upon current self-reported levels of freedom of expression. Applying two different matching methods and a regression discontinuity design that exploits plausible exogenous variation in exposure to the rebellion generated by a mountain range, we find a negative treatment effect. The results are robust to controls for individual characteristics and a host of district-level variables such as rainfall, temperature, elevation, land area, and distance to the nearest industrial town.

Keywords: Historical Legacies, Colonialism, Political Behavior, African Politics.

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1 Introduction

On March 29, 1947, a group of Malagasy nationalists revolted against the colonial rule of France in the eastern part of the island. The uprising immediately spread over one-third of Madagascar's territory, but the French armed forces were able to restore order after receiving reinforcements. By November 1948, the rebels had been erased from the map, resulting in numerous arrests and a death toll estimated to range into the thousands. The series of violently crushed revolts that took place between 1947 and 1948 are called the Malagasy Uprising (or the Madagascar Revolt).

The repression of the Malagasy Uprising is regarded as one of the bloodiest episodes in the history of Colonial Africa. The centrality of this event in shaping social memory has been explored by historians (e.g., Tronchon 1986; Lahirinko 2000; Fremigacci 2007) and anthropologists (e.g., Althabe 1969; Cole 1997, 1998, 2001, 2003). It has been argued that the brutality with which this insurgency was extinguished has traumatized the Malagasy population, affecting different aspects of people's neuroses and behavior in the long run. Members of generations succeeding those that experienced extreme violence unconsciously retain information linked to the events of the massacre (Althabe 1969). Apparently, the memory of genocide is inescapable.

The extensive ethnographic research conducted by Jennifer Cole (1997, 1998, 2001, 2003) on this topic and this country is particularly interesting. Based on a handful of in-depth interviews with members of the Betsimaraka community affected by the repression, she claims that the legacy of the Malagasy rebellion has become a reference system to understand new social and political experiences. Among other interesting hypotheses, the author draws attention to the persistence of fears associated with engagement in politics (especially during elections) as a potential collective trauma. Although an enormous amount of qualitative information can be found in such studies, to date no systematic empirical evidence has been provided to support or reject these hypotheses.

This article seeks to go further in examining the long-term effects of political repression during colonial times by empirically estimating how and to what extent individual exposure to the legacy of the Malagasy uprising affects people's attitudes and behavior today. Specifically, we estimate the impact upon current self-reported levels of freedom of expression (e.g., freedom of speech, freedom of association, freedom to vote, among others). Our theoretical expectations yield one simple hypothesis, which builds on what has been suggested by existing anthropological studies: The *ceteris paribus* association between individual

exposure to the legacy of colonial repression and current self-reported levels of freedom of expression is negative and statistically significant.

Although the 1947 revolt had a symbolic impact nationwide, only some ethnic groups within a delimited area of the country were affected by the repression. This information, seemingly inconsequential on its own, can be combined with survey data to detect whether individuals from an ethnic group and district that participated in the uprising are more or less confident to express themselves today. To do so, we undertake an empirical strategy that combines Afrobarometer survey data (2008) with geographic and ethnographic information of the rebellion. We take into consideration both the ethnicity and the residential location of respondents to construct a treatment variable of exposure to the legacy of repression, and use relevant questions from the survey to estimate an index of freedom of expression.

We find that exposure to the legacy of repression negatively affects people's freedom of expression, and show this by controlling for individual characteristics and a host of district-level variables such as average rainfall and temperature one year before the outbreak of the rebellion, mean elevation, district size, and distance to the nearest industrial town. To improve the estimation of causal effects, we implement two matching methods, and a novel regression discontinuity design that exploits plausible exogenous variation in exposure to the rebellion generated by a mountain range that limited the geographical expansion of the insurrection.

From a political science perspective, this piece of work may fall into different categories: research on political repression and social attitudes (e.g., Booth and Richard 1996); studies on the effects of civil conflict (e.g., Wood 2003; Bellows and Miguel 2006, 2008; Blattman 2009); and other works that look at the effect of historical institutions on present day outcomes (e.g., Iyer 2008; Nunn and Wantchekon forthcoming; and Dell forthcoming). This study is most closely related to Nunn & Wantchekon (forthcoming), which looks at the long-term effects of slave trade on individual trust using Afrobarometer survey data. However, to our knowledge, no quantitative research has been done to measure the long-run effects of an event of political repression that took place during colonial times.

We begin our analysis in the next section with a brief historical background. Section 3 lays out the conceptual framework, and section 4 describes our data sources and coding procedures. We then turn, in section 5, to an explanation of our empirical approach. Next, we present our main empirical results, followed by robustness tests. We close the paper commenting on the potential mechanisms through which this legacy of colonial repression may operate.

2 Brief History of the Malagasy Uprising

In 1896, Madagascar was annexed into the French colonial empire. After the Second World War in 1946, the island obtained the statute of French territory of overseas. Madagascar was then equipped with an elected but institutionally limited assembly. Roughly speaking, this political base awoke nationalist feelings among some ethnic groups (mainly among Betsimarakas and Merinas) and triggered the creation of insurgent movements.

The *Mouvement Democratique de la Renovation Malagache* (MDRM), a nationalist political party created in 1946, is at the heart of the Malagasy uprising. Many of the attempted rebellions were connected with the MDRM, whose goal was independence for Madagascar. Starting on March 29, 1947, Malagasy nationalists revolted in the eastern part of the island. The first base of the insurrection was the triangle Ambila-Sahasinaka-Ampasimanjeva. The insurrection immediately reached Manakara and Moramanga, and spread to several other parts of the country over the following months. The rebels seized the eastern and central regions of the country before the French soldiers in Madagascar received reinforcements.

It was not until after reinforcements from France arrived that the colonial authorities were able to restore order in Madagascar. The rebellion was brutally crushed. By November 1948, the French armed forces had extinguished every single outbreak of rebellion. In December 1948, the high Commissioner Pierre de Chevigné boasted on the radio that not a single square centimeter of the island had escaped French military control.

While there is no consensus on the exact number of the casualties accrued during the uprising, all reported figures are indicative of a brutal massacre. French authorities originally alleged only between 8,000 and 10,000 casualties, a number that is now proven to be far from accurate. Depending on the source, reliable estimates range from 30,000 to 100,000 deaths. For instance, Jacques Tronchon (1986) talks about 80,000 victims, while Lucile Rabearimananam (1997) suggests that at least 60,000 persons were killed. A more recent study by the historian Jean Fremigacci estimates between 30,000 and 40,000 deaths, of which 10,000 were due to violent death, and the rest caused by disease and malnutrition (Fremigacci 2007).

During the years immediately following the repression, the rebellion was portrayed as an unspeakable and unforgettable atrocity. As the anthropologist Jennifer Cole (2003) points out, "it was taboo to

discuss the events of 1947 or to assimilate them to a nationalist narrative". The representation of 1947 as an anomaly in the history of Madagascar was further encoded in history textbooks throughout the First Republic.

Thus, regardless of the exact number of victims, the repression of the Malagasy uprising has been regarded not only as a foundational event of national history, but also as a historical trauma that affects the population in modern times. The question is then: How does this legacy of violent political repression affect Malagasies' attitudes and behavior so long after these deaths took place?

3 How does a legacy of repression affect people's attitudes?

As earlier mentioned, in addition to anthropological studies, much of the work on colonial legacies has been done from a descriptive historical perspective. Similarly, the literature on political repression includes a number of studies that provide qualitative accounts of the use of state violence. This literature, too vast to cite, includes primarily state-focused analyses on human rights. A series of empirical research has explored the links between political repression, economic development, demographic conditions, and regime type (e.g., Poe and Tate 1994; Davenport 1995; Mitchell and McCormick 1988; Regan and Henderson 2002), but very few scholars have analyzed the effects of repression on people's attitudes and behavior (e.g., Booth and Richard 1996). Nearly absent, if not to say non-existent, are studies that quantitatively attempt to estimate the long-term effects of political violence.

A considerable amount of quantitative research has been devoted to the analysis of the short-term effects of civicl conflict. An influential account in the literature has been the "conflict trap" (Collier et al. 2003, Collier 2007). This theory suggests that civil war has economic and social effects that do not only affect combatants, but also people who have no part in creating or sustaining the conflict. Some of these adverse consequences include large and persistent psychological damage, deterioration of political institutions and political freedom, the loss of social capital, and social disintegration. From this perspective, legacies of civil war preclude economic, social, and political recovery, particularly in the short term.

Other research has stressed very different political behavior outcomes. Elisabeth Wood (2003) found government violence in El Salvador pushed civilians in affected areas to support and join insurgent forces out of a sense of moral outrage. John Bellows and Edward Miguel (2006,2008) found that the

displacement and deaths of households' relatives in Sierra Leone led to greater political participation and political awareness. Likewise, Chris Blattman (2009) presents evidence for a link from past violence in Northern Uganda to increased political engagement among excombatants. In this article, we provide evidence suggesting that the repression of the Malagasy Uprising has a negative long-term impact upon freedom of expression.

Finally, a more recent line of empirical research relevant to this study includes works that look at historical determinants of present day outcomes (e.g., trust, economic growth, and living conditions, and educational attainment, among others). For instance, Dell (forthcoming) examines the long run impacts of the *mita*, an extensive forced mining labor system in effect in Peru and Bolivia between 1573 and 1812. She finds that a mita effect lowers household consumption in subjected districts today. But the present study is most closely related to Nunn & Wantchekon's forthcoming work, which shows that current differences in the levels of mistrust within Africa can be traced back to the trans-Atlantic and Indian Ocean slave trades.

Therefore, this article adds to the existing empirical literature on political violence by inquiring into the trauma caused by colonial repression. Given the peculiarities of the Malagasy uprising, it is reasonable to hypothesize that exposure to the legacy of repression negatively affects people's freedom of expression. Why is it so? If, as suggested by previous qualitative studies, fears associated with engagement in politics persist across generations, then it is very likely that those fears are being translated into less willingness to express, to speak about politics, to vote, or to join a political organization, for instance.

4 Data

4.1 Outcome Variable: Freedom of Expression

Data on freedom of expression in Madagascar, as well as individual-level covariates, come from the fourth round of the Afrobarometer (2008), which is an independent and non-partisan research project conducted by Center for Democratic Development (CDD), the Institute for Democracy in South Africa (IDASA) and the Michigan State University. The Afrobarometer measures the social, political and economic atmosphere in Africa. Surveys were repeated on a regular cycle since 1999 and the fourth round was conducted in 20 countries. In the case of Madagascar, the survey is based on interviews of a random, national representative sample of 1,350 adults. It covers the six provinces of the country, and 85 districts.

Answers to six questions are used to create an index of freedom of expression. The estimation details are described in the next section. The Afrobarometer asks respondents "In this country, how free are you: to say what you think? to join any political organization you want? to choose whom to vote for without feeling pressured?". To each of these three questions, respondents can choose to answer either (i) completely free, (ii) somewhat free, (iii) not very free, or (iv) not at all free. Thus, this information provides us with individual, ordinal measures of freedom of speech, association, and vote. An overview of answers to these questions is shown in Table 1. Note that only about one-third of respondents feel completely free to say what they think, or to join any political organization they want.

Table 1: Overview of the Responses to Questions on Freedom of Expression I

	Freedom of Speech		*Freedom of Association*		*Freedom to Vote*	
Not at all free	55	4.1%	54	4.0%	12	0.9%
Not very free	231	17.1%	99	7.3%	49	3.6%
Somewhat free	515	38.2%	439	32.5%	369	27.3%
Completely free	405	30.0%	452	33.5%	792	58.7%
Don't know	144	10.7%	306	22.7%	128	9.5%
Total	1350	100.0%	1350	100.0%	1350	100.0%

In addition, we take into consideration a question that quantifies whether people feel in any way being censored, or feel obliged to be careful of what they say about politics. The exact wording is as follows: "In this country, how often do people have to be careful of what they say about politics?" Respondents can choose to answer either (i) always, (ii) often, (iii) rarely, or (iv) never. We assume answers to this question tell us something about peoples' fears or self-censorship when it comes to talking about politics. Finally, we include two variables of political hostility. The first one refers to fear of political intimidation or violence during elections. The exact wording of the question is: "During election campaigns in this country, how much do you personally fear becoming a victim of political intimidation or violence?" Respondents can answer either (i) a lot, (ii) somewhat, (iii) a little bit, or (iv) not at all. The second question reveals fear of governmental punishment: "How likely do you think it is that people can be punished by government officials if they make complaints about poor quality services or misuse of funds?" Answer options include (i) very likely, (ii) somewhat likely, (iii) not very likely, and (iv) not at all likely.

An overview of answers to the last three questions is shown in Table 2. The data indicate that more

than half of respondents feel obliged to be careful of what they say about politics. Likewise, about half of them fear political violence to some degree, and 40% thinks it is somewhat or very likely that people can be punished by government officials if they complain about poor quality services or misuse of funds.

Table 2: Overview of the Responses to Questions on Freedom of Expression II

How often careful when talking about politics?			*How much do you fear political violence?*			*How likely that people can be punished if they complain?*		
Never	87	6.4%	A lot	109	8.1%	Not at all	285	21.1%
Rarely	286	21.2%	Somewhat	222	16.4%	Not very	241	17.9%
Often	308	22.8%	A little bit	315	23.3%	Somewhat	414	30.7%
Always	391	29.0%	Not at all	625	46.3%	Very likely	107	7.9%
Don't know	278	21.6%	Don't know	79	5.9%	Don't know	303	22.4%
Total	1350	100.0%	Total	1350	100.0%	Total	1350	100.0%

4.2 Treatment Variable: Legacy of Repression

To analyze how the crushing of a rebellion that happened a long time ago affects people's lives today, we need first of all to identify the exact geographic location of the events. The Malagasy uprising took place in the eastern and central regions of the island (mainly the provinces of Fianarantsoa and Toamasina, but also part of Antananarivo). The rest of the country remained unaffected. Figure 1 displays three maps with detailed archival information about the insurgency movement and the French reoccupation of the territory (Tronchon 1986). The territorial limit attempted by the insurgency is clearly demarcated by a thick, solid line. We also observe the steps forward the reoccupation of the territory over time, as well as the exact location and number of the insurgent troops. As it is shown, among the locations (districts) that were heavily affected by the repression are: Moramanga, Manakara, Mahanoro, Ifanadiana, Fort-Carnot, Soanierana Ivongo, Mananara, Andilamena, Ambatondrazaka, Andevoranto, Vatomandry, Nosivarika, and the surrounding areas of Fianarantsoa, Antananarivo and Antsirabe.

Figure 2 shows two district-level maps with provinces outlined in black color. The first map shows all the districts that were sampled in the Afrobarometer survey. As we can see, a large part of the Malagasy territory was sampled. The second map pinpoints the locations where the repression took place. This map is based on the information contained in the historical map shown in Figure 1[1].

[1]Since there is no within-district information about the rebellion, all districts within (or crossed by) the line that depicts the territorial limit attempted by the insurgency are considered as treated.

Figure 1: Organization of the Rebellion and Reoccupation of the Malagasy Territory

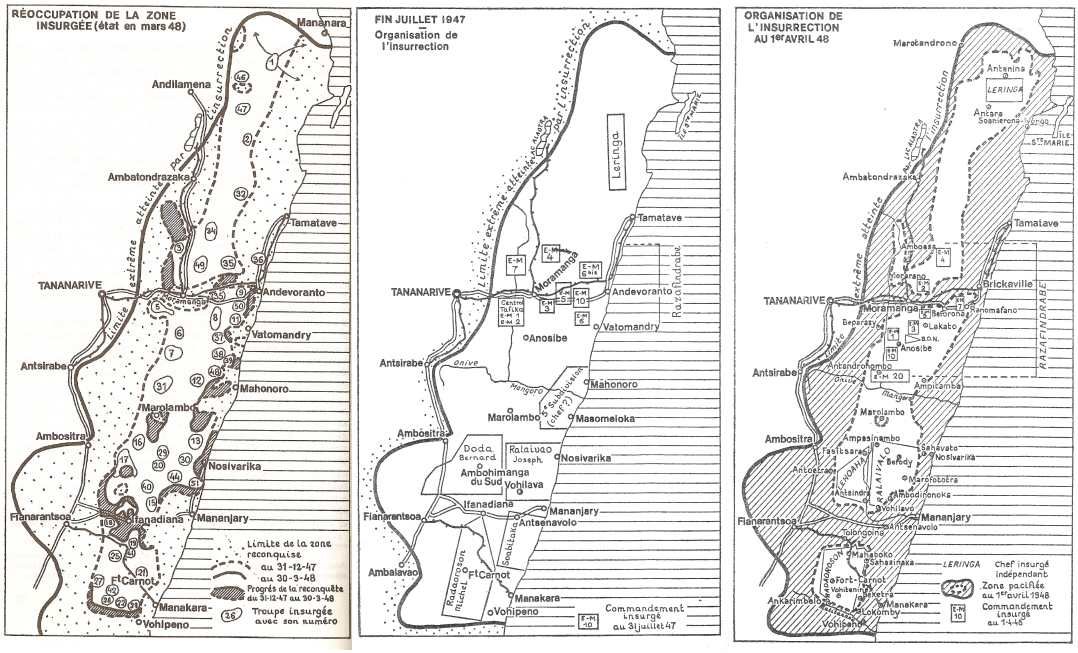
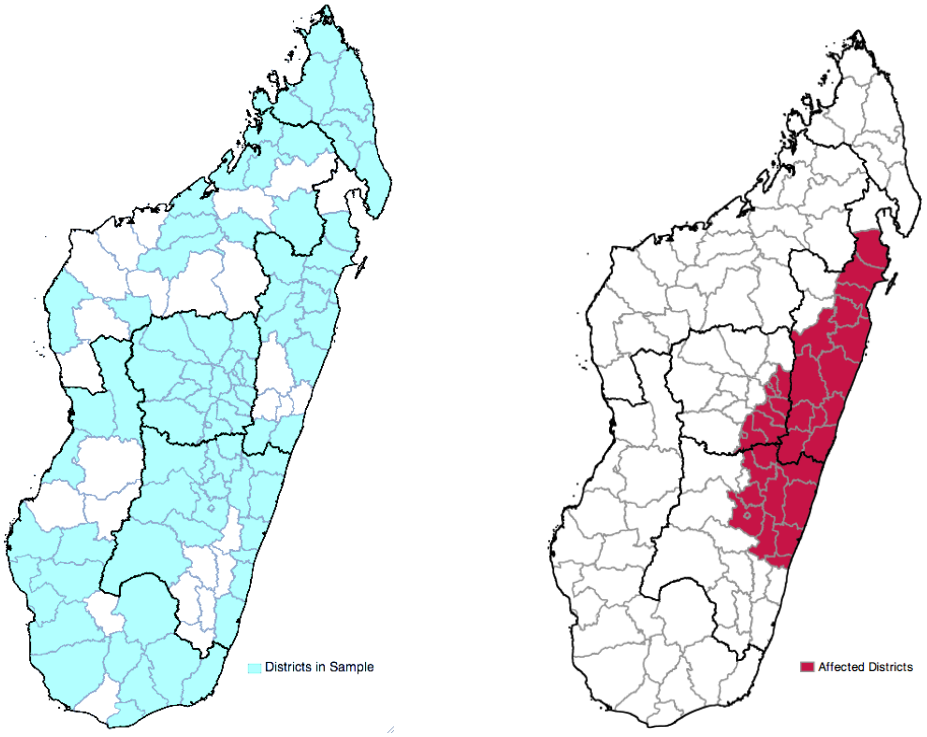


Figure 2: Districts in Sample (Left) & Districts Affected by the Repression (Right)



Thus, information on the geography of this anti-colonial rebellion is available at an unusual cartographic precision and accuracy. Most importantly, the geographical expansion of the rebellion and its repression was contained within a single polygon's area, which facilitates the identification of individuals exposed to the legacy of this historical event. Unfortunately, there is no measured variation in the extent of repression, so we cannot exploit differences in the extent of repression among the set of districts that participated in the uprising.

The second step towards identifying who may have been exposed to the legacy of this repression is to code the ethnic groups that were involved in the movement. In this regard, historians identify the Antemoro, the Betsileo, the Betsimisaraka, the Merina (Madagascar's dominant ethnic group), the Sihanaka, and the Tanala (Tronchon 1986). One important characteristic of the distribution of ethnic groups in Madagascar is that they tend to be territorially clustered, and not scattered across the island. This can be seen in Figure 3. Moreover, by comparing current data with older ethnographic maps of Madagascar, we can corroborate that the territorial distribution of ethnic groups in the island remains quite stable over the time (see maps in the appendix). This facilitates the identification of natives from a given region, that is, people who were born and raised in that region. In other words, if a respondent belongs to the dominant ethnic group of the region where he lives in, then it is very likely that he is a native from that region. On the other hand, if he belongs to an ethnic group that is dominant in a different part of the country, then it is very likely that he is not a local.

Figure 3: Current Distribution of Ethnic Groups in Madagascar

Hence, taking into consideration both the ethnicity and the location of a respondent, we construct a treatment variable of exposure to the legacy of the repression. The coding protocol follows these simple steps: (1) verify whether a respondent lives in one of the districts contained inside of the thick, solid line that demarcates the territorial limit attempted by the insurgency in Figure 1; (2) verify whether the respondent belongs to the dominant ethnic group of the district where he lives in; and (3) verify whether the respondent's ethnicity belongs to one of the six ethnic groups affected by the repression. If these three conditions are satisfied, code Treatment as 1; 0 otherwise. In total, the sample gives us 449 observations coded as treated units, from a total of 1350.

Table 3: Summary of Descriptive Statistics

	Mean	Std. Dev.	Min	Max
Dependent Variables:				
Normalized Index of Freedom of Expression	6.5	2.1	0.0	10.0
Freedom of Speech	3.1	0.8	1.0	4.0
Freedom of Association	3.2	0.8	1.0	4.0
Freedom to Vote	3.6	0.6	1.0	4.0
Careful when talking about politics	1.9	1.0	0.0	3.0
Fear political violence	0.9	1.0	0.0	3.0
Likelihood of punishment	1.3	1.0	0.0	3.0
Independent Variables:				
Treatment (exposure to repression)	0.3	0.5	0.0	1.0
RD Treatment (dist. to mount. range)	-6.6	8.8	-24.9	6.7
Female	0.5	0.5	0.0	1.0
Age	39.5	14.2	18.0	100.0
Education	5.7	3.8	0	18
Income: Much Better	0.1	0.3	0.0	1.0
Income: Better	0.0	0.1	0.0	1.0
Income: Same	0.6	0.5	0.0	1.0
Income: Worse	0.3	0.4	0.0	1.0
Income: Much Worse	0.0	0.2	0.0	1.0
Ethnicity: Betsileo	0.2	0.4	0.0	1.0
Ethnicity: Betsimaraka	0.1	0.3	0.0	1.0
Ethnicity: Merina	0.3	0.4	0.0	1.0
Ethnicity: Antemoro	0.0	0.2	0.0	1.0
Ethnicity: Sihanaka	0.0	0.1	0.0	1.0
Ethnicity: Tanala	0.0	0.1	0.0	1.0
Religion: Catholic	0.4	0.5	0.0	1.0
Religion: Lutheran	0.2	0.4	0.0	1.0
Religion: Calvinist	0.2	0.4	0.0	1.0
Province: Antananarivo	0.3	0.4	0.0	1.0
Province: Fianarantsoa	0.2	0.4	0.0	1.0
Province: Toamasina	0.1	0.3	0.0	1.0
Province: Mahajanga	0.1	0.3	0.0	1.0
Province: Antsiranana	0.1	0.3	0.0	1.0
Province: Toliary	0.2	0.4	0.0	1.0
District Distance to Industry (1966)	0.9	0.7	0.0	2.5
District Av. Precipitation in 1946	143.3	88.5	21.9	409.3
District Av. Temperature in 1946	22.2	3.5	15.6	27.2
District Area (sq. km.)	4083.8	3562.1	39.0	17358.0
District Mean Elevation (m.)	627.8	593.4	0.0	2026.0

5 Empirical Approach

5.1 Estimation Framework

The goal of this paper is to determine whether exposure to a legacy of violent political repression affects people's freedom of expression. The canonical equation that will be estimated is the following:

$$Y_i = \alpha + \beta Treatment + \gamma X_i + \epsilon_i$$

where Y_i is the outcome of interest (*Freedom of Expression*) for individual i. X_i is a vector of control variables, which includes: gender (female), age, education years, religion, ethnicity, a host of district-level variables (area size, elevation, rainfall, temperature, and distance to industrial areas), 5 province fixed effects, and 5 income (or living conditions) fixed effects[2]. The term ϵ_i is a disturbance term, which is allowed to be correlated across respondents from the same district in all regressions. The parameter of interest is β and $Treatment$ is an indicator variable that takes on values of 1 if an individual has been exposed to the legacy of the Malagasy uprising; and 0 otherwise.

This specification model is intended to control for variables that might affect Y and are not affected by the treatment. Gender is obviously not affected by the treatment, and it might be a confounder. We would anticipate that men report higher levels of freedom of expression. Similarly, it is possible that cultural variables such as religion and ethnicity play an important role in defining people's behavior, including their abilities and willingness to express. Therefore, we control for religious and ethnic groups.

It is worth mentioning that explanatory variables such as education or living conditions could be considered as post-treatment outcomes. However, it might be the case that the rebels may have been located in poorer regions, which had access to fewer public goods such as education. Thus, if lower income and education levels reduce trust freedom of expression, then omission of these controls could generate bias on the estimated effect of the repression treatment. This is why we incorporate education and income controls.

Since exposure to the uprising only varies at the district level, it is important to control for district-level characteristics that could be correlated with uprising participation. To do so, we include district average rainfall (precipitation) and temperature one year before the insurrection (1946), distance to the

[2]Income fixed effects are based on the respondents' answers regarding their living conditions relative to others: (i) much worse, (ii) worse, (iii) same, (iv) better, or (v) much better.

nearest industrial town, land area (in squared kilometers), and district mean elevation (meters)[3]. Finally, we incorporate province fixed effects to control for potential, province-level institutional factors.

5.2 Modeling Freedom of Expression as a Latent Variable

Freedom of expression, as well as many other concepts in social sciences, cannot be observed directly. Instead of observing quantities of these concepts, we may have indicators (information from multiple sources) of the *latent* concept. The standard approach to operationalize this kind of constructs is to use statistical procedures to combine these indicators. This could be done in several ways. For instance, by creating a simple linear additive index, or by using a weighting scheme to estimate the unobserved levels of the latent concept. In this article, we follow the approach suggested by Treier and Jackman (2008), which offers a substantial improvement to this type of measurement problems. We operationalize *Freedom of Expression* as a latent continuous variable. To do so, the six ordinal indicators (Afrobarometer questions) are modeled as functions of the unobserved levels of freedom of expression, resulting in an ordinal-item response model. To be more precise, let $i = 1, ..., n$ index individual observations (respondents) and $j = 1, ..., m$ index the Afrobarometer indicators. Let $k = 1, ..., K_j$ index the ordered response categories for item j . Then, the model is:

$$\begin{aligned} Pr(y_{ij} = 1) &= F(\tau_{j1} - x_i\beta_j) \\ &\vdots \quad\quad \vdots \\ Pr(y_{ij} = k) &= F(\tau_{jk} - x_i\beta_j) - F(\tau_{jk-1} - x_i\beta_j) \\ &\vdots \quad\quad \vdots \\ Pr(y_{ij} = K_j) &= 1 - F(\tau_{j,Kj-1} - x_i\beta_j) \end{aligned}$$

where x_i is the latent level of Y_i (*Freedom of Expression*) for respondent i, y_{ij} is the i-th respondent's score on indicator j, and $F(\cdot)$ is a function mapping from the real line to the unit probability interval, defined here as the logistic CDF $F(z) = 1/(1 + exp(-z))$. β_j is the discrimination parameter, and τ_j is

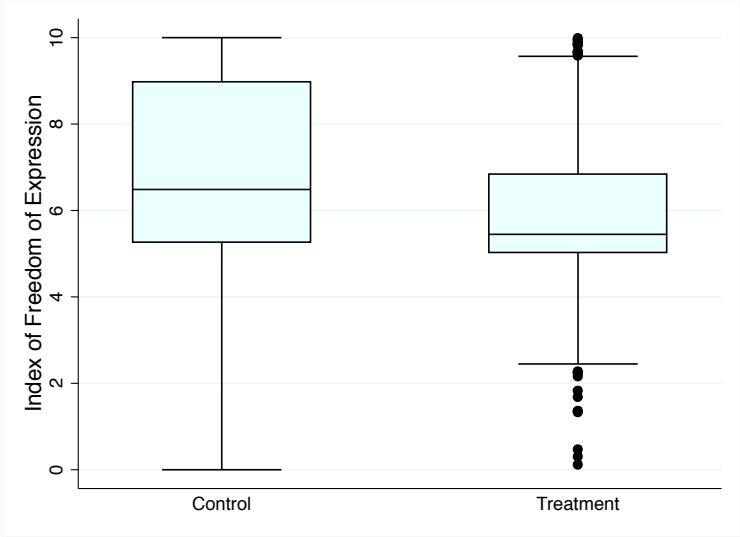
[3]Data on rainfall (precipitation) and temperature at the district level was obtained from the *Historical Meteorological and Climatological Data for Madagascar [1889-1968]*, which is part of the NOAA Central Library Climate Data Imaging Project. A sample spreadsheet of this historical data can bee seen in the appendix. Distance to the nearest industrial town was computed using the haversine formula, and major industrial towns (see map in the appendix) were taken from the *Area Handbook of the Malagasy Republic* (Nelson 1973). The industrial locations listed in the map are from 1966, but it is reasonable to assume that industrial activity at the time of the uprising was located in the same towns. Elevation data comes from gtopo30 (1996), a global elevation data set developed by the us Geological Survey's Center for Earth Resources Observation and Science (eros). Elevations in gtopo30 are regularly spaced at 30-arc seconds across the entire surface of the Earth on a map using a geographic projection. Finally, district area in sq. km. comes from the Institut National de la Statistique of Madagascar.

a vector of unobserved thresholds for item j, of lenght $K_j - 1$, that follow an ordering constraint implied by the ordering of the responsed, i.e., $\tau_{ja} < \tau_{jb}, \forall a < b, \forall j$.

We estimated this ordinal-item response model via Markov Chain Monte Carlo (MCMC) Ordinal Data Factor Analysis. The MCMC routine generates a posterior distribution with N simulations for each observation. We ran 2500 simulations and took the posterior mean values to construct the index. [4]. The estimation of the item-response model generated a continuous variable that ranges from -2.5 to 1.4. This variable is then interpreted as an index of freedom of expression. To make the interpretation more understandable, we normalized the index rescaling by the minimum to make all the elements lie between 0 (not at all free) and 10 (completely free).

Figure 4 shows the relationship between the normalized index of freedom of expression and the treatment variable. Box plots show lower and upper adjacent values, 75th percentile (upper hinge), median, 25th percentile (lower hinge), and outside values. As we can see, in comparison to control units, treated observations present lower levels of freedom of expression.

Figure 4: Relationship Between Freedom of Expression and Legacy of Repression



[4]The 2nd loading for each variable was constrained to be positive or negative, depending the direction of the ordinal scale of the variable. For instance, the the 2nd loading for the variable Freedom of Speech was constrained to be positive, since higher values on this variable are associated with higher levels of freedom of expression. By contrast, the 2nd loading for the variable Fear of violence was constrained to be negative, since higher values on this variable are associated with lower levels of freedom of expression. The Λ matrix used here has factors+1 columns. The first column of Λ corresponds to negative item difficulty parameters and should generally not be constrained.

5.3 Matching

Because exposure to a legacy of political repression may not be randomly assigned, affected and non-affected individuals may differ in ways that are correlated with both the freedom of expression and the probability of being exposed to a legacy of violent repression. For instance, one case of potential reverse causality could be that ethnic groups that have lower levels of freedom of expression (historically and today), may have been more likely to rebel, and hence to be repressed. Therefore, to deal with potential problems of endogeneity, we implement two matching methods. Specifically, we use Diamond and Sekhon's (2005) Genetic Matching (GenMatch), and the Coarsened Exact Matching (CEM) method proposed by King, Iacus and Porro (2008).

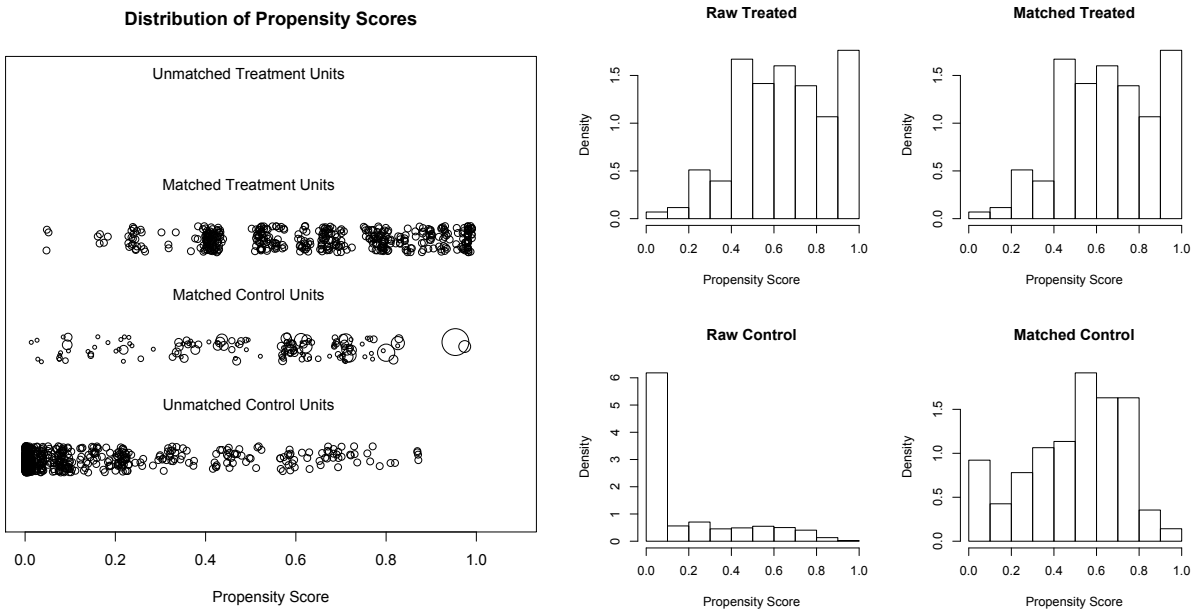
There are four main assumptions nessecary to interpret matching estimates causally: (1) ignorability, (2) sufficient overlap, (3) an appropriate specification of the propensity score model, and (4) SUTVA. In consistency with our specification model, we match on the following potential confounders at the individual level: gender, age, education, ethnicity, religion, and income. We assume these variables are not affected by whether an individual has been exposed to a legacy of represssion. In addition, matching has been done on the basis of the following district-level characteristics: average annual rainfall (precipitation) and average annual temperature during year before the uprising (1946), district distance to the nearest industrial town, district size (squared kilometers), and district mean elevation.

To maximize the number of matched units, each district-level variable (elevation, temperature, rainfall, area, and distance to the nearest industrial town) was coarsened in four equally spaced cutpoints when using the CEM method. The distributions of propensity scores are shown in Figure 5. The histograms ins panels A and B clearly show that there are plenty of coutnerfactual units available for the treatment group. In fact, both matching methods yield fairly similar results. Overall, 572 observations were matched via GenMatch (431 treatment units, and 141 control units), while 691 observations were matched via CEM (316 treatment units, and 375 control units).

Covariate balance before and after matching is shown in Figure 6. Note that important imbalances were corrected after matching, specially after implementing the CEM method. For instance, ethnicity indicators, as well as income fixed effects, were perfectly matched. Only a few district-level covariates such as area size, rainfall, and temperature remained somewhat unbalanced.

Figure 5: Matching Distribution of Propensity Scores

Panel A: Genetic Matching



Panel B: Coarsened Exact Matching

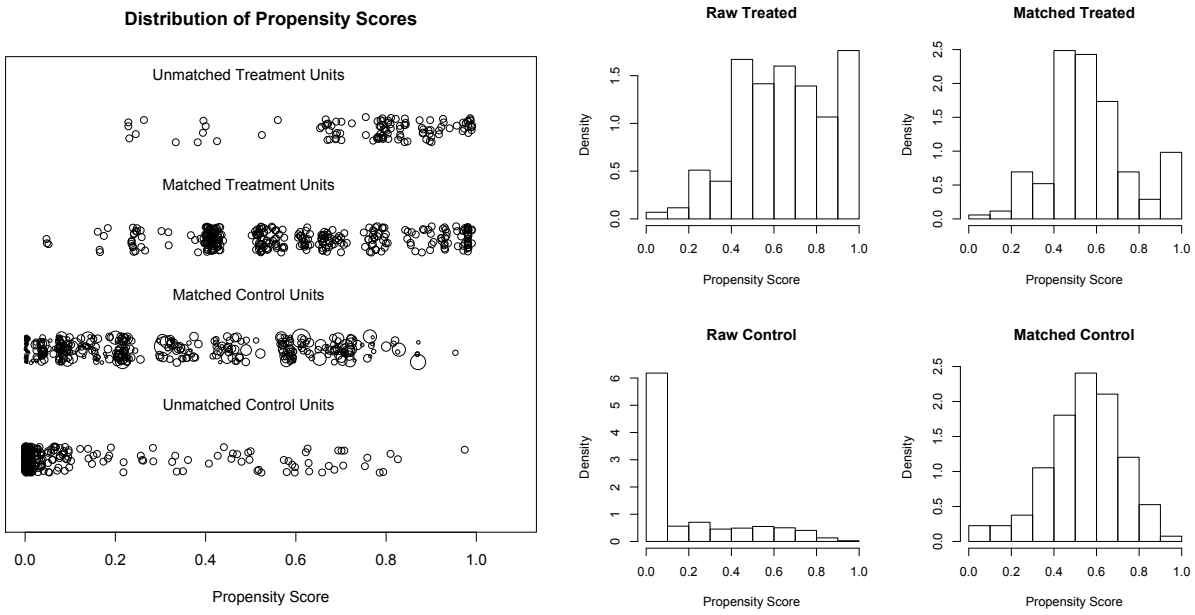
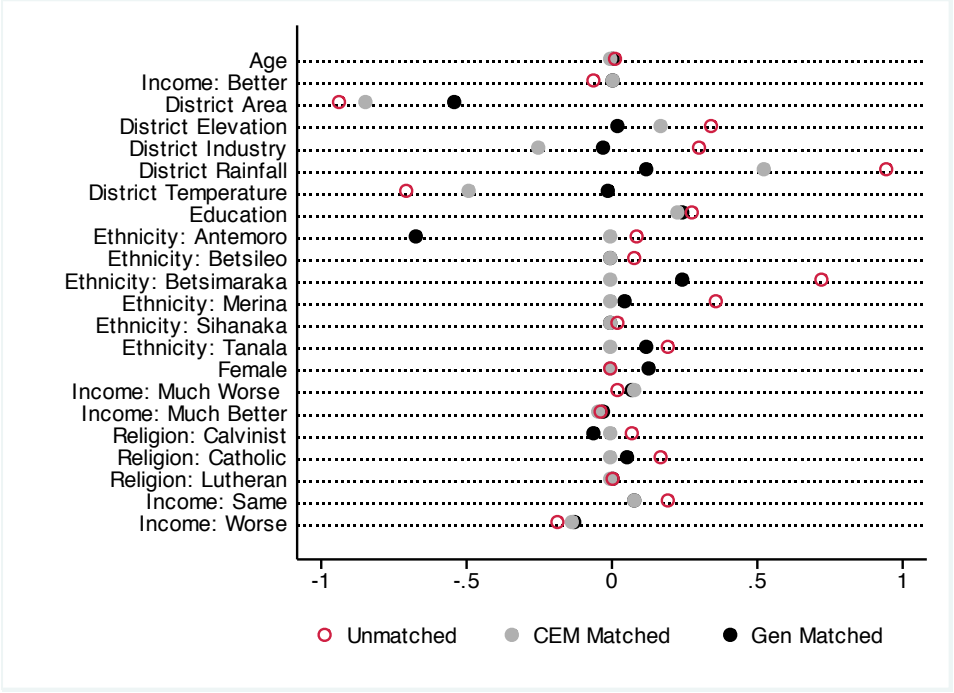


Figure 6: Covariate Balance Before and After Matching



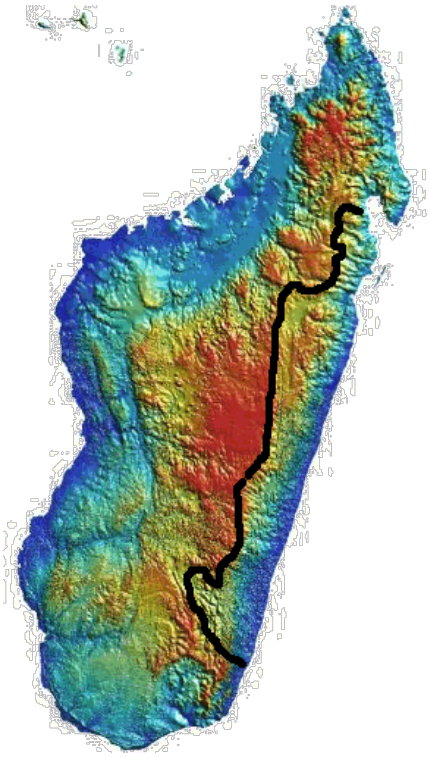
Notes: The figure displays the standardized bias before (open circles) and after matching (filled circles).

5.4 Regression Discontinuity

The causal interpretation of matching estimates relies on the assumption of unconfoundedness. This assumption is not fully satisfied if, conditional on the observed covariates, there are remaining imbalances in important unobserved variables between the control and the treated units. Controlling for unobserved confounding factors is practically impossible in observational studies, but the geography of the Malagasy uprising provides an excellent opportunity to apply a regression discontinuity (RD) design to the problem.

As described in the data section, the rebellion and its repression took place in a delimited area of the country. But what explains the geographical expansion of the rebellion? Why did the rebels not go further? If we take a look at the topography of Madagascar, one sensible explanation that jumps to mind is that the geographical expansion of the insurgency was limited by a vertical mountain range that helped the French army to seize the insurgent area. The first bases of the insurrection were located in the eastern part of the country, and the rebels attempted to spread the movement in all possible directions, but they could not reach the west, and hardly reached some communities closely located to the left of the mountain range depicted by the solid black line in the digital elevation model shown in Figure 7.

Figure 7: Topography of Madagascar



Notes. Digital elevation model (DTM) representing the topography of Madagascar. Areas of low elevation are represented as blue, while areas of high elevation are represented as red.

Hence, our RD design aims to estimate the difference in freedom expression at the threshold demarcated by the mountain range that exogenously decided exposure and non-exposure to the rebellion. If local random assignment holds at this threshold, then the RD estimates are our best approximation to a randomized experiment. To be more precise, let D_i be the distance from respondent i's district of residence to the nearest point in the mountain-range line. For respondents residing in districts located to the east side of the line, D_i takes on positive values. For respondents residing in districts located to the west side of the line, D_i takes on negative values. In all cases, the distances are computed in tenths of miles from the centroid of the district's polygon to the nearest point in the mountain-range line.

Since a district may be partitioned by the mountain-range threshold, or in some cases individuals adjacently located to the left of the mountain range may have been exposed to the rebellion, we apply a Fuzzy Regression Discontinuity (FRD) design (Imbens and Lemieux 2010), which means that being exposed to the repression treatment is not a deterministic function of $T_i = 1\{D_i \geq 0\}$. In other words, the probability of receiving the treatment need not change from zero to one at the threshold. Instead, an

FRD design allows for a smaller jump in the probability of assignment to the treatment at the threshold: $\lim_{d\downarrow 0} \Pr(T_i = 1|D_i = d) \neq \lim_{d\uparrow 0} \Pr(T_i = 1|D_i = d)$, without requiring the jump to equal 1. This implies a situation in which factors determining exposure to the rebellion change discontinuously at the threshold, without these factors being powerful enough to move all units from non-exposure to exposure. In this design, the ratio of the jump in the regression of the outcome to the jump in the regression of the treatment indicator is interpreted as an average causal effect of the treatment. Formally, the estimand is defined as follows:

$$\tau_{FRD} = \frac{\lim_{d\downarrow 0} E[Y_i|D_i = d] - \lim_{d\uparrow 0} E[Y_i|D_i = d]}{\lim_{d\downarrow 0} E[W_i|D_i = d] - \lim_{d\uparrow 0} E[W_i|D_i = d]}$$

6 Main Empirical Results

We start with a comprehensive model using data before matching. Table 4 reports simple OLS estimates of the determinants of the index of freedom of expression. Robust standard errors are clustered at the district level since individuals are categorized as being from a region with uprising based on their district of residence, which means that the variation in treatment is at the district level. We observe that the coefficient estimates on the treatment variable are negative and statistically significant at the conventional levels in both specifications, i.e., with and without province fixed effects.

With regard to other covariates, we find that gender (female) is negatively correlated with freedom of expression, whereas the three religion dummies, as well as the indicator for the province of Antsiranana (which was unaffected by the repression) seem to have positive effects. Neither the income fixed effects nor the ethnicity indicators have a seizable or statistically significant impact on the dependent variable. Similarly, education and the district-level controls (area, rainfall, temperature, and mean elevation) seem to be irrelevant in determining an individual's level of freedom of expression.

In brief, these results are consistent with the hypothesis of a legacy of repression adversely affecting current levels of freedom of expression. Being exposed to the repression treatment decreases freedom of expression levels by at least half point. We should take these results with some caution, however, since these models do not deal with endogeneity concerns, and important covariate imbalance may result in a biased estimate of the treatment effect.

Table 4: OLS Estimates of Freedom of Expression

DV: Freedom of Expression	Model 1		Model 2	
Treatment	-0.66	(0.17)	-0.50	(0.16)
Female	-0.22	(0.09)	-0.23	(0.09)
Age	0.01	(0.00)	0.01	(0.00)
Education	-0.05	(0.02)	-0.05	(0.02)
Income: Much Worse	-0.37	(0.86)	-0.37	(0.84)
Income: Worse	-0.11	(0.78)	-0.20	(0.76)
Income: Same	0.35	(0.79)	0.21	(0.78)
Income: Better	0.62	(0.82)	0.46	(0.81)
Income: Much Better	0.00	(0.00)	0.00	(0.00)
Ethnicity: Betsileo	0.33	(0.24)	0.35	(0.24)
Ethnicity: Betsimaraka	0.01	(0.24)	-0.12	(0.27)
Ethnicity: Merina	0.41	(0.26)	0.33	(0.26)
Ethnicity: Antemoro	0.22	(0.39)	0.07	(0.36)
Ethnicity: Sihanaka	-0.71	(0.70)	-0.55	(0.71)
Ethnicity: Tanala	0.71	(0.51)	0.70	(0.53)
Religion: Catholic	0.24	(0.16)	0.31	(0.15)
Religion: Lutheran	0.31	(0.20)	0.44	(0.18)
Religion: Calvinist	0.59	(0.16)	0.58	(0.16)
District Industry	-0.28	(0.12)	-0.28	(0.12)
District Rainfall	-0.00	(0.00)	-0.00	(0.00)
District Temperature	0.13	(0.04)	0.07	(0.05)
District Area	-0.00	(0.00)	-0.00	(0.00)
District Elevation	0.00	(0.00)	0.00	(0.00)
Province: Antananarivo	-	-	0.34	(0.48)
Province: Fianarantsoa	-	-	0.18	(0.39)
Province: Toamasina	-	-	-0.02	(0.43)
Province: Mahajanga	-	-	0.63	(0.41)
Province: Antsiranana	-	-	1.08	(0.37)
Constant	3.43	(1.30)	4.58	(1.40)
Observations	1232	-	1232	-
σ	1.99	-	1.97	-

Clustered robust standard errors in parentheses

6.1 Matching Estimates

Matching estimates are reported in Table5. The upper panels display the effect estimates for two quantities of interest: the Average Treatment Effect (ATE), defined as $\tau_{ATE} = E[Y_i(1) - Y_i(0)]$, and the Average Treatment effect for the Treated (ATT), given by $\tau_{ATT} = E[Y_i(1) - Y_i(0)|W_i = 1]$. As the data suggest, regardless of the matching method we use, we find a negative and statistically significant impact of the treatment on self-reported levels of freedom of expression. Being exposed to the legacy of the repression decreases freedom of expression by between 11.9% and 13.0%. The results are robust to controls for individual characteristics, district-level variables,and province fixed effects, which is indicative of a treatment effect that survives under any contextual or institutional factors.

Table 5: Matching Estimates: Effect of Treatment on Freedom of Expression

	Model 3		Model 4	
	GenMatch	GenMatch	CEM	CEM
DV: Freedom of Expression	ATE	ATT	ATE	ATT
Effect of Treatment	-0.85	-0.87	-0.91	-0.92
Standard error	0.21	0.19	0.18	0.17
Percent Index increase	-11.9	-11.9	-12.8	-13.0
95% Lower bound	-18.6	-18.0	-18.9	-18.4
95% Upper bound	-5.0	-6.1	-6.9	-7.8
Individual controls	✓	✓	✓	✓
District-level controls	✓	✓	✓	✓
Province fixed effects	✓	✓	✓	✓
Observations	552	431	691	316

Notes. Individual controls include: gender (female), age, education years, religion, ethnicity, and 5 income fixed effects. District-level controls include: average annual rainfall (precipitation) and average annual temperature during year before the uprising (1946), distance to the nearest industrial town, district size, and district mean elevation. In addition, 5 province fixed effects are included. ATT = average treatment effect for the Treated, ATE=average treatment effect. Matching results are from Coarsened Exact Matching (CEM) and Genetic Matching (GenMatch)with postmatching regression adjustment. Standard errors are clustered at the district level.

6.2 RD Estimates

Table 6 displays the RD estimates of the effect ot the treatment variable on freedom of expression. As it is shown, the results confirm the existence of a negative and statistically significant treatment effect at the threshold $D = 0$. The results are robust across specifications that add or remove different subsets of control variables. The estimated average treatment effect that ranges from -1.49 to -0.86 in a 10-point scale. We therefore feel confident to reject the null hypothesis of no effect.

Figure 8 shows a visual representation from the RD design. The index of freedom of expression is plotted against respondents distance to the mountain range, as previously defined. The dotted reference line at zero indicates the threshold that separates respondents that have been exposed to the legacy of the rebellion from those that have not. The solid lines represent the expected level of freedom of expression conditional on the distance to the mountain range, which was computed using a locally weighted polynomial regression fitted separately to both sides of the threshold. Note that the expected level of freedom of expression tends to slightly decrease as the distance measure approaches the threshold

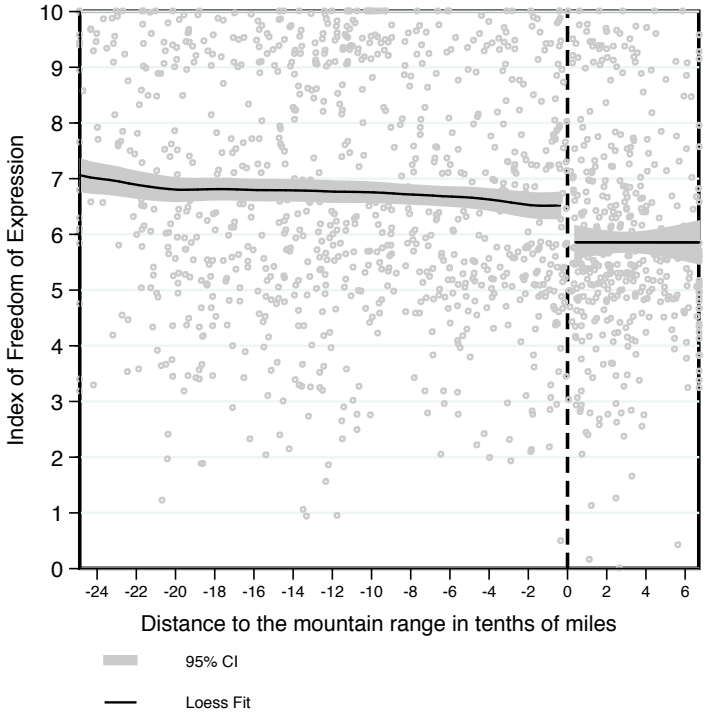
from the left, then it clearly jumps downwards at threshold and the expected value remains steady on the right side. This suggests that control units are more likely to be affected by the rebellion the closer they are to the affected area of the country, while the treatment effect is the same for all treated units, regardless of the distance to the mountain range.

Table 6: RD Estimates: Effect of Treatment on Freedom of Expression

DV: Freedom of Expression	Model 5	Model 6	Model 7	Model 8
Effect of Treatment	-1.49	-0.86	-0.94	-1.13
Standard error	0.41	0.46	0.50	0.54
Individual controls	-	✓	✓	✓
District-level controls	-	-	✓	✓
Province fixed effects	-	-	-	✓
Observations	166	165	165	165

Notes. Individual controls include: gender (female), age, education years, religion, ethnicity, and 5 income fixed effects. District-level controls include: average annual rainfall (precipitation) and average annual temperature during year before the uprising (1946), distance to the nearest industrial town, district size, and district mean elevation. In addition, 5 province fixed effects are included.

Figure 8: RD Design: Effect of Treatment on Freedom of Expression



7 Analyzing Robustness

7.1 Allowing Measurement Uncertainty

One important advantage of the modeling approach used to estimate freedom of expression as a latent variable is that it allows us to assess the noise, or measurement error, in our resulting index. As we mentioned before, each of the MCMC routines we ran generated a posterior distribution with 2,500 simulations, and we picked the posterior means to create the index. Therefore, a sensible robustness test is to let uncertainty in the index scores (x) to propagate into inferences about the coefficients. To do so, we sample x from the posterior distribution $p(x/Z)$ to create a new index, and then we run the regressions again. The results are shown in Table 7. We control for the full set of covariates used in previous specifications, and confirm that the negative treatment effect is robust to allowing measurement uncertainty in the scores of the index to propagate into inferences over the parameters in the model. We observe that measurement uncertainty estimates do not differ from original point estimates in substantial ways. In fact, the RD estimates reported under measurement uncertainty are practically identical to the RD original point estimates -the ATE passed from -1.13 to -1.03. Being the RD estimates our best approximation to a randomized experiment, we can feel confident to say that, *ceteris paribus*, individual exposure to the legacy of the rebellion decreases an individual level of freedom of expression by about 1 point in a 10-point scale.

Table 7: Effect of Treatment on Freedom with Measurement Uncertainty Propagated

	Original Point Estimates			Measurement Uncertainty		
	RD	GenMatch	CEM	RD	GenMatch	CEM
DV: Freedom of Expression	ATE	ATE	ATE	ATE	ATE	ATE
Effect of Treatment	-1.13	-0.85	-0.91	-1.03	-0.60	-0.66
Standard error	0.54	0.21	0.18	0.45	0.19	0.18
Individual controls	✓	✓	✓	✓	✓	✓
District-level controls	✓	✓	✓	✓	✓	✓
Province fixed effects	✓	✓	✓	✓	✓	✓
Observations	165	552	691	165	552	691

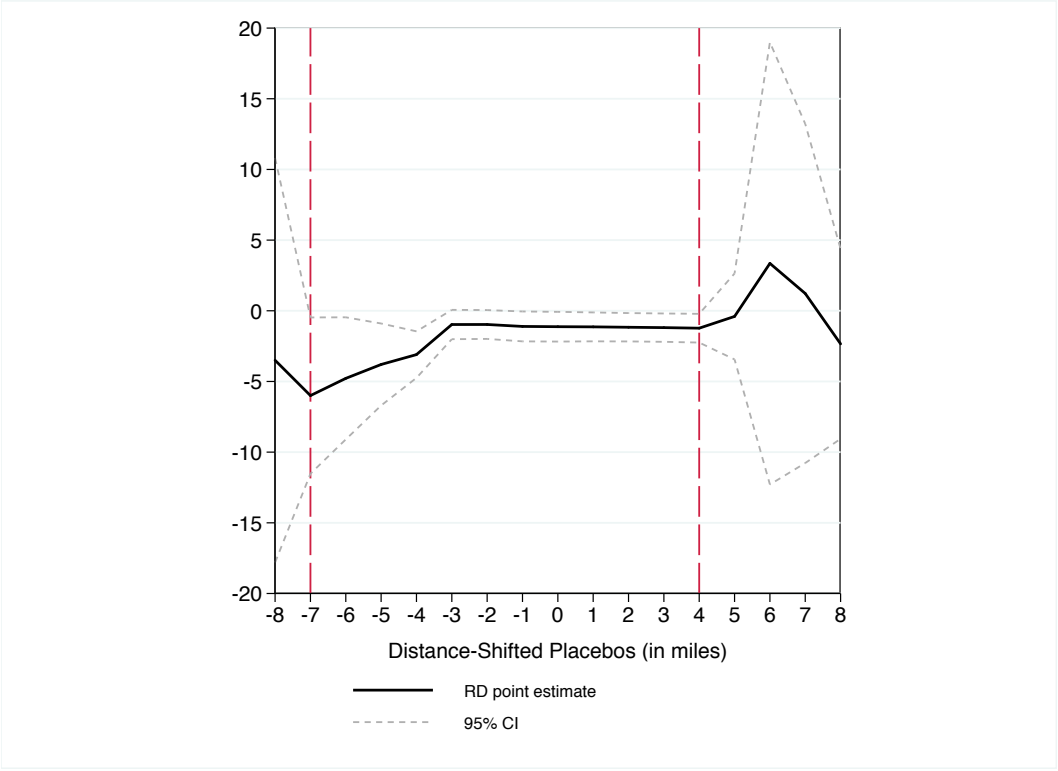
Notes. Individual controls include: gender (female), age, education years, religion, ethnicity, and 5 income fixed effects. District-level controls include: average annual rainfall (precipitation) and average annual temperature during year before the uprising (1946), distance to the nearest industrial town, district size, and district mean elevation. In addition, 5 province fixed effects are included. ATE=average treatment effect. RD indicates regression discontinuity estimates. Matching results are from Coarsened Exact Matching (CEM) and Genetic Matching (GenMatch)with postmatching regression adjustment. Standard errors are clustered at the district level.

7.2 Distance-Shifted Placebo Laws

The RD estimates thus far have focused on estimating the difference in freedom expression at the threshold demarcated by the mountain range that exogenously determined exposure to the rebellion. However, as earlier mentioned, a given district may be partitioned by the mountain-range threshold, and this is why we implement a Fuzzy Regression Discontinuity (FRD) design. In addition, we can use more fine-grained distance data to estimate the effect of placebo laws, which we generate by shifting the threshold 8 miles backward and 8 miles forward, creating 16 placebo treatments. For instance, the placebo law resulting from the -4 mile shift placebo redefines the threshold so it starts four miles to the left of the actual mountain range.

Figure 9 displays the coefficients from these 16 placebo laws estimates, along with the 95% confidence intervals. It is worth noting that a negative effect seems to hold statistically significant within an 11-mile band, that is from -7 to 4, but the statistical significance of the coefficients disappears with any additional mile in either direction. This suggests that the effect occurred no more than 7 miles to the left, and no more than 4 miles to the right of the mountain range.

Figure 9: RD Estimates: Effects from Distance-Shifted Placebos



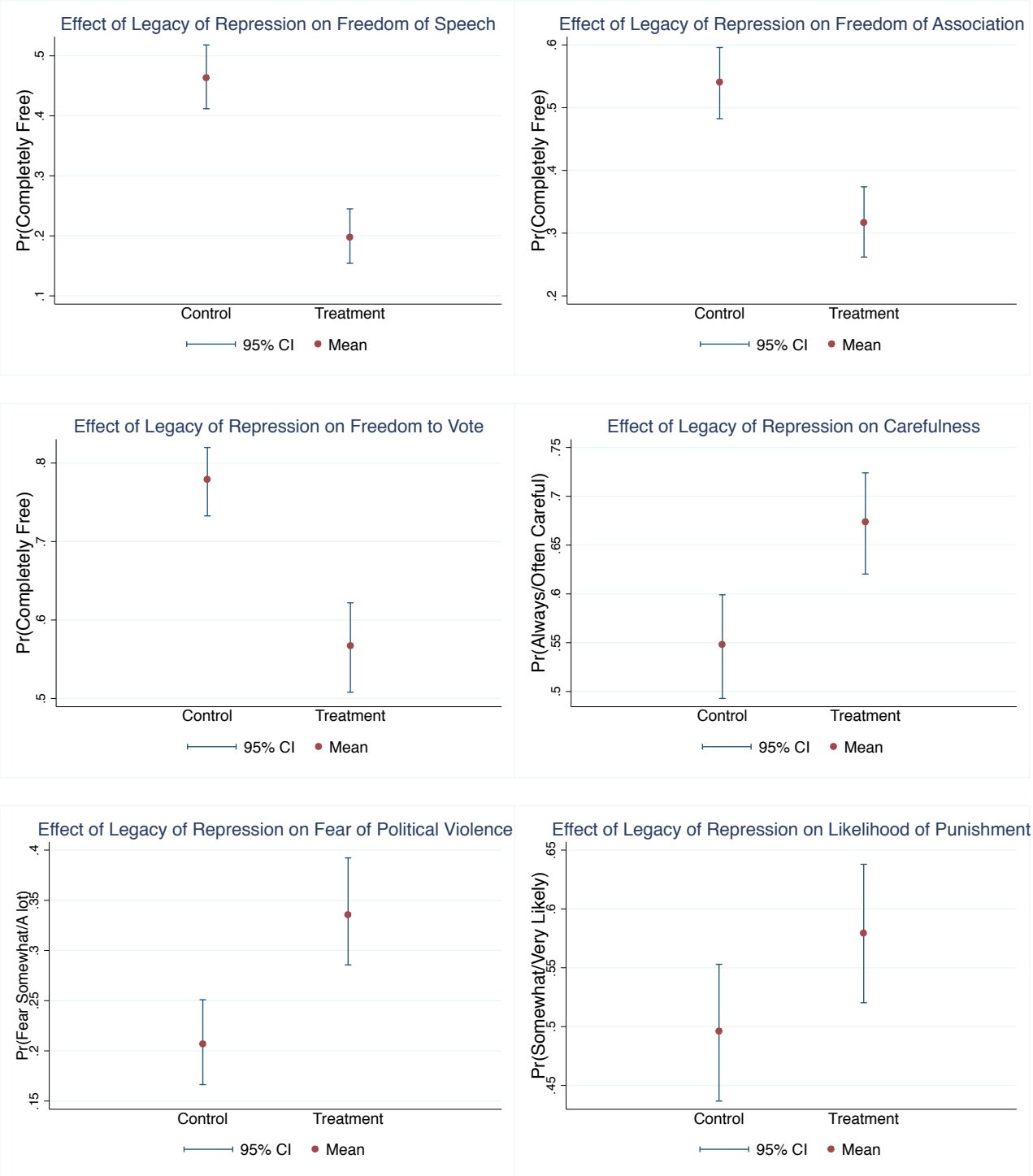
7.3 Logit Estimates of the Components of the Index

Throughout this paper we have treated freedom of expression as a latent continuous variable. This is because we are interested in having an encompassing measure of the unobserved levels of this concept. However, the components used to estimate this index are ordinal variables. Therefore, one could estimate ordinal logit models of these variables, or alternatively recode them into relevant dummies to simply estimate logit or probit models. We have adopted the second strategy to simplify the presentation of results. We recoded each component of the index as an indicator variable and estimated logistic regressions of these indicators using CEM matched data. We then computed the predicted probabilities of the dependent variables for control and treatment units via CLARIFY (setting all covariates at their means or modes, depending on the nature of each variable).

Figure 10 presents graphical representations of the predicted probabilities of each component of the index for both the control and the treatment groups. As we can see, the treatment effect goes in the expected direction in each case. For instance, exposure to the legacy of repression negatively affects freedom of speech, and positively impacts fear of political violence during elections. The same applies to the remaining cases. Although not reported here for simplicity, coefficient estimates on the treatment variable are statistically significant at the conventional levels. Moreover, as it is evident from the plots, the 95% confidence intervals around the predicted probabilities for the control and the treatment groups do not overlap in most cases, which is indicative of a strong treatment effect.

Finally, it is worth drawing some attention to the effects of exposure to the rebellion upon freedom of speech, freedom of association, and freedom to vote, which are found to be quite robust. Holding everything else constant, only about 20% of those exposed to the legacy of the uprising are expected to feel completely free to say what they think, while this percentage is as high as 45% for those who were not exposed to the repression treatment. Similarly, more than half of those pertaining to the control group are expected to feel completely free to join any political organization they want, whereas only one third of the treated units are expected to feel the same way. As for the freedom to vote, 78% of the non-treated versus 57% of the treated units are expected to feel completely free to choose whom to vote for without feeling pressured.

Figure 10: Logit Estimates: Components of the Index of Freedom of Expression



Notes. All estimates are based on logistic regressions using CEM matched data. Robust standard errors are clustered at the district level. Predicted probabilities were computed using CLARIFY setting all covariates at their means or modes, depending on the nature of each variable. Dependent variables were recoded as follows: "Freedom of Speech", "Freedom of Association" and "Freedom to Vote" are equal to 1 if "completely free ", and 0 otherwise; "Carefulness" is 1 if "always" or "often very careful", and 0 otherwise; "Fear of Political Violence" is 1 if fear "somewhat" or "a lot", and 0 otherwise; and "Likelihood of Punishment" is equal to 1 if "somewhat" or "very likely", 0 otherwise.

7.4 Placebo Dependent Variables

Finally, we estimate the effect of our treatment variable on a number of placebo outcomes. Table 8 reports logit estimates of two different sets of placebo dependent variables: trust in institutions (Panel A), and democratic views (Panel B). Trust-related variables have been recoded as 1 if "trust a lot", and 0 otherwise. We have included trust in the president, the parliament, the courts, the traditional leaders, the electoral institutions, and the police. Variables on democratic views were recoded as follows: "Plurality" is equal to 1 if agree that many parties are needed, and 0 otherwise; "Supp. Elect." is 1 if support for elections, and 0 otherwise; "Supp. Dem." is 1 if support for democracy, and 0 otherwise; "Patronage" is 1 if agree with helping own community only, and 0 otherwise; "No Term Lim." is 1 if in favor of no term limits, and 0 otherwise; and "Turnout" is equal to 1 if voted in the last election, and 0 otherwise. According to the results, trust in the electoral institutions seems to be the only variable affected by the legcy of the repression. We find this makes our results even more convincing, since freedom of expression may be closely related to electoral credibility and participation.

Table 8: Effect of Treatment on Placebo Dependent Variables

Panel A: Trust in Institutions

Placebo DVs:	**President**	**Parliament**	**Courts**	**Trad. Leaders**	**Elect. Inst.**	**Police**
	(Logit)	(Logit)	(Logit)	(Logit)	(Logit)	(Logit)
Treatment	-0.20	-0.74	-0.63	0.28	-1.72	-0.75
Standard error	0.32	0.40	0.45	0.55	0.60	0.41
Observations	659	558	604	231	542	662

Panel B: Democratic Views

Placebo DVs:	**Plurality**	**Supp. Elect.**	**Supp. Dem.**	**Patronage**	**No Term Lim.**	**Turnout**
	(Logit)	(Logit)	(Logit)	(Logit)	(Logit)	(Logit)
Treatment	0.07	-0.42	0.37	-0.084	0.25	0.08
Standard error	0.27	0.34	0.22	0.22	0.25	0.24
Observations	616	647	509	647	610	693

Notes. All estimates are based on logistic regressions using CEM matched data. Robust standard errors are clustered at the district level.Trust variables were recoded as follows: 1 if trust a lot; 0 otherwise. Variables on democratic views were recoded as follows: "Plurality" is 1 if agree that many parties are needed, and 0 otherwise; "Supp. Elect." is 1 if support for elections, and 0 otherwise; "Supp. Dem." is 1 if support for democracy, and 0 otherwise; "Patronage" is 1 if agree with help own community only, and 0 otherwise; "No Term Lim." is 1 if in favor of no term limits, and 0 otherwise; and "Turnout" is equal to 1 if voted in the last election, and 0 otherwise.

8 Conclusion

Our results highlight the role of traumatic historical events as determinants of political attitudes and behavior. We have provided enough empirical evidence to conclude that the legacy of the repression of the Malagasy uprising of 1947 has caused negative long-term effects on self-reported levels of freedom of expression. The regression analysis shows that this traumatic influence is strongly connected with the geography (and ethnography) of the repression. The effects hold statistically significant even when incorporating province fixed effects, and are robust to both individual chracteristics and district-level controls. Therefore, we can feel confident to say that the effect of the repression treatment is stronger than any other time-invariant, contextual or institutional variable. This suggests that the mechanism through which this legacy of repression operates is cultural, rather than institutional. It is closely tied to ethnicity and geographic location.

One important thing to note about our treatment variable is that it is not conceptually clear whether we are observing a legacy of repression, or simply a legacy of participation in the uprising. However, what we have learned from previous anthropological studies and historical accounts indicates that it is the image of a ruthless massacre that persists in people's collective memory, rather than the memories of an heroic, but failed, anti-colonial insurrection. Hence, our theoretical assumption is that as time goes by it is much more likely that we are observing a legacy of repression than a legacy of participation in the uprising. To conclude, it is worth emphasizing that our results are theoretically consistent with hypotheses suggested in previous anthropological studies, in particular with the idea of the persistence of fears associated with engagement in politics.

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Appendix

Figure 11: Ethnic Groups and Group Migration: 1908 and 1958

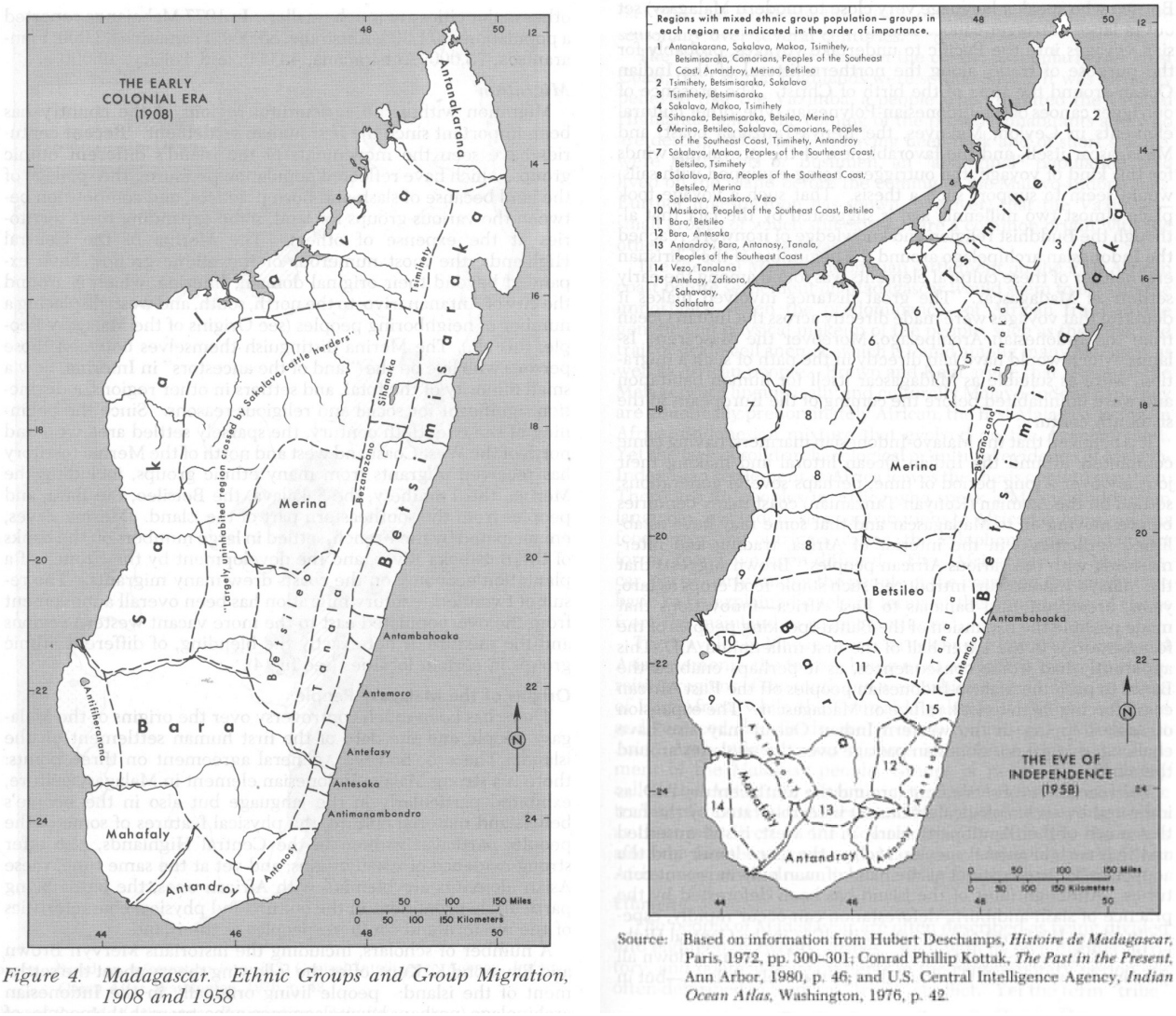


Figure 4. Madagascar. Ethnic Groups and Group Migration, 1908 and 1958

Source: Based on information from Hubert Deschamps, *Histoire de Madagascar*, Paris, 1972, pp. 300–301; Conrad Phillip Kottak, *The Past in the Present*, Ann Arbor, 1980, p. 46; and U.S. Central Intelligence Agency, *Indian Ocean Atlas*, Washington, 1976, p. 42.

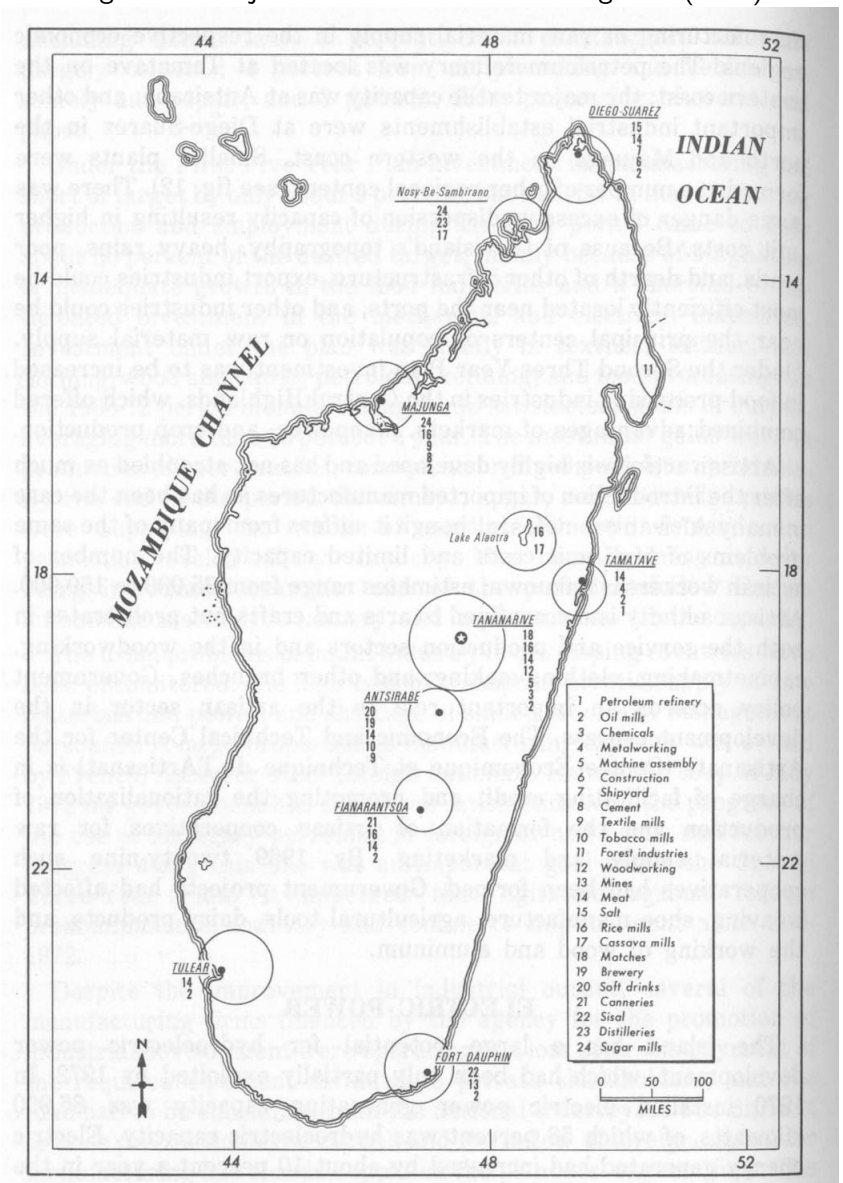
Source: Harold, Nelson. 1973. *Area Handbook of the Malagasy Republic.* U.S. Government Printing Office.

Figure 12: Sample of the Historical Meteorological and Climatological Data for Madagascar

RESUMÉ DES OBSERVATIONS MÉTÉOROLOGIQUES PENDANT LE MOIS DE JANVIER 1946.

STATIONS.	PRESSION à 06 h. 30 locales.	TEMPÉRATURE DE L'AIR.						NOMBRE de JOURS d'orage.	ÉVAPORATION en m/m.	PRÉCIPITATIONS.		
		MINIMUM absolu.	MAXIMUM absolu.	MOYENNE des minima.	MOYENNE des maxima.	MOYENNE $\frac{Tx+Tn}{2}$	ÉCART à la NORMALE.			HAUTEUR totale en m/m.	ÉCART à la normale.	NOMBRE de jours.
COTE EST.												
Diégo-Suarez	1011.8	20.9	33.4	23.2	30.6	26.9	— 0.6	13	60	422	+ 149	20
Vohémar	1011.8	21.8	33.0	23.2	30.4	26.8	— 0.6	27	—	213	+ 11	16
Antalaha	1012.4	21.3	30.7	22.1	29.3	25.7	— 0.2	25	46	485	+ 199	25
Mananara-Nord	1013.1	22.0	32.1	22.8	30.5	26.6	— 0.3	26	—	643	+ 288	24
Sainte-Marie	1012.9	21.2	31.3	23.5	28.3	25.9	— 0.9	10	—	581	+ 179	23
Tamatave	1013.2	21.4	31.6	23.2	29.5	26.4	— 0.2	11	103	690	+ 288	20
Vatomandry	1013.6	×	30.8	22.8	28.8	25.8	— 0.3	5	—	553	+ 166	21
Mahanoro	1013.8	21.6	29.9	22.6	28.6	25.6	— 0.3	4	—	410	+ 20	19
Nosy-Varika	1013.3	21.4	31.2	22.7	29.9	26.3	+ 0.4	4	—	184	— 241	18
Mananjary	1013.9	20.0	30.5	22.0	29.2	25.6	— 0.7	5	—	279	— 192	19
Manakara	1014.1	21.1	×	22.7	×	×	×	4	—	356	— 43	16
Farafangana	1013.8	21.0	29.3	23.3	28.0	25.7	— 0.1	6	72	160	— 200	15
Fort-Dauphin	1013.1	20.4	34.1	22.3	30.0	26.2	+ 0.7	14	143	29	— 164	7
VERSANT EST.												
Mandritsara	975.7	19.4	34.1	21.3	30.9	26.1	— 0.2	3	—	245	— 75	19
Ambohitsilaozana	926.2	16.1	30.6	18.1	28.3	23.2	— 0.1	13	—	336	+ 74	16
Moramanga	913.1	14.2	30.7	17.3	27.0	22.2	0 0	10	—	118	— 173	20
Marolambo	964.9	19.0	33.3	20.6	30.4	25.5	+ 0.3	7	—	217	— 111	21
PLATEAUX.												
Tananarive	859.3	14.2	29.4	15.3	24.5	19.9	— 0.1	26	96	126	— 147	22
Antsirabe	—	×	29 9	×	25.5	×	×	14	—	298	— 3	18
Ambositra	867.5	13.4	30 5	16.0	25.7	20.8	+ 0.2	15	—	150	— 146	22
Fianarantsoa	886.4	—	—	—	—	—	—	×	—	71	— 232	12
Ihosy	932.3	18.1	33.6	19.4	30.8	25.1	+ 0.7	12	—	137	— 94	16
Betroka	925.2	—	—	—	—	—	—	24	—	100	— 127	9
VERSANT OUEST.												
Port-Bergé	1012.2	20.9	36.3	22.7	33.6	28.1	+ 0.6	24	—	355	— 123	23
Maevatanàna	1012.4	20.1	36.2	22.8	32.9	27.8	+ 0.2	29	—	340	— 131	23
Kandreho	×	×	×	22.5	×	×	×	25	—	182	— 321	23
Tsiroanomandidy	917.0	17.9	×	18.9	×	×	×	25	—	530	+ 133	28
Miandrivazo	1012.1	20.2	36.4	22.9	33.6	28 3	— 0.2	31	—	×	×	×
Malaimbandy	993.4	20.0	35.7	22.4	33.6	28 0	— 0.2	31	—	572	+ 221	25
Berorohs	×	×	×	×	×	×	×	22	—	196	0	12
Sakaraha	959.7	18.1	35.0	20.7	32.6	26.6	+ 0.2	22	—	385	+ 211	18
Benenitra	985.9	20.7	37.4	23.1	35.3	29 2	+ 0.6	30	—	339	+ 76	13
COTE OUEST.												
Nossi-Bé	1011.8	22.2	32.2	23.4	31.1	27.2	+ 0.4	9	—	321	— 199	27
Analalava	1011.8	21.8	33.1	23.0	30.7	26.8	+ 0.2	14	—	481	— 105	22
Majunga	1012.0	21.5	35.0	23.3	31.2	27 3	+ 0.1	26	76	339	— 181	19
Soalala	1011.6	21.9	34.6	23.9	31.4	27.6	+ 0.4	17	—	232	— 173	17
Besalampy	1011.8	22.0	34.0	23.6	31.9	27.8	+ 0.3	17	—	198	— 192	20
Maintirano	1011.6	21.1	32.8	23.7	30.7	27.2	— 0.1	24	64	312	+ 83	19
Morondava	1011.7	20.5	33.6	24.1	31.3	27.7	— 0.2	27	102	166	— 42	18
Morombe	1011.1	21.1	34.5	24.0	32.9	28.5	+ 0.1	25	—	×	×	×
Tuléar	1010.7	20.8	35.1	23.0	32.0	27.5	— 0.1	28	88	93	+ 16	9
SUD.												
Tsivory	968.0	17.9	38.1	21.3	34.2	27.8	+ 1.6	18	—	94	— 142	8
Tsihombe	1011.7	×	×	23.4	35.2	29.3	+ 1.7	14	—	22	— 55	8
COMORES.												
Moroni	1011.6	22.6	30.8	23.9	29.5	26.7	— 0.2	8	71	266	— 157	13
Dzaoudzi	1011.4	21.8	32.6	23.9	30.3	27.1	+ 0.2	9	—	231	— 65	15

Figure 13: Major Industrial Towns of Madagascar (1966)



Source: Adapted from Georges Bastian, *Madagascar: Etude Géographique et Economique*, Tananarive, 1967.

Figure 12. Location of Industry, Malagasy Republic, 1966

Source: Harold, Nelson. 1973. *Area Handbook of the Malagasy Republic.* U.S. Government Printing Office.