

CONCESSIONS, VIOLENCE, AND INDIRECT RULE: EVIDENCE FROM THE CONGO FREE STATE*

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All colonial powers granted concessions to private companies to extract natural resources during the colonial era. In Africa, these concessions were characterized by indirect rule and violence. We use the arbitrarily defined borders of rubber concessions granted in the north of the Congo Free State to examine the causal effects of this form of economic organization on development. We find that historical exposure to the concessions causes significantly worse education, wealth, and health outcomes. To examine mechanisms, we collect survey and experimental data from individuals near a former concession boundary. We find that village chiefs inside the former concessions provide fewer public goods, are less likely to be elected, and are more likely to be hereditary. However, individuals in the concessions are more trusting, more cohesive, and more supportive of sharing income. We interpret our results as reflecting how institutions and culture may act as substitutes in the context of the widespread colonial concession system. *JEL* Codes: O15, N47, D72, O43, Z13

I. INTRODUCTION

The Congo Free State (CFS), what is today the Democratic Republic of the Congo (DRC), was the personal colony of

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King Leopold II of Belgium between 1885 and 1908. Leopold designated large parts of the CFS as concessions to private companies. These private companies extracted natural resources by using extreme violence and by co-opting local leaders. Historians have noted that the rubber concessions granted under Leopold II had disastrous consequences for local populations. An estimated 10 million people, approximately half of the population of Congo, died between 1880 and 1920 ([Hochschild 1998](#); [Vansina 2010](#)).

While the concessions granted under the CFS and the subsequent abuses that occurred are particularly infamous, all major colonial powers granted concessions to private companies. In Africa, concessions existed in French, British, Belgian, German, and Portuguese colonies (e.g., Angola, Botswana, Central African Republic, Cameroon, Chad, DRC, Gabon, Malawi, Mozambique, Namibia, Nigeria, Republic of Congo, Tanzania, Zambia, Zimbabwe).¹ Although the form of concessions varied widely across contexts, a common element is that these companies' primary purpose was to extract natural resources. They were assigned powers that are typically associated with government—such as monopoly over violence and ability to tax. In sub-Saharan Africa, concessions to private companies were characterized by indirect rule, in which the scope and power of local leaders was altered and co-opted, alongside the use of violence to achieve their extraction goals ([Mamdani 1996](#); [Michalopoulos and Papaioannou 2020](#)).

While concessions to private companies were common across colonial Africa as a form of organizing economic production, causal evidence on their effects has been difficult to obtain. The lack of evidence is due in part to how ubiquitous these concessions were. Some colonies were completely run as concessions.² In addition, the concessions' boundaries were rarely randomly allocated, and concessions were often granted in resource-rich areas.

However, the rubber concessions granted in northern Congo—Abir and Anversoise—offer an opportunity to test how exposure to private concession companies has affected development. Abir and

1. Concessions to private companies also existed outside of Africa, for example, the East India Company in India, the United Fruit Company in much of Central America ([Méndez-Chacón and Van Patten 2021](#)), and the Dutch East India company in Indonesia.

2. For example, all of Rhodesia (present-day Zimbabwe) was granted as a concession to the British South Africa company.

Anversoise were defined using salient geographic features when relatively little was known of the interior of Congo. In addition, the former concession boundaries do not align with any present-day political boundaries, ethnic group boundaries, or any particular natural resource endowment. The concessions only existed for 14 years, a relatively short amount of time. Finally, the concessions focused exclusively on extraction, rather than investments in infrastructure or human capital (in contrast to [Dell and Olken 2020](#); [Méndez-Chacón and Van Patten 2021](#)). These features allow us to isolate the effects of exposure to extraction-based colonial concessions on our outcomes of interest ([Michalopoulos and Papaioannou 2020](#)). In this study, we examine the effects of the rubber concessions granted in the CFS on development, the performance and accountability of local leaders, and prosocial norms and behavior.

Exposure to the concessions in the CFS was characterized by violence and the use of village chiefs to enforce rubber collection quotas. The concession companies were given monopoly rights over natural resource extraction within the concession boundaries. European agents had monetary incentives tied to rubber production and were given support from the CFS armed forces (the *Force Publique*), their own militias, and a state mandate to use coercive means to reach their goals. Historical accounts of the rubber concession period highlight how the rubber companies forced village chiefs to support the rubber regime. Those who did not support the rubber regime were killed and replaced by outsiders willing to enforce the rubber quotas ([Harms 1975](#); [Vangroenweghe 1986](#)). This combination of co-optation and coercion is a highly relevant bundle for the colonial context and likely the most relevant for understanding the importance of colonial extraction ([Michalopoulos and Papaioannou 2020](#)).

We examine the implications of the rubber concessions for development outcomes using a geographic regression discontinuity (RD) design. Consistent with the idiosyncratic manner with which the historical boundaries were determined, we demonstrate that those areas designated as concessions are geographically and culturally similar to the areas just outside of the concessions. We then use Demographic and Health Survey (DHS) data from 2007 and 2014 to estimate the effects of the historical concessions on present-day education, wealth, and health outcomes ([ICF 2007–2014](#)). We find that individuals from the former concessions have significantly worse outcomes. The results are robust to a

variety of analyses, including alternative RD specifications, bandwidths, and kernels; a donut hole analysis; dropping observations along the Congo River; standard error adjustments to account for spatial autocorrelation; and an analysis by concession. We address several possible concerns with examining the effects of the historical rubber concessions: the use of river basins to define boundaries, selective migration, and subsequent colonial or missionary investment. We find no evidence that these factors explain our observed results.

We then examine mechanisms. We present a conceptual framework based on three premises. First, the use of indirect rule may have led to less accountable and more despotic leaders (Mamdani 1996; Vanhee 2005). Second, weakened institutions and violence may have encouraged more prosocial behavior; as local institutions failed to function, returns to investing in social capital became higher and cooperation became more important (von Dawans et al. 2012; Bauer et al. 2016). Third, institutions and culture may act as substitutes, leading to a low-development equilibrium (Bisin and Verdier 2017).

We collected survey and experimental data from 520 individuals in Gemena, DRC, a town on the border of the former Anversoise concession. Gemena was created after the end of the concession era; those who live there are migrants themselves or descendants of migrants. Our analysis follows the epidemiological approach (Fernández 2011): we compare data from individuals in Gemena with ancestors from inside the former concessions to those with ancestors from outside the former concessions.

Using data on the villages of origin of our respondents, we examine the selection mechanism for the chief and the extent to which the chief provides various public goods for the village. Generally, village chiefs are chosen either through elections, in which village members or representatives of villagers can vote among several candidates, or are hereditary, coming from one specific lineage within the village. We find that village chiefs within the former concessions are 35 percentage points less likely to be elected to their position and are more likely to be hereditary. This is possibly due to the common historical practice of anointing particular lineages as “ruling” lineages, from which subsequent village chiefs would be chosen. In some cases, medals were given to particular chiefs as proof that their lineage is a ruling lineage (Vanhee 2005; Omasombo 2013).

We examine the responsibilities of the village chief. The village chief serves a particularly important role in this context, as

the national government is weak and generally unable to provide basic public goods (Sanchez de la Sierra 2020). We find that village chiefs inside the former concessions are less likely to provide public goods, such as road maintenance, conflict arbitration, and maintenance of schools. As a consequence, these villages also have fewer public goods.

Building on other work examining the effects of colonial extraction (Dell 2010; Dell and Olken 2020) that primarily focuses on institutional and investment channels, we test whether the concession system had consequences for several different cultural traits, including trust, social cohesion, altruism, and support for sharing income. This is important given growing evidence of the feedback between institutions and cultural traits (Bisin and Verdier 2017).

Using survey questions on trust in a variety of other individuals or groups, we find that individuals from areas exposed to the rubber concessions are more trusting of others than those just outside the former concessions. We also examine measures of social cohesion and support for sharing income. We find that individuals from the former concession areas report feeling closer to a variety of others, are more likely to agree with statements that money should be shared with others, and are more likely to redistribute in an experimental task. Based on the historical narrative and our conceptual framework, we suggest that these changes may be due to a need to compensate for the lower-quality institutions that arose from the concession era. In addition, these changes may reinforce each other: chiefs are held less accountable and allowed to stay in power since individuals rely less on their formal institutions and instead rely more on informal sharing norms for support.

We contribute to several literatures. An important set of studies examine the effects of colonialism, precolonial characteristics, and exposure to the slave trade on modern outcomes (La Porta et al. 1998; Acemoglu, Johnson, and Robinson 2001; Gennaioli and Rainer 2007; Nunn 2008; Michalopoulos and Papaioannou 2013, 2014; Alsan 2015). A related literature has examined the effects of investments made by colonial governments (Huillery 2009; Osafo-Kwaako 2012; Cagé and Rueda 2016, 2020; Wantchekon, Klasnja, and Novta 2015; Lowes and Montero 2021a).³

3. See Michalopoulos and Papaioannou (2020) for a thorough review of work examining historical legacies in Africa.

However, there is no evidence on the concession system, despite the fact that it was a very common form of economic organization for extracting natural resources from colonies (Michalopoulos and Papaioannou 2020).⁴ In the case of these concession companies, they did not make productive investments in these areas. Rubber requires little capital investment to be collected, and it does not require training of the labor force. The primary input is labor, and the concession areas are connected to river networks so that there was no need to invest in road infrastructure. Thus, the key focus was extraction.⁵

Past work has shown that forms of indirect rule are associated with worse development outcomes (Banerjee and Iyer 2005; Acemoglu, Reed, and Robinson 2014). The concession era contributed to the proliferation of indirect rule. We find evidence consistent with Mamdani's hypothesis that indirect rule has created less accountable and worse leaders. By co-opting local institutions, replacing uncooperative leaders with compliant ones, and creating ruling lineages, the rubber concessions instituted a series of local strongmen, who continue to dominate village politics today.

There is growing theoretical evidence that culture responds to institutions and that understanding this process is important for understanding persistence (Bisin and Verdier 2017; Acemoglu and Robinson 2019; Nunn 2021). By combining survey and fieldwork with our historical analysis, we are able to empirically examine the role of both institutions and culture. In addition, the results speak to the importance of "place" for intergenerational mobility (Chetty, Hendren, and Katz 2016; Chetty and Hendren 2018; Alesina et al. 2021). We show that development outcomes for second-generation migrants converge once in Gemena, even though they maintain different cultural norms.

Finally, we provide the first quantitative evidence on the effects of an historical event of significant magnitude. This itself is an important contribution. After the slave trade, the concessions granted under King Leopold are one of the most important events in modern African history. Joseph Conrad, author of *Heart*

4. Current evidence mostly focuses on cases in which companies made productive investments (Juif and Frankema 2017; Dell and Olken 2020)

5. This is also related to the literature on the long-run effects of labor coercion, a common element of colonial extraction in Africa and a common feature of labor relations for much of human history (Nunn 2008; Dell 2010; Acemoglu and Wolitzky 2011; van Waijenburg 2015; Dippel, Greif, and Trefler 2020).

of *Darkness*, describes this era as “the vilest scramble for loot that ever disfigured the history of human conscience and geographical exploration.”⁶ We find that the rubber concessions granted by Leopold II have large and significant negative effects on economic development. This finding is relevant for the many parts of sub-Saharan Africa, South America, and Asia that were granted as concessions to private companies during the colonial era.

The article is organized as follows. [Section II](#) provides historical background on the CFS and the rubber concessions. [Section III](#) presents the main empirical results from the DHS data. [Section IV](#) describes the fieldwork data and results. [Section V](#) concludes. An [Online Appendix](#) supplements the article.

II. THE HISTORY OF THE RUBBER CONCESSIONS

By the mid-1870s, European powers had made claims to most parts of Africa. However, the center of Africa remained largely unexplored. In a bid to make Belgium a colonial power, King Leopold II convinced other European colonial powers of his philanthropic goals in Congo, including his mission to end the slave trade. The British, French, and German governments acquiesced to Leopold’s interest in Congo to avoid conflict with each other over their own colonial aspirations. Thus, the CFS was created in 1885 as the personal colony of Leopold. According to the Berlin conference in which the borders of the CFS were outlined, Congo was to remain a free trade zone for individuals of all nationalities.

II.A. Concessions in the CFS

Leopold needed to demonstrate continued state presence in the Congo to retain his rights over it. This proved a costly endeavor. In 1891 and 1892, in an attempt to increase revenues and contrary to the spirit of the Berlin agreement, he declared all lands and any raw materials found on these lands to be the property of the CFS. This decree divided Congo into three areas. The first area was the *domaine privé*, which was property of the state. Areas of the *domaine privé* were divided into concessions given to private companies. The two largest concessions granted in the

6. This is related to literature on the effects of mass killings, such as the Holocaust, the Rwandan genocide, and the expulsion of the Moriscos ([Acemoglu, Hassan, and Robinson 2011](#); [Rogall and Yanagizawa-Drott 2014](#); [Chaney and Hornbeck 2016](#)).

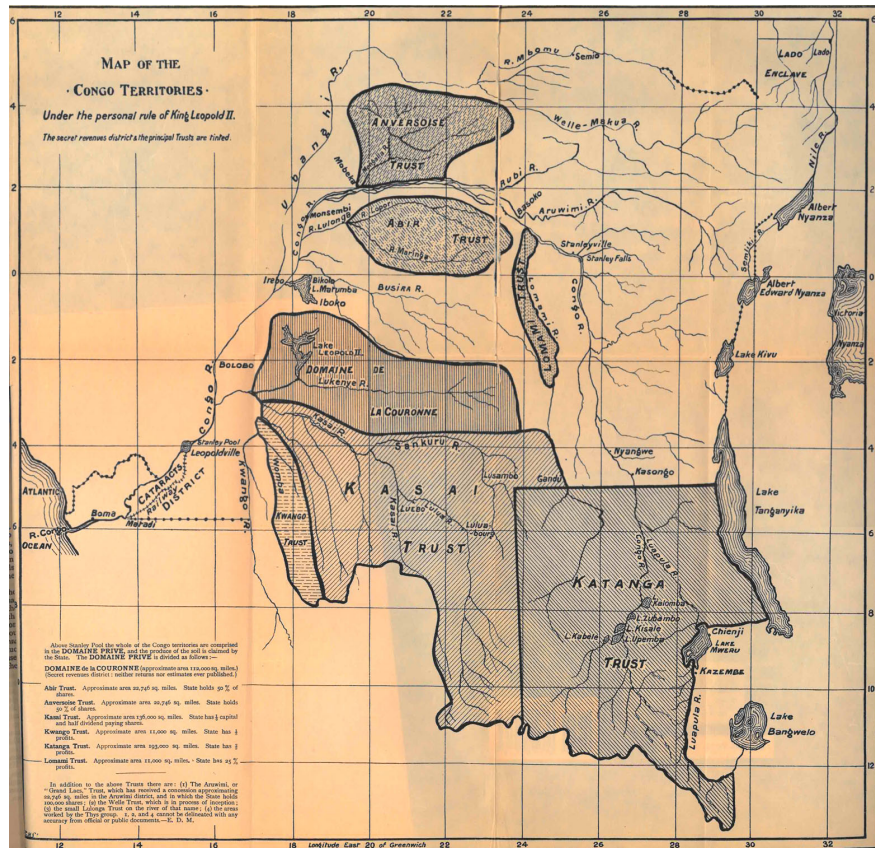


FIGURE I

1904 Map of Concessions Granted by Leopold II

The two most northern concessions are Anversoise and Abir. This map was published in [Morel \(1905, insert following page 266\)](#). The digital image is from a copy in the Harvard Library.

domaine privé were Anglo-Belgian India Rubber Company (Abir) and Anversoise ([Waltz 1917](#)). An additional part of the *domaine privé* was allocated as private land for the king himself, called the *domaine de la couronne*. A second area, called the “closed area,” was to be settled as circumstances allowed. Most of this area was eventually allocated to the Katanga Company in the southwest. The rest of the country was primarily a “free trade zone” where individuals of any nationality could engage in trade. The Kasai region in the south and southeast remained open to free trade until 1902, when the Kasai trust was established. See [Figure I](#) for a map of the concessions as of 1904.

The administration of the various areas of the CFS varied depending on whether they were part of a concession, the

concession's timing and duration, and the natural resources present in the area. The Abir and Anversoise concessions were the largest focusing on the collection of rubber and existed for 14 years, from 1892 to 1906.⁷ The Abir and Anversoise concessions differed from other concessions in that their borders were defined by the extent of river basins, their borders do not coincide with present-day political boundaries, they existed for a short period of time, and the concessions focused almost exclusively on the collection of rubber, which required little to no investment. While most of the article focuses on the Abir and Anversoise concessions, we return to an examination of all of the concessions granted during the CFS era in [Section III.E](#).

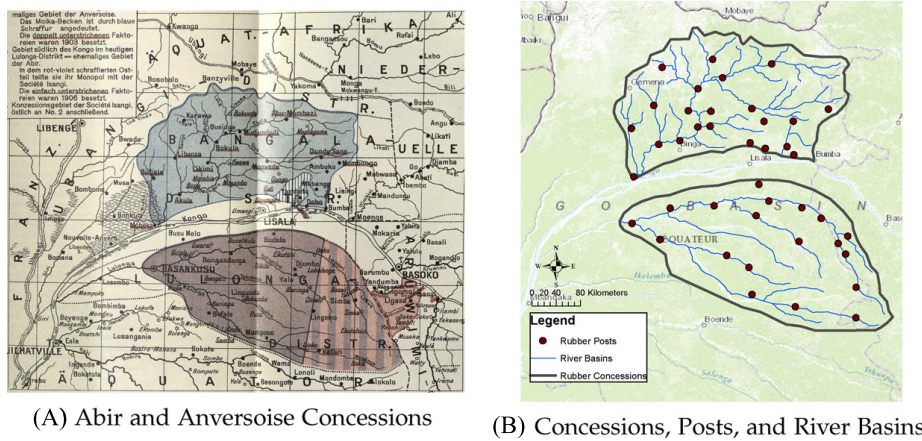
II.B. Creation of Abir and Anversoise

Abir and Anversoise were created in the upper Congo Basin shortly after the invention of the pneumatic tire in 1890, which led to a dramatic increase in the demand for natural rubber. The upper Congo Basin had immense natural rubber resources, and Leopold finally saw an opportunity for profits. The state had limited labor and capacity, so Leopold established concessions to be given to private companies for the exploitation of rubber.

Because most of the interior of the Congo was uncharted at the time, the concession boundaries were defined using salient geographic characteristics, namely, major rivers and their basins ([Harms 1975](#)). The contracts establishing the agreements between the CFS and Abir and Anversoise confirm that salient geographic characteristics determined the concession boundaries. Abir was established in 1892 and given rights over the Maringa-Lopori Basin. This concession area was defined by two rivers and their tributaries: the Maringa River and the Lopori River, plus a 25 km buffer area around them.⁸ In the same year Anversoise was

7. The Kasai area was partially under the free trade regime, then part of a concession company from 1902 to the mid-1950s. The Katanga area was part of a concession, though the extraction focused primarily on copper, rather than rubber.

8. The initial contract between the Secretary of the Interior of the CFS, Mr. Eetvelde, and Mr. J. T. North and Alexis Mols, representatives of the Société Anonyme Anglo-Belgian-India-Rubber and Exploration Company, defines the boundaries of Abir as follows: "The State of Congo concedes to the undersigned on the other part under the conditions stated in this contract and for a period of 30 years starting today, the right to exploit rubber, gum copal and other products of the forest situated on state lands in the basin of the Lopori and the Maringa, from and including Basakusu and to include the forest situated in an area of 10 kilometers around this post. The state will provide all facilities for such



(A) Abir and Anversoise Concessions (B) Concessions, Posts, and River Basins

FIGURE II

Abir and Anversoise Concession Boundaries

The Anversoise concession is the northern concession and the Abir concession is the southern concession. The Mongala River Basin is the northern basin and the Maringa-Lopori River Basin is the southern basin. Panel A was published as Map 10, “Compagnie du Congo Belge,” insert between pages 260 and 261, in [Waltz \(1917\)](#). It was prepared by Ernst Vohsen. The digital image is from a copy in the Harvard Library.

created and given extraction rights in the Mongala River Basin, defined by the Mongala River and its tributaries.⁹ [Figure II](#), Panel A presents the boundaries of the Abir and Anversoise concessions.¹⁰

exploitation that will be with the assistance of the District Commissioner and at the sole risk and peril of the concessionary” ([Waltz 1917](#), 372). Article 4 of the document specifies rights to an area of 25 km around each post.

9. This concession was defined as the area north of part of the Congo River up to the former international border between the CFS and French Equatorial Africa. The initial contract between the Secretary of the Interior of CFS, Mr. Eetvelde, and Mr. Alexander de Browne de Tiège, representative of Anversoise, defines the boundaries of the Anversoise concession as follows: “The Congo State accords to the undersigned on the other part, under the conditions indicated in the present contract and for a term of 50 years starting today...the concession of the forests in the state land situated in the basin of the Mongala, with the exclusive right to exploit the rubber, gum copal, and all the other products of the forest” ([Waltz 1917](#), 352).

10. The maps of the rubber concessions are from [Waltz \(1917\)](#), which describes all of the concessions given by King Leopold II. This includes details on the physical boundaries of the concessions and the year when each concession was granted. [Figure II](#), Panel A is a map of the concessions of interest: Abir and Anversoise. These were the largest concessions in the upper Congo Basin, and the largest concessions that focused exclusively on rubber ([Vangroenweghe 1985](#)).

To see that the boundaries of the concessions do conform to the definitions as stated in the founding contracts, [Figure II, Panel B](#) illustrates the concession boundaries and the associated river basins. The concession borders appear to align almost exactly with the extent of the river basins. In addition, [Figure II, Panel B](#) shows the locations of the rubber collection posts established by the concession companies. The posts all fall within the boundaries of the concessions. In return for the land granted to the concession companies, the state would collect 2% of the companies' profits. Leopold himself was a majority stakeholder in Abir and Anversoise ([Harms 1975](#)). Areas just outside of the concessions continued to be free trade zones, but people trading in these areas did not have the same rights and resources granted to the concession companies.

II.C. Rubber Collection

The concession companies forced individuals in their concessions to collect rubber as a form of paying taxes. The collection of rubber required little capital investment, in contrast to the collection of other natural resources such as diamonds or minerals, and it did not require training of the labor force. The intensity of rubber extraction in concession areas was thus linked to the supply and productivity of labor.

Once the rubber concessions were allocated, the companies set up posts to collect rubber. One or two European agents would be assigned to each post in a concession. They would survey surrounding villages and make a census of the number of adult men in the village. Concession companies set quotas for the collection of rubber based on these population censuses. Male villagers were required to deliver a quota of about 4 kg of dried rubber every two weeks. In addition, villages were required to provide food and supplies to maintain nearby posts ([Harms 1975, 1983](#)).

Most rubber collected during the CFS era was from the vine *Landolphia*, which is delicate and easily damaged, rather than from the more hearty rubber trees, *Funtumia elastica*, which were more prevalent in the French Congo and West Africa ([Harms 1975](#)). Rubber collection was both time-intensive and physically demanding. The rubber collection process could take days, particularly as rubber supplies dwindled and untapped rubber vines became more difficult to find. For example, men in the Baringa area would spend around 10 of every 14 days in the forest collecting rubber ([Harms 1983](#)).

II.D. Violence

The concession companies maintained militias composed of sentries who were responsible for ensuring compliance with the rubber quotas. Generally, the sentries were outsiders recruited from other areas of Congo; this strategy was purposefully selected to ensure that sentries were willing to use violence against villagers. Approximately 25 to 80 “post sentries” armed with rifles were assigned to each new post established. An additional 65 to 100 “village sentries,” armed with muzzle-loading cap guns, were stationed in the villages surrounding the posts. In 1903, one Abir post received 17,600 cartridges for the Albin rifles used by the post sentries (Harms 1983). To prevent waste, soldiers were required to provide a human hand for every bullet used. The human hands were then smoked for preservation and collected by the European agents.

Individuals were severely punished if they failed to meet their rubber quota. Punishment could take many forms. For example, they could be imprisoned and forced to work. Their family members could be held for ransom until the quota was fulfilled. Individuals could also be subjected to various forms of physical violence, including whipping by the *chicotte* (a whip made of hippopotamus hide), burning with gum copal, or death. The chief of the village could be imprisoned if his village did not meet the quota. In July 1902, records indicate that 44 chiefs were imprisoned in the villages around a single post (Harms 1983). The sentries from the concession companies’ private militias were primarily responsible for carrying out these violent tactics. The European agents also engaged in the imprisonment, torture, and killing of villagers.

Testimony collected by Roger Casement, a consul for the British sent to Congo to investigate accusations of atrocities, documents the intensity of the violence:

When I was still a child, the sentries shot at the people in my village because of the rubber. My father was murdered: they tied him to a tree and shot and killed him, and when the sentries untied him they gave him to their boys, who ate him. My mother and I were taken prisoner. The sentries cut off my mother’s hands while she was still alive. Two days later, they cut off her head. (Janssens 1904)

If the sentries faced any resistance, they were able to call on soldiers from the *Force Publique* to provide support.

II.E. Indirect Rule

A tactic employed by sentries to ensure rubber production was to undermine and co-opt local authority. Noncompliant chiefs were held captive, replaced, or killed. One of the sentries in each village was assigned the position of *kapita*, or head sentry for that village. In fact, *kapita* is a Lingala word used today to denote “chief.” Once in the village, the *kapita* would recruit 8 to 10 people to serve as bodyguards. He then began the process of asserting his authority over the villagers. To do so, he would attack men in positions of esteem or authority. For example, lineage headmen were required to carry soil and rubbish alongside slaves. Anyone who challenged the *kapita* could be whipped or killed.

The *kapitas* severely undermined the prestige, authority, and wealth of lineage headmen and village chiefs. The village headmen were “shamelessly degraded in the eyes of their people, made to fetch and carry for soldiers, cast into chains and flung into prison” (Morel 1905). Though they were still considered to have important connections to ancestors, the headmen no longer had the authority to make important decisions. They were unable to protect their lineage from the brutality and terror imposed by the sentries. In addition, since most able-bodied men were required to collect rubber in the forest, there was a power vacuum in the village that was filled by the *kapita*. In fact, some sentries began to take on the responsibilities previously allocated to lineage headmen, such as settling disputes among lineage members. Finally, the sentries would take the wealth from lineage headmen, including marrying their daughters and wives (Harms 1974).

II.F. Aftermath

Though the CFS government objected in principle to the violence, in practice it allowed and encouraged it. The effectiveness of the labor coercion allowed the concession companies to make exorbitant profits (Plas and Pourbaix 1899). By 1905, the natural rubber supplies were nearly exhausted in the upper Congo Basin. Due to depleted rubber supplies and increasing condemnation of their labor practices in Europe, Abir and Anversoise left CFS in 1906. In 1908, the CFS became a Belgian colony. After 1910, competitive production of rubber from *Hevea* plantations in Southeast Asia and South America, along with the invention of

synthetic rubber, led to a large decrease in rubber prices ([Harms 1975](#)).¹¹

Historians have noted that the rubber concessions granted under Leopold II had disastrous consequences for local populations. Villages subjected to the rubber regime were unable to tend to their fields, leading to low yields and famine. Sentries raided local livestock. Malnourished people became particularly susceptible to disease, including the increasingly rampant sleeping sickness ([Harms 1983](#)). As Hochschild describes, “the world has managed to forget one of the great mass killings of recent history... it was unmistakably clear that the Congo of a century ago had indeed seen a death toll of Holocaust dimensions” ([Hochschild 1998](#), 3–4). The brutality of the rubber collection tactics resulted in the deaths of an estimated 10 million people and earned the policies the nickname “Red Rubber” ([Vangroenweghe 1985](#)).

Since the end of the rubber era, there have been three key periods: Belgian colonial rule (1908–1960), the Mobutu era (1965–1997), and the present. Across the Equateur region, the Belgian era was characterized by little investment, forced cultivation of cash crops (coffee, palm oil, and cotton), forced labor (particularly during the world wars), missionary provision of education, and sleeping sickness campaigns ([Clement 2014](#)). Mobutu pursued policies of centralization (reducing the number of provinces); returning to cultural “authenticity” (banning Western influences); and “Zairinization,” in which foreign enterprises were expropriated and eventually taken over by the state. Corruption was rampant, and the government invested only 1.5% of its budget in the Equateur region ([Hesselbein 2007](#)). Since Mobutu’s overthrow, the Equateur region has experienced civil conflict and unrest. Equateur remains one of the poorest regions of Congo. Most individuals are engaged in subsistence agriculture; the nonagricultural sector is close to nonexistent ([Van Reybrouck 2014](#)).

III. THE EFFECTS OF THE RUBBER CONCESSIONS ON DEVELOPMENT

III.A. *Data*

To examine the long-run effects of the rubber concessions on development outcomes we combine DHS data from 2007 and

11. For more information on the history of concessions in the region and for additional references, see [Online Appendix J](#).

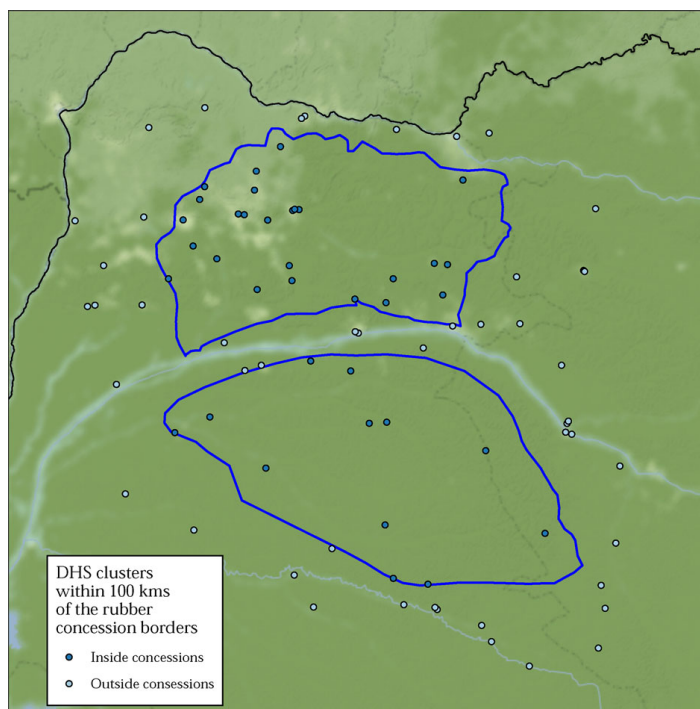


FIGURE III

Maps of Clusters from the DHS 2007 and 2014 for DRC within 100 km

2014 with maps of the boundaries of Abir and Anversoise. The DHS surveys from the DRC provide detailed information on education, assets, and health outcomes. These data sources and the variables used in our analyses are described in detail in [Online Appendix A](#).¹² [Figure III](#) provides a map with the rubber concession borders and the DHS clusters from 2007 and 2014 that are within 100 km of the borders of the rubber concessions. [Online Appendix C.1](#) provides summary statistics for clusters inside and outside of the former concessions.

III.B. Empirical Strategy

We can estimate the causal effect of exposure to the rubber concessions on the outcomes of interest with the following RD

12. In [Online Appendix I](#) we also explore other data sets, including data on population density (Landsat and African Population Database); nightlights; and conflict (PRIO).

specification:

$$(1) \quad y_{i,v} = \alpha + \gamma RubberConcession_{i,v} + f(location_v) + \mathbf{X}_i\beta + \phi + \varepsilon_{i,v} \quad \text{for } v \in bw,$$

where $y_{i,v}$ is our outcome of interest for individual i from village v ; $RubberConcession_{i,v}$ is an indicator equal to 1 if v is inside a rubber concession area and 0 otherwise; \mathbf{X}_i is a vector of covariates for individual i such as gender, age, and age squared; ϕ is a nearest concession fixed effect; and $f(location_v)$ is the RD polynomial, which controls for smooth functions of geographic location for village v . Following [Calonico, Cattaneo, and Titiunik \(2014\)](#); [Cattaneo, Idrobo, and Titiunik \(2020\)](#), and [Gelman and Imbens \(2016\)](#), our baseline specification is a local linear polynomial in distance to the concession border estimated separately on each side of the concession. We use a triangular weighting kernel and calculate the optimal bandwidth bw using the MSE-minimizing procedure suggested by [Cattaneo, Idrobo, and Titiunik \(2020\)](#). We also present results with a wider fixed bandwidth of 100 km from the border.¹³ We check robustness to using various other forms of the RD polynomial, kernel, and bandwidths (see [Online Appendix C](#)).

Our coefficient of interest is γ : the effect of being just inside the concession area on our outcome of interest. The intuition behind this specification is that concession borders arbitrarily allocated some villages to be part of the concessions and others to be just outside the concessions. These villages should have similar geography, culture, history, and institutions prior to the concession era, allowing us to identify the effect of rubber extraction on contemporary outcomes.¹⁴

The RD approach presented in equation (1) requires two identifying assumptions. The first assumption is that all relevant factors before the concessions were granted varied smoothly at the concession boundaries. This assumption is needed to

13. We calculated the [Imbens and Kalyanaraman \(2012\)](#) optimal bandwidth for several of our outcomes of interest with distance to the border as the running variable. The optimal bandwidth was generally between 75 and 125 km depending on the outcome. Thus, we chose our fixed bandwidth to be 100 km.

14. This RD approach has been used in multiple settings to examine the effects of historical events, such as in [Dell \(2010\)](#); [Miguel and Roland \(2011\)](#); [Grosfeld, Rodnyansky, and Zhuravskaya \(2013\)](#); [Michalopoulos and Papaioannou \(2014\)](#); [Becker et al. \(2015\)](#); [Fontana, Nannicini, and Tabellini \(2018\)](#).

ensure that individuals located just outside the concessions are an appropriate counterfactual for those located just inside them.

A key concern for identification is that the rubber concessions were chosen strategically for certain characteristics that could also affect our outcomes of interest. For example, these areas might have been more suitable for certain crops or populated by ethnic groups with different cultures. However, whether an area was exposed to rubber extraction is a deterministic and discontinuous function of whether a village fell inside the concession boundaries. As described in [Section II](#), these concessions were granted at a time when much of the Congo had not been explored. The concession boundaries were defined by salient geographic characteristics—in this case, rivers and river basins. Thus, the concession boundaries are unlikely to have been selected based on local characteristics that also vary discontinuously at the concession border.

To assess the plausibility of this first assumption, [Table I](#) presents summary statistics and estimates using specification (1) for important geographic and preconcession characteristics. This analysis is at the 20 km by 20 km grid cell level. These results are presented with standard errors clustered at the territory level for geographic characteristics and the ethnicity level for cultural characteristics; we also present results using Conley standard errors with a cut-off window of 50 km to account for spatial autocorrelation ([Conley 1999](#)) in [Online Appendix C.2](#) and with wild bootstrap p -values ([Cameron, Gelbach, and Miller 2008](#)) in [Online Appendix C.3](#).¹⁵ In addition to showing balance at the grid cell level, we show balance on preconcession characteristics at the DHS cluster level in [Online Appendix C.4](#).

Consistent with the first identification assumption, we find balance on a number of important geographic and preconcession characteristics. The geographic characteristics include elevation, rainfall, rainfall variability, land suitability, ruggedness, river characteristics, disease suitability measures, and distance

15. For the clustered standard errors, we cluster at the territory level, the lowest administrative level for which there is spatial data. For RD bandwidths below 50 km, the number of clusters is slightly below 30, potentially leading to overly optimistic standard errors ([Cameron, Gelbach, and Miller 2008](#)). Overall, the clustered standard errors tend to be quite consistent with (and more conservative than) both the wild bootstrap and Conley standard errors.

TABLE I
BALANCE ON GEOGRAPHIC AND PRECONCESSION CHARACTERISTICS

	Within 100 km			Within 50 km			RD Estimates		
	Inside (1)	Outside (2)	Std. err. (3)	Inside (4)	Outside (5)	Std. err. (6)	RD coefficient (7)	Std. err. (8)	
Geographic characteristics									
Elevation	437.26	430.24	(8.10)	440.06	432.46	(5.87)	2.77	(17.39)	
Rainfall (avg.)	72.49	76.42	(4.08)	70.43	74.19	(3.22)	0.01	(7.59)	
Rainfall (st. dev.)	1.31	1.43	(0.07)	1.32	1.41	(0.07)	-0.02	(0.16)	
Land suitability	5.78	7.62	(1.64)	5.01	7.84	(1.94)	-2.26	(2.42)	
Ruggedness	4.94	6.25	(1.02)	5.31	5.74	(0.87)	0.26	(2.24)	
Obs.	349	504		232	272		894		
River characteristics									
Navigable river density	10.07	10.51	(2.58)	12.20	9.19	(3.41)	1.64	(4.48)	
> 0 navigable rivers	0.21	0.22	(0.05)	0.24	0.19	(0.07)	0.04	(0.08)	
> 0 rivers	0.44	0.51	(0.05)	0.38	0.46	(0.07)	-0.11	(0.09)	
Obs.	349	504		232	272		894		
Disease characteristics									
Malaria suitability	18.76	18.75	(0.24)	18.71	18.84	(0.19)	-0.23	(0.29)	
Tsetse fly suitability	1.33	1.34	(0.01)	1.32	1.33	(0.01)	0	(0.02)	
Obs.	349	504		232	272		894		
Location characteristics									
Distance: Kinshasa	767.30	792.81	(37.53)	764.17	776.68	(25.17)	21.82	(58.51)	
Distance: coast	1,093.71	1,047.54	(19.33)**	1,082.01	1,064.67	(11.35)*	-18.23	(26.47)	
Obs.	349	504		232	272		894		

TABLE I
CONTINUED

	Within 100 km			Within 50 km			RD Estimates		
	Inside (1)	Outside (2)	Std. err. (3)	Inside (4)	Outside (5)	Std. err. (6)	RD coefficient (7)	Std. err. (8)	
Preconcession characteristics									
No. enslaved (Atlantic trade, 1,000s)	0.65	2.40	(1.66)	0.91	4.24	(3.22)	-3.92	(6.41)	
Obs.	236	314		159	170		573		
No. ethnic groups	11	23		10	17		24		
Population density	1.41	1.19	(0.19)	1.36	1.18	(0.12)	0.09	(0.19)	
Obs.	121	187		74	89		329		
No. ethnic groups	3	7		3	6		7		
Centralization	0	0.21	(0.10)	0	0.14	(0.07)	-0.04	(0.08)	
Obs.	124	280		103	148		426		
No. ethnic groups	5	11		5	10		11		
Polygynous	0.46	0.47	(0.11)	0.49	0.45	(0.11)	0.06	(0.21)	
Obs.	247	322		173	176		593		
No. ethnic groups	7	13		7	12		13		
Hereditary Local Headman Selection	1	0.90	(0.10)	1	0.96	(0.04)	-0.04	(0.03)	
Obs.	204	240		142	139		462		
No. ethnic groups	5	11		5	10		11		

Notes. The unit of observation is a 20 km by 20 km grid cell. Columns (1), (2), (4), and (5) present the mean of the corresponding variable. Columns (3) and (6) present clustered standard errors for the difference in means clustered at either the territory level for geographic variables or ethnic group level for precolonial variables. Inside and Outside indicate whether a grid cell is inside or outside the former rubber concession area respectively. Columns (7) and (8) give the estimated RD coefficient and standard error that uses the corresponding variable as its outcome using a local linear specification estimated separately on each side of the concession boundary and a triangular kernel. The RD MSE optimal bandwidth is determined using the procedure suggested by Cattaneo, Idrobo, and Titiunik (2020). Column (7) uses the average of all optimal bandwidths (39.30 km). Regressions include a nearest-concession fixed effect. Variable definitions and data sources used in this analysis are described in detail in Online Appendix A. * $p < .10$, ** $p < .05$, *** $p < .01$.

to Kinshasa and the coast.¹⁶ We find balance on these characteristics, suggesting that the areas inside and outside the concession are comparable along the border.

Finally, we show balance on a number of preconcession characteristics using data from the Ethnographic Atlas (EA) (Murdock 1967) and Nunn and Wantchekon (2011). Ideally we would present balance on preconcession characteristics for all ethnic groups near the concession. However, the EA only contains information for a subsample of groups in our area of interest. Using the subsample with information in the EA, we find balance on a number of preconcession characteristics such as exposure to the Atlantic slave trade, population density prior to colonization, levels of centralization, and polygamy. Additionally, the concession borders do not align with Murdock ethnic group borders (see Online Appendix Figure B4), nor do they align with present-day political borders.

The second important assumption for the RD approach is that there was no selective sorting across the RD threshold when the concession borders were established. Selective sorting would require certain villages be able to select out of being allocated to a concession. This is unlikely to have happened given that villages were unable to negotiate the boundaries of the concessions.

An important related concern is selective migration either during the rubber era or subsequently, which would be considered an outcome of the rubber concessions.¹⁷ It is likely that some migration took place during the rubber era, as individuals tried to avoid the rubber demands and the associated violence. Unfortunately, there are no data available to quantify the magnitude of migration during the rubber era.¹⁸ Although we are unable to analyze migration during the rubber era, we conduct a number

16. Note that rubber in the CFS era was from a vine called *Landolphia owariensis*, rather than from rubber trees. We do not have data on the suitability for the rubber vine, which was found in forested areas. Reassuringly, the entire Congo basin region is heavily forested, and this does not align with the concession boundaries. Online Appendix Figure B2 visually presents the extent of river networks.

17. By selective migration, we mean migration of only the “highest-ability” individuals from just inside the concessions to just outside the concessions.

18. We can only highlight the difficulties associated with migration. Anecdotal evidence from Harms (1975) suggests that the rubber companies greatly controlled migration (using village censuses they collected themselves) and forced people to remain in their villages. Harms (1975) notes that local chiefs were held accountable when individuals that migrated did not meet their quotas, incentivizing chiefs to prevent migration. Finally, since the concessions were defined by the extent of river

of tests using present-day DHS data and fieldwork data to show that selective migration is unlikely to fully explain the effects. In [Online Appendix F](#), we examine the sensitivity of the results to selective migration and to heterogeneity by ease of migrating from inside the concession to outside the concession boundaries. Rates of selective migration would have to be quite high to fully explain our results, and there is no evidence of differential effects based on ease of migration.

III.C. Regression Discontinuity Results

To examine the long-run effects of exposure to the rubber concessions, we analyze 2007 and 2014 DHS data on education, wealth, and health. All variables are defined in the table notes. [Table II](#) reports estimates for specification (1) with education outcomes in Panel A, asset wealth outcomes in Panel B, and health outcomes in Panel C. [Section III.D](#) discusses additional RD polynomials and other robustness checks. The results in [Table II](#), Panel A show that areas inside the concession have significantly lower levels of education across all specifications and bandwidths. Individuals just inside the former rubber concessions are estimated to have approximately 1.4 fewer years of education than individuals just outside the concessions.

[Table II](#), Panel B reports estimates for the asset wealth measures available in the DHS survey.¹⁹ Individuals in villages inside the former rubber concessions are approximately 26% less wealthy than similar individuals outside the rubber concessions. In standard deviation terms, areas inside the former concessions are about 0.5 standard deviations less wealthy.

[Table II](#), Panel C reports estimates for different health outcomes and finds evidence that individuals from inside the former concessions have worse health outcomes. Children and women inside the former concessions have approximately 9 percentage points lower height-to-age percentiles. Overall, we find evidence that individuals residing in villages inside the former rubber concessions are less educated, less wealthy, and have worse health outcomes today than individuals in villages outside the former rubber concessions.

basins, and rivers were used for transport, migration outside of the concessions would likely have been difficult.

19. To reduce the influence of outliers and to ease interpretation, we show wealth results using the log of the wealth factor score.

TABLE II
RUBBER CONCESSIONS AND ECONOMIC DEVELOPMENT

	(1)	(2)	(3)	(4)
Panel A: Education	Years of education		Literacy	
Inside concession	-1.804** (0.777)	-1.396** (0.635)	-0.190** (0.084)	-0.150** (0.069)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	3,309	4,274	3,368	4,266
Clusters	61	85	62	85
Bandwidth	59.43	100.00	60.97	100.00
Mean dep. var.	4.997	5.109	0.447	0.465
Std. dev. dep. var.	3.802	3.821	0.497	0.499
Panel B: Asset wealth	Wealth index		Log(wealth score)	
Inside concession	-0.797* (0.436)	-0.686** (0.306)	-0.350** (0.173)	-0.259** (0.126)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	2,627	4,281	2,627	4,281
Clusters	47	85	47	85
Bandwidth	41.76	100.00	41.92	100.00
Mean dep. var.	2.090	2.034	10.932	10.912
Std. dev. dep. var.	1.074	1.060	0.431	0.443
Panel C: Health	Respondent ht./age percentile		Child ht./age percentile	
Inside concession	-0.112** (0.045)	-0.093** (0.038)	-0.090** (0.037)	-0.085** (0.033)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	1,050	1,422	1,065	1,314
Clusters	55	85	64	85
Bandwidth	53.49	100.00	64.85	100.00
Mean dep. var.	0.262	0.259	0.248	0.247
Std. dev. dep. var.	0.254	0.252	0.318	0.316

Notes. Standard errors are clustered at the DHS cluster level. All regressions include a local linear specification estimated separately on each side of the concession boundary and use a triangular kernel. Optimal bandwidths are chosen using the MSE-minimizing procedure suggested by Cattaneo, Idrobo, and Titiunik (2020) and are reported in km. Regressions control for age, age squared, gender, survey year, and nearest-concession fixed effects. *Literacy* is an indicator variable equal to 0 if the respondent cannot read at all and 1 otherwise. *Wealth score* is an index generated by the DHS using the principal component of asset ownership. *Wealth index* is a 1 to 5 categorical variable where 1 is poorest quintile and 5 is richest quintile from the *Wealth score*. *Respondent ht./age percentile* is measured for a subset of female respondents and divides each respondent's height by her age and finds her percentile in the entire sample. Similarly, *Child ht./age percentile* was asked to a subset of children and divides each child's height by his or her age and finds his or her percentile in the entire sample. * $p < .10$, ** $p < .05$, *** $p < .01$.

Figure IV presents standard RD plots for our main outcomes of interest, with distance to the border as the running variable and a local linear trend to each side of the discontinuity. For these outcomes, we observe there is a clear discontinuity at the concession border. See Online Appendix B for the spatial RD plots.

III.D. Robustness of DHS Results

There are three main empirical concerns for the DHS results presented in Table II: robustness to alternative RD specifications, random displacement of DHS clusters, and the use of basins to define borders. The first concern is whether the results are robust to alternative specifications of the RD polynomial. In Online Appendix C.5, we show that the results are robust to alternative bandwidths, bandwidth selection procedures, and kernels (e.g., uniform, triangular, and Epanechnikov). In Online Appendix C.6 we show that the results are robust to using local quadratic polynomials. We also test robustness to latitude and longitude specifications in Online Appendix C.7, where we modify $f(\cdot)$ in equation (1) to be a function of latitude and longitude.

A second potential issue is that the DHS randomly displaces the coordinates of the clusters to maintain the confidentiality of the respondents. The GPS coordinates are displaced by up to 5 km for all urban clusters and 99% of rural clusters, and up to 10 km for 1% of rural clusters. Importantly, this displacement is random and induces classical measurement error. This would bias our coefficient toward zero. However, with the RD approach, one might be concerned that the results are being driven by clusters right along the border that might be incorrectly assigned to inside or outside the concession because of the random displacement. Thus, we estimate our regression discontinuity results with a “donut-hole” of 10 km (the maximum possible displacement) in Online Appendix C.8 and find that the results are robust to excluding observations close to the border.

A third possible concern is that because the concession borders were drawn using major river basins as the salient geographic feature, the results may reflect some inherent characteristic of river basins, rather than exposure to the concessions. To assess this claim, in Online Appendix D we conduct a falsification exercise where we run our main specification across all major river basins in DRC and show that the estimated effects for the former concessions are larger and more negative than the

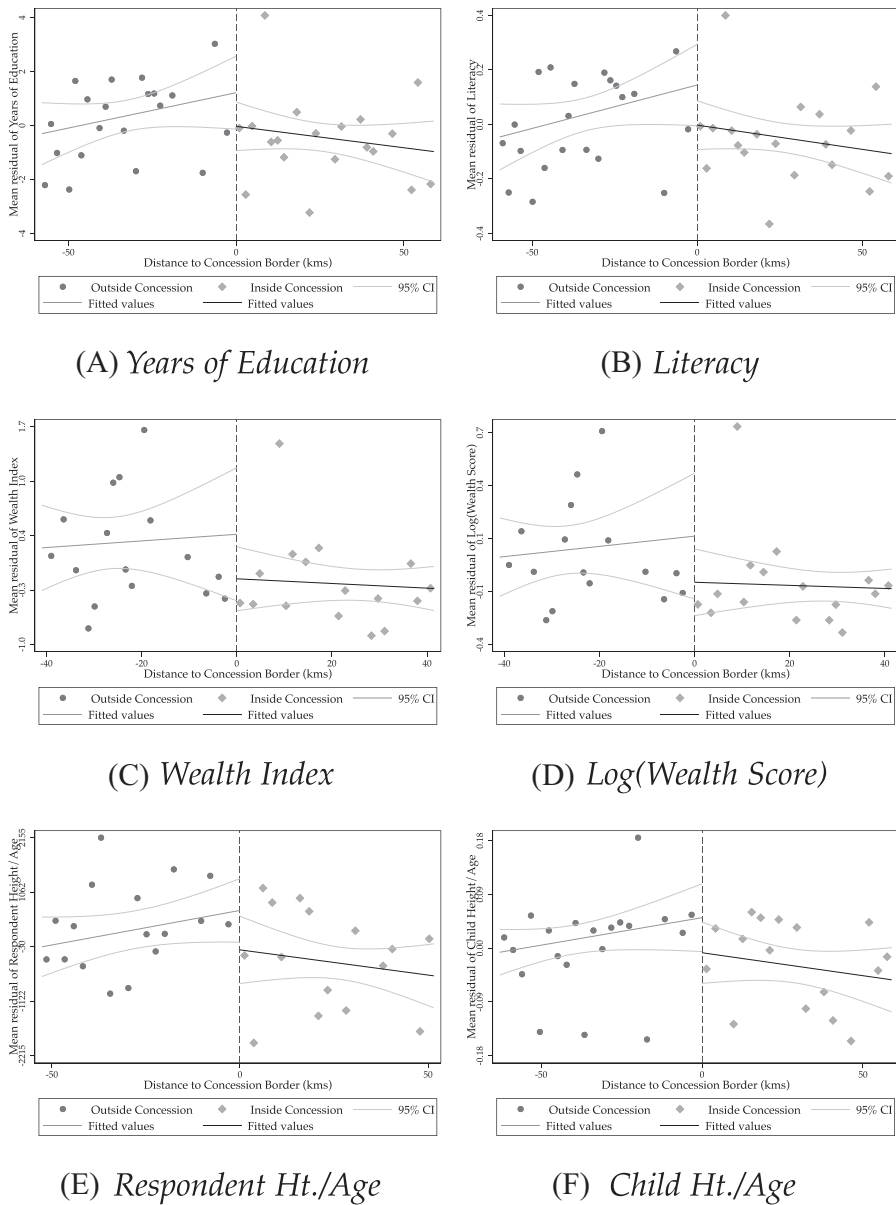


FIGURE IV

RD Plots for Development Outcomes

The figure presents RD plots for our main outcomes and the mean value of each outcome variable at each 2.5 km bin along the running variable (distance to concession border) as well as with a local linear trend estimated separately on each side of the discontinuity. Each regression is estimated using the optimal bandwidth chosen using the MSE-minimizing procedure suggested by Cattaneo, Idrobo, and Titiunik (2020). Regressions control for age, age squared, gender, survey year, and include a nearest-concession fixed effect. Standard errors are clustered at the DHS cluster level and the figures show 95% confidence intervals.

estimated effects for most of the other major river basins in DRC. The falsification exercise presents important evidence that the results are not a consequence of the concessions being drawn using river basins, but instead suggests that our estimates represent the effect of exposure to rubber concessions. In addition, to address concerns that the concession borders may have been manipulated, [Online Appendix D](#) shows that the estimated effects are similar when we use the relevant basin borders and a 25 km buffer as an instrument for being inside the former concessions.

In [Online Appendix C](#), we show that our results are robust to the following additional robustness tests. We analyze the results: looking at each concession individually to ensure that the results are not being driven by one particular concession (C.9); without covariates (e.g., gender, age, and age squared) (C.10); with Conley standard errors (C.11); at the DHS cluster level, rather than the individual level since assignment to treatment occurs at the village level (C.12); dropping observations along the Congo River to address concerns that villages along the Congo River are different than those farther away from the river (C.13); and dropping one DHS cluster at a time (C.14). In [Online Appendix E](#) we find no evidence of differential missionary presence or subsequent colonial investment, and in [Online Appendix I](#), we examine the relationship between the concessions and road network density, population density, nighttime lights, and conflict.

Finally, in [Online Appendix I](#) we present two additional complementary analyses. First, in I.4 we examine the correlation between intensity of exposure to the rubber concessions—as measured by the year a post is constructed and the number of tons of rubber collected at that post—and our key outcomes of interest. We find that greater intensity of exposure is negatively correlated with education, wealth, and health. We also test whether there appears to be convergence in outcomes over time across age cohorts in [Online Appendix I.5](#). We find no evidence for convergence.

III.E. Analysis for All Concessions

We have found that those individuals from the former Abir and Anversoise concession areas have lower levels of education, wealth, and health today. Given that other concessions were granted during the CFS era, it is natural to examine the broader implications of the concession system for the development of DRC.

In [Online Appendix K](#), we present RD results for education, wealth, and health examining all concessions granted in DRC as of 1904 (see [Figure I](#) for a map of the concession boundaries). We present results pooling all of the concessions as well as results excluding Abir and Anversoise. We find that across all concessions in DRC, individuals experience worse education, wealth, and health outcomes. The coefficients are always negative, though sometimes not significant when Abir and Anversoise are excluded. Given that 60% of DRC's landmass was formerly part of a concession, wealth would be about 40% higher had they not been part of a concession. Although these estimates are unlikely to be causal, given that these other concession boundaries correspond with present-day political boundaries and have different histories than Abir and Anversoise, they are suggestive of the detrimental long-run legacy of the concession system.

IV. TESTING MECHANISMS WITH FIELDWORK

IV.A. Conceptual Framework

Our analysis so far has documented lasting negative effects of the rubber concessions granted in northern Congo on development outcomes. These concessions were characterized by indirect rule, violence, and no productive investment—characteristics that were common across the many concessions granted during the colonial era ([Coquery-Vidrovitch 1972](#); [Vangroenweghe 2006](#)). However, the concessions only lasted 14 years; thus, it is important to understand the mechanisms through which the negative effects of the rubber concessions persist.

Our conceptual framework consists of three main premises and is informed by the recent theoretical literature on how institutions and culture matter for development (e.g., [Bisin and Verdier 2017](#); [Acemoglu and Robinson 2019](#); [Persson and Tabellini 2020](#); [Nunn 2021](#)). This literature takes as a starting point that institutions are an important factor for explaining economic development (e.g., [North 1990](#); [Acemoglu, Johnson, and Robinson 2001](#)). However, a key insight from this emerging literature is that one cannot understand historical persistence by focusing only on institutions; rather, it is important to also understand how culture evolves and endogenously responds to institutions. Informed by work from historians and oral histories, we apply these insights to our setting and discuss conditions when the framework is most likely to be relevant.

The first premise is that the rubber era undermined local institutions via the use of indirect rule.²⁰ A key aspect of how rubber concessions were able to function was through the co-option of local leaders (Harms 1974, 1975, 1983; Stengers and Vansina 1985; Marchal 1996). Prior to the concession era, lineage headmen held positions of authority and leadership in communities. These leaders either cooperated with the rubber regime or were replaced by individuals who would. As Stengers and Vansina (1985, 336) write, “Chiefs were auxiliary agents of the state. They did not need to have any traditional legitimacy.”

Compliance with the rule of co-opted leaders was achieved through extreme violence. This violence was often perpetrated by armed sentries recruited from outside the area with the support of European agents. Local institutions suffered, and leaders could no longer be relied on to protect the community or fulfill important leadership functions (Harms 1974; Vangroenweghe 1986). Thus, we examine how local institutions differ inside the former concessions. Specifically, we examine how chiefs are selected—either hereditarily or through elections—and whether chiefs are responsible for public goods provision.

The second premise of our conceptual framework is that cultural traits likely responded to these changes in local institutions.²¹ Bisin and Verdier (2017) highlight that certain cultural traits will respond endogenously to changes in institutions and that *ex ante* it is unclear how culture may respond (see also Tabellini 2008). Under certain conditions, changes in culture will reinforce changes in local institutions, leading to persistence, while in others, cultural change will counteract institutional change.²²

Historians have highlighted how villagers had to develop alternative coping mechanisms as they faced a brutal rubber regime and local leaders who were unable to protect them (Harms 1974; Nelson 1994; Marchal 1996). The rubber period required communities to adapt and cooperate to survive.

20. We define lower-quality local (village-level) institutions as being institutions characterized by less-accountable leaders who provide fewer public goods (in line with Bisin and Verdier 2017).

21. Culture is generally defined as values and preferences that are internal to individuals in a society (Tabellini 2008).

22. This insight is related to a growing literature on how institutions can affect culture (e.g., Guiso, Sapienza, and Zingales 2004, 2016; Tabellini 2010; Lowes et al. 2017).

In particular, there was an increased reliance on horizontal ties (e.g., age sets) and mutual insurance. This allowed individuals to bypass corrupt and ineffective elders who had been targeted by the rubber regime.²³

Changes in the political power structure may have led to important changes in cultural norms related to prosocial behavior, cooperation, and trust. Therefore, we examine how prosocial norms and behavior differ inside the former concessions.

The final premise of the conceptual framework is that the interaction between institutions and culture is important for understanding the long-run effects of the rubber era. As modeled in [Bisin and Verdier \(2017\)](#), institutional quality and culture may act as substitutes, enforcing an equilibrium of low institutional quality but more prosocial norms (see also [Jha 2013](#); [Platteau 2000](#)).²⁴ If culture and institutions are substitutes, stronger prosocial norms may undermine long-run development if they allow less-effective and less-accountable local leaders to remain in power. We explore correlational evidence consistent with this premise using fieldwork data.²⁵

We discuss when these mechanisms are likely to be present. The conceptual framework applies to concessions characterized by indirect rule, violence, and extraction. Four main conditions appear central.²⁶ First, the extracted resources require minimal productive investment for production (unlike in [Dell and Olken 2020](#)) and face external market pressures favoring short-run extraction.²⁷ Second, the extraction and violence were generally

23. For example, the rubber period was associated with an increase in cooperation among individuals of the same age grade. These “pacts of friendship and mutual aid between age-mates facilitated the social mobility required in the search for rubber” ([Nelson 1994](#), 110), as people were often forced to collect rubber in groups far away from their village.

24. As in [Bisin and Verdier \(2017\)](#), we view institutional change as a “myopic” short-run process. In contrast, culture evolves more slowly over time, through socialization and cultural transmission.

25. [Bisin and Verdier \(2017, 38\)](#) write that their theoretical work “underlines the fact that the search for a unique origin for long-term development can be quite an arduous and even sterile undertaking. Focusing more systematically on the positive or negative interactions between culture and institutions along the development process might be more fruitful in terms of historical understanding”.

26. These are conditions that can be considered as exogenous from the perspective of the local populations in the concessions and the agents working for the concessions.

27. For instance, at the time of the concessions, the CFS had a near monopoly on natural rubber, but it was about to face significant supply-side competition from

perpetrated by outsiders—either European agents or sentries recruited from outside of the region.²⁸ Third, initial state capacity is important: the northern concessions had little state centralization prior to colonization; anecdotally, ethnic groups with more centralization (e.g., in the south of Congo) were better able to resist concession companies and their indirect rule and violence (Stengers and Vansina 1985). In addition, since independence, the Congolese state has been weak and ineffective at projecting power outside of urban areas. Fourth, the initial social structures of the local populations matter: individuals in the region relied on small, tight-knit kin networks for mutual aid and support. This condition makes it more likely that local institutions and culture would act as substitutes as local institutions deteriorated (Tabellini 2008). The concessions granted across large parts of sub-Saharan Africa generally met these four conditions (Coquery-Vidrovitch 1972; Vangroenweghe 2006).

IV.B. Data Collection

Existing data from DRC does not allow us to examine institutional or cultural mechanisms. Therefore, we conducted surveys and collected experimental data in Gemena, DRC. Gemena is the capital of Sud-Ubangi province and is situated near the border of the former Anversoise concession. Gemena is inside the former concession boundary, but less than 10 km away from the border. Gemena was created by colonial administrators in the mid-1920s, after the CFS period, and therefore consists primarily of migrants from surrounding areas. Nearly all individuals in our sample identify their “village of origin” as a village outside the town of Gemena. A “village of origin” is the village where an individual’s family or ancestors are from.²⁹

burgeoning rubber plantations in other countries. In addition, natural rubber was effectively nonrenewable in the short run—much like ivory or diamonds.

28. By outsiders to the region in our setting, we mean individuals who were not from the traditional ethnic homelands. Tribal affiliations were the relevant cultural grouping in the northern DRC (Stengers and Vansina 1985). The importance of outsiders versus insiders is informed by a growing literature on how culture and institutions respond differently to violence depending on the identity of the perpetrators and the underlying social structure (e.g., Bauer et al. 2016; Henrich 2020).

29. This is a commonly understood concept in this area, and all respondents knew their village of origin. A village of origin is not necessarily where an individual is born.

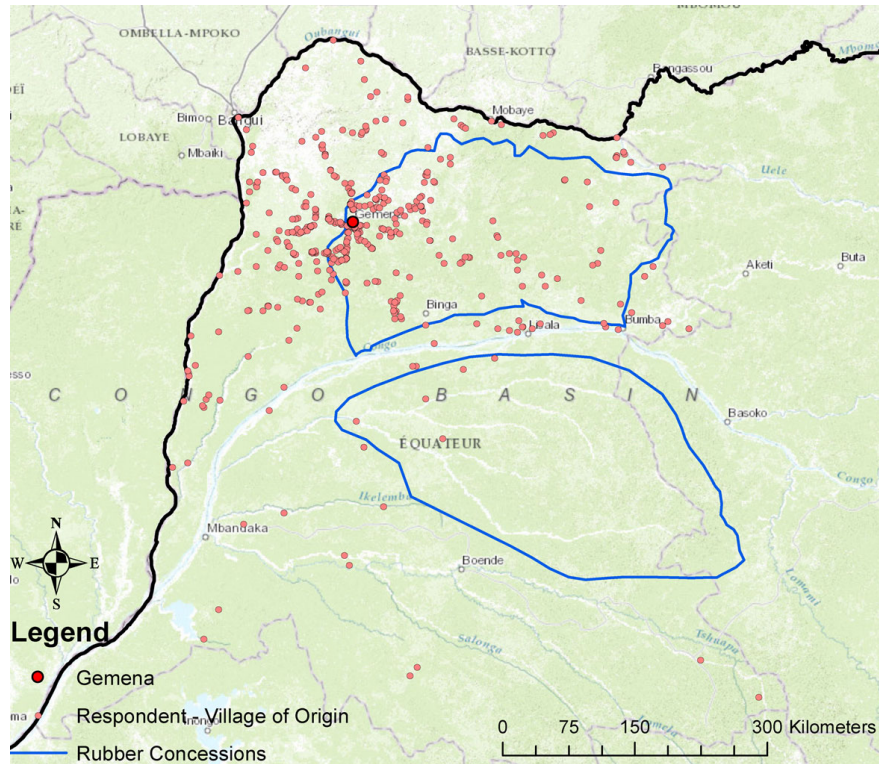


FIGURE V

Gemena, the Rubber Concessions, and Location of Origin Villages in the Sample

The data were collected between July and August 2015. We randomly sampled individuals in Gemena for a total sample size of 520 for the first visit and 484 for the second visit. We divided our survey into two visits per household to avoid survey fatigue; the first visit consisted of the main survey module, and the second visit consisted of lab experiments and a short survey. Of those sampled, 49.71% percent identified their village of origin as being from inside the boundaries of one of the former concessions, and a total of 511 originate from villages within 200 km of the former concession boundaries. [Figure V](#) presents a map of the locations of villages of origin for our sample, the location of Gemena, and the borders of the former rubber concessions. For more details on sampling and survey methods, see [Online Appendix G.1](#).

We use the data from the Gemena-based sample to compare individuals with ancestors from inside the former concessions to those with ancestors from outside the former concessions. This approach has two main advantages. First, logistically, it is

considerably easier to work in one main town rather than numerous villages in the area, as transportation infrastructure is of very poor quality. Second, it allows us to more precisely identify cultural differences: by examining individuals removed from their original institutional environments and who now share the same institutional environment, any differences in behavior in experimental measures or responses to survey questions are capturing differences in internalized cultural norms.³⁰

Individuals answered a series of questions on demographics, migration history, income, trust, and beliefs. In addition to collecting individual-level data, we ask respondents detailed questions about the institutions in their villages of origin. Those who were familiar with their village of origin were asked questions on the selection mechanism for the village chief, public goods available in their villages of origin, and the responsibilities of the chief. Finally, individuals completed two behavioral experiments and an Implicit Association Test (IAT), which are described in detail below.

The survey data have multiple questions that could be used to test the hypotheses of interest. We present all of our survey-based results using thematic indices that group related questions. We follow [Anderson \(2008\)](#) and compute the inverse covariance weighted (ICW) index across outcomes within an index. In [Online Appendix G.7](#) we include coefficient plots of each of the individual components of the index in addition to the estimated ICW index coefficient. As with the previous RD analyses, we estimate equation (1).

Summary statistics are presented in [Online Appendix G.5](#) by whether an individual originates from inside the former concession. On average, individuals from inside the concession have fewer years of education and lower income than those from outside the concession, but these differences are not statistically significant. In addition, there is no relationship between being from inside the former concessions and being knowledgeable about one's village of origin, which mitigates concerns about differential knowledge of villages of origin. A possible concern with data collected in Gemena is differential selective migration based on whether an individual is from the former concession area. In [Online Appendix Table G3](#) we present mean differences on key

30. This is the epidemiological approach as described by [Fernández \(2011\)](#). This approach was employed in [Lowes et al. \(2017\)](#) and [Alesina, Giuliano, and Nunn \(2013\)](#).

migration characteristics for individuals from inside and outside the former concessions. We find very little evidence of differences in reasons for migration for individuals from inside and outside the concession.³¹

IV.C. Economic Development in Villages of Origin

We first examine whether villages of origin in the former concessions are less developed than those just outside the former borders using our survey data from Gemena. This analysis is similar to [Section III.C](#) where we use DHS data to test for differences in development outcomes. We asked individuals about the public goods available in their villages of origin and their perception of the relative wealth of their village of origin. [Table III](#), Panel A presents the coefficients for two ICW indices: an index of public goods available in the village of origin and an index of a respondent's subjective measures of the development of their village of origin. All questions included in the index and their response options are reported in the notes of the table. Villages in the former concession are described as having fewer public goods and are rated as less developed.

IV.D. Differences in Village Chief Selection and Performance

We turn to the first premise in the conceptual framework: the rubber era may have undermined local institutional quality. The historical accounts of the rubber period and the oral histories from individuals in Gemena suggest that the position of chief may have been affected by the rubber period ([Young 1965](#); [Vanhee 2005](#)). Today, village chiefs are tasked with organizing public good maintenance and construction, resolving conflict, and welcoming outsiders. If the rubber regime altered the accountability and quality of village chiefs, this could explain the worse development outcomes we observe inside the former concessions.

1. *Selection and Performance of Village Chiefs.* [Table III](#), Panel B presents the results on the chief selection mechanism. Chiefs in villages inside the former rubber concessions are 35 percentage points less likely to be chosen by election. Instead,

31. Because it is difficult to rule out selective migration with the Gemena sample, we also corroborate our main fieldwork findings using baseline data for another project that was collected from 300 villages in the region ([Lowes et al. 2016](#)) in [Online Appendix H](#).

TABLE III
RUBBER CONCESSIONS AND VILLAGE INSTITUTIONS

	(1)	(2)	(3)	(4)
Panel A: Village development	Village public goods index		Village subjective ratings index	
Inside concession	-0.127*	-0.115**	-0.881***	-0.434**
	(0.074)	(0.055)	(0.252)	(0.176)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	266	304	147	212
Clusters	136	221	87	162
Bandwidth	34.39	100.00	22.63	100.00
Mean dep. var.	-0.003	0.003	0.062	0.068
Std. dev. dep. var.	0.285	0.291	0.740	0.690
Panel B: Chief quality and accountability	Chief elected		Chief public good index	
Inside concession	-0.423**	-0.345***	-0.279**	-0.194*
	(0.182)	(0.129)	(0.136)	(0.106)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	189	255	250	296
Clusters	104	189	120	210
Bandwidth	26.89	100.00	28.44	100.00
Mean dep. var.	0.503	0.506	-0.080	0.016
Std. dev. dep. var.	0.502	0.501	0.519	0.494
Panel C: Respect for authority	Survey questions index		Chief IAT score	
Inside concession	0.137	0.197	0.165	0.026
	(0.258)	(0.149)	(0.176)	(0.091)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	274	465	257	417
Clusters	142	313	127	285
Bandwidth	21.71	100.00	21.07	100.00
Mean dep. var.	0.068	0.003	-0.091	-0.088
Std. dev. dep. var.	0.739	0.750	0.566	0.549

Notes. Standard errors are clustered at the origin village level. All regressions include a local linear specification estimated separately on each side of the concession boundary and use a triangular kernel. Optimal bandwidths are chosen using the MSE-minimizing procedure suggested by Cattaneo, Idrobo, and Titiunik (2020) and are reported in km. Regressions include nearest-concession fixed effects and control for age, age squared, and sex. *Village public goods index* is a summary index for the following questions (with the number of components for each question in brackets): (1) What material is the road in your village of origin made of? [2: 0=Sand, 1=Gravel or Pavement] (2) Is your village of origin on a main road? (3) Does your village of origin have a secondary school? [2] (4) Does your village of origin have a health dispensary? [2] (5) Does your village of origin have a hospital? [2] (6) Does the water in your village of origin come from a well? [2: 0=Spring water, 1=Well]. *Village subjective ratings index* is a summary index for the following questions (with the number of components for each question in brackets): (1) How would you rate the quality of the primary school in your village of origin? [5] (2) How would you rate the quality of the secondary school in your village of origin? [5] (3) How would you rate the quality of the road in your village of origin relative to other roads in the area? [5] (4) Relative to other villages in the area you have visited, how would you rate your village of origin overall? [5] *Chief public good index* is a summary index for the following questions: Is the chief in your village of origin responsible for providing (1) road maintenance, (2) new roads, (3) school maintenance, (4) land allocation, (5) protection of property rights, (6) tax collection, (7) jobs, (8) conflict arbitration, and (9) road brushing; all questions answered as a 0 to 2 categorical variable where 0 is No, 1 is Partially, and 2 is Yes. *Chief elected* is an indicator variable equal to 1 if the village chief of a respondent's origin village is selected by elections. *Respect for local authority index* is a summary index for the following questions: (1) How much do you trust your village of origin chief? [4], (2) How much do you trust your subtribe chief? [4], (3) How satisfied are you with your village of origin chief? [4], (4) Would you vote for your village of origin chief if there were an election held tomorrow? [2], (5) How much confidence do you have in local chiefs? [4]. *Chief IAT score* is the D-score for the Implicit Association Test that asked respondents to sort sounds of words related to local chief authority, where more positive values indicate a more positive implicit association with local chiefs. * $p < .10$, ** $p < .05$, *** $p < .01$.

they are more likely to be hereditary, that is chosen from a particular lineage in the community. This lineage is known as the “ruling” lineage, and chiefs then tend to come exclusively from this lineage.

To examine whether there are differences in the quality of chiefs, we construct an index that combines all questions on whether chiefs are responsible for providing specific public goods (and their maintenance) in the villages of origin; a lower value on this index suggests chiefs are of lower quality in the sense that they are not considered responsible for providing key public goods at the village level. We find that chiefs inside the former concessions are responsible for providing fewer public goods.³²

2. Respect for Chief Authority. An important consideration when examining differences in village institutions is to account for differences in respect for authority. If respect for chief authority is lower inside the concessions due to the rubber concession period, then local chiefs may be less able to organize productive activities, resolve conflicts, and provide order, even if the chiefs themselves are of the same quality.

To examine respect for village chief authority, we first construct an index of subjective survey questions on confidence and trust in chiefs. We scale all variables so that more positive values indicate greater respect for local chiefs. Because respondents may be unwilling to answer potentially sensitive questions about local political figures truthfully, we also conducted a Single-Target Implicit Association Test (ST-IAT) to measure implicit attitudes toward chiefs.³³ Table III, Panel C reports the estimates from these two different measures of respect for authority. Individuals from inside the former concessions report that they respect chiefs more in the subjective index, though the results are not statistically significant. Likewise, the IAT results do not provide evidence of different levels of respect for authority. Overall, the measures of respect for authority in Panel C suggest that the result of lower public goods provision by chiefs inside the former concessions is not driven by lack of respect for authority.

32. In addition, we provide evidence from our fieldwork samples that elected chiefs are more accountable and provide more public goods than hereditary chiefs in [Online Appendix](#) Figure I8.

33. See [Online Appendix](#) G.4 for more information on the ST-IAT and its implementation.

IV.E. Differences in Trust, Social Cohesion, Altruism, and Support for Sharing

The second premise of the conceptual framework is that the rubber regime led to changes in cultural traits. The historical accounts suggest that exposure to the rubber regime affected a series of important outcomes related to cooperation and sharing by increasing the importance of and reliance on mutual insurance. We examine differences in trust, feeling of closeness with others, and survey and experimental measures of support for sharing.

1. Trust in Others. We examine whether trust is different across the former concession borders in [Table IV](#), Panel A by constructing an index of questions on how much individuals trust various people.³⁴ The coefficient on trust inside the former concessions are positive and statistically significant, suggesting that individuals from the former concessions are in fact more trusting than those outside the former concessions. The coefficient plot for each question individually is presented in [Online Appendix G.7](#). We also ask respondents how close they feel to various groups of people. We present the results on differences in closeness in [Table IV](#), Panel A. We find that individuals from the former concessions report feeling closer to a wide variety of other individuals.

2. Strength of Beliefs in Importance of Sharing. To test whether there are differences in beliefs in the importance of sharing, we first construct an index of survey questions asking individuals whether they think it is appropriate to share income in a variety of different situations. The index includes questions on whether you and others should share income when it is earned by luck and when it is earned by work. We also ask the respondent how they think people in their village of origin would respond to the same series of questions to understand their expectations regarding the beliefs of others.

[Table IV](#), Panel B present the estimates for each of these measures. Individuals from the former concessions are more likely to agree that income should be shared with others. They are also more likely to report that individuals in their villages of

34. We chose these survey questions following work by [Johnson and Mislin \(2011, 2012\)](#), who demonstrate that trust survey questions have a positive, robust correlation with experimental measures of trust (i.e., amount sent in the trust game).

TABLE IV
SURVEY AND EXPERIMENTAL MEASURES OF TRUST AND SHARING BELIEFS

	(1)	(2)	(3)	(4)
Panel A: Trust and closeness	Trust index		Closeness index	
Inside concession	0.299 (0.235)	0.313*** (0.120)	0.521** (0.210)	0.551*** (0.135)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	304	465	299	465
Clusters	152	313	158	313
Bandwidth	23.70	100.00	24.99	100.00
Mean dep. var.	0.137	0.041	0.156	0.045
Std. dev. dep. var.	0.701	0.707	0.717	0.717
Panel B: Survey measures of sharing norms	Respondent		Village of origin	
Inside concession	0.517** (0.254)	0.339* (0.184)	0.490** (0.230)	0.268* (0.143)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	308	453	285	363
Clusters	156	304	144	255
Bandwidth	26.47	100.00	28.06	100.00
Mean dep. var.	0.068	0.031	0.012	0.006
Std. dev. dep. var.	0.835	0.825	0.785	0.783
Panel C: Experimental measures of sharing norms	Dictator game: share sent		Effort task: share redistributed	
Inside concession	-0.018 (0.025)	0.001 (0.020)	0.067** (0.030)	0.053** (0.023)
Bandwidth choice	Optimal	Wide	Optimal	Wide
Observations	258	438	368	437
Clusters	135	300	193	300
Bandwidth	21.46	100.00	37.22	100.00
Mean dep. var.	0.449	0.445	0.410	0.405
Std. dev. dep. var.	0.122	0.123	0.134	0.134

Notes. Standard errors are clustered at the origin village level. All regressions include a local linear specification estimated separately on each side of the concession boundary and use a triangular kernel. Optimal bandwidths are chosen using the MSE-minimizing procedure suggested by Cattaneo, Idrobo, and Titiunik (2020) and are reported in km. Regressions include nearest-concession fixed effects and control for age, age squared, and sex. *Trust index* is a summary index for the following questions: How much do you trust (1) people from your village of origin, (2) people of another tribe, (3) people of your own tribe, (4) people you meet for the first time, (5) your family, (6) your neighbors, (7) people of another nationality, and (8) people of your subtribe; all questions answered on a 0 (Not at All) to 4 (Completely) scale. *Closeness to others index* is a summary index for the following questions: (1) How close do you feel to people from your village of origin?, (2) How close do you feel to people of Gemena?, (3) How close do you feel to people of your own tribe?, (4) How close do you feel to people of your age set from your origin village?, and (5) How close do you feel to people of your age set in Gemena?; all questions answered in a scale from 0 (not close at all) to 5 (very close). *Sharing norms index* is a summary index for the following questions: (1) If you get money from luck you should share it, (2) If you earn money from hard work you should share it, (3) If someone else earns money from luck they should share it, (4) If someone else earns money from hard work they should share it; all questions answered in a scale from 1 (strongly disagree) to 5 (strongly agree). *Sharing norms index village of origin* is a summary index for the following questions, where all questions start with “How much would someone from your village of origin agree with the following statements”, for the same statements listed above. *Dictator game: amount shared* measures the amount sent to an anonymous player 2 in the standard Dictator game. *Effort task: share redistributed* is the total share taken (weighted by the maximum budget amount possible to take) in the effort task from the anonymous player 1’s earned income. It represents an experimental measure of respect for earned-income property rights. Two individuals declined participating in the dictator game, and one additional individual declined participating in the reverse dictator game. * $p < .10$, ** $p < .05$, *** $p < .01$.

origin would also agree that income should be shared. Individuals support sharing income regardless of whether it is earned by work or luck and regardless of whether they are speaking about sharing their own income with others or others sharing with them.

We also collected experimental measures of support for sharing. Individuals in our sample participated in a dictator game (DG) to measure altruism and in a reverse dictator game, to measure support for redistribution. In the standard DG, a player 1 is given an endowment and is asked to allocate it between themselves and a player 2. The reverse DG differs in two key ways from the standard DG. First, the player 1 earns an endowment by completing a task.³⁵ Second, the player 2 is told how much the player 1 earned and is asked what share of the player 1's earned income they would like to keep for themselves. The amount player 2 decides to take from player 1's earned income therefore represents a measure of willingness to redistribute.³⁶ See [Online Appendix G.2](#) for more details on the reverse DG with earned income, the protocols used, and a description of the earnings task.

[Table IV](#), Panel C presents the estimates for the experimental measures of altruism and willingness to redistribute. We find no significant differences in the amount sent in the dictator game. For the reverse dictator game, we find that individuals from the former concessions redistribute a larger share of the other player's earned endowment to themselves. We interpret this as having

35. For the earnings task, we selected a task that could be easily understood by all respondents and for which more effort was rewarded by more income. Subjects played a "clicking game" on touch screen tablets. In this "clicking game," a small blue dot appears in a random location on the screen every three seconds and the respondent has one second to push the dot before it disappears. Importantly, this effort task did not rely on physical strength or skill but instead relied on concentration and perseverance. The game lasted five minutes and respondents were paid based on the number of successful "clicks," earning 100 Congolese francs (approximately US\$ 0.10) per 10 successful clicks. Respondents were very engaged in the task and earned on average 700 CF in this task.

36. Variation (i) of the DG has been used before by [Hoffman et al. \(1994\)](#) and [Cherry, Frykblom, and Shogren \(2002\)](#); subjects tend to be much less generous when they earned their own income, which [Farh and Irlenbusch \(2000\)](#) refer to as earned property rights. Variation (ii) on its own changes the standard DG to what is known as a reverse DG, which has been used many times before ([List 2007](#)). [Jakiela \(2011\)](#) combines these two variations to get a measure of respect for earned property rights and finds that subjects in the United States tend to respect others' earned income much more than subjects in Kenya.

greater support for redistribution, consistent with the survey measures on sharing which suggest that individuals think income should be shared.³⁷

One implication of greater support for sharing income is that we would expect villages inside the former concessions to have less income inequality. Consistent with greater support for sharing income, in [Online Appendix I.3](#), we find lower levels of income inequality, as measured by both the standard deviation of the wealth score and the interquartile range of the wealth score, within DHS clusters inside the former concessions.

The results in [Table IV](#) provide evidence that individuals from inside the former concessions are more trusting, feel closer to others, believe it is important to share income, and redistribute more in a reverse dictator game. The results all point to more prosocial beliefs and values in the former concessions.

Note that our priors before data collection had been that the rubber concessions may have led to both worse institutions and less prosocial norms. These priors were informed by work by [Nunn and Wantchekon \(2011\)](#), who find that the slave trade undermined trust. Thus, while potentially surprising, our results are in line with recent work by [Bauer et al. \(2016\)](#), who review findings from 16 postconflict settings and have found that individuals exposed to conflict are more prosocial because they are more dependent on local informal systems of risk-sharing and insurance.³⁸ Our results suggest that in response to weakened institutions and violence, cultural traits related to cooperation and mutual aid changed.

IV.F. Discussion of Results

An important question is: how do the changes in institutions and culture lead to a low-development equilibrium? Of course, this cannot be directly tested in our data, but a compelling explanation underlying our conceptual framework is that these changes in institutional quality and culture reinforce each other: chiefs are held less accountable and allowed to stay in power because

37. Work by [Platteau \(2000\)](#) discusses how there may be a dark side to sharing and redistribution norms. For example, they can dampen incentives for investment.

38. This finding is also related to the “tend-and-befriend” hypothesis in psychology, which suggests people build alliances during times of stress (see [von Dawans et al. 2012](#)).

individuals do not rely on their formal institutions as much and instead rely on informal sharing norms for support. Indeed, consistent with the conceptual framework, in [Online Appendix Figure I1](#), we find a negative correlation between prosocial norms and a chief's provision of public goods, a positive correlation between a chief's provision of public goods and wealth, and a negative correlation between prosocial norms and wealth. We interpret this as suggestive evidence that more prosocial norms serve as a substitute for better-quality institutions.

Our fieldwork data also let us explore whether the cultural changes on their own are sufficient to lead to low-development outcomes, or whether they only lead to less development when paired with low-quality local institutions. We do this by comparing first- and second-generation migrants from inside and outside the concessions. These individuals are removed from their village institutions and share a common institutional environment presently.

We first explore whether migrants converge in terms of development outcomes when they share a common institutional environment in [Figure VI](#). We find differences in education and income that are quite stark if we look only at first-generation migrants.³⁹ However, if we examine second-generation or higher migrants separately, we find convergence in these outcomes.

We then turn to the cultural outcomes. The results in [Figure VI](#) suggest that both first- and second-generation migrants exhibit more prosocial norms. This has important implications for understanding if our observed effects are “place” or “person” specific. It suggests that removing individuals (and their cultural norms) from the former concession areas actually leads to relatively quick convergence in education and wealth outcomes.

V. CONCLUSION

We examine how exposure to the concession system, which was characterized by violence and indirect rule, has shaped the development of areas of Congo. The rubber concession period was characterized by its extreme brutality and violence and the use of local leaders to achieve rubber production quotas. We provide micro-level evidence on how these common colonial

39. Interestingly, the differences are of very similar magnitude to the DHS results we present in [Section III.C](#).

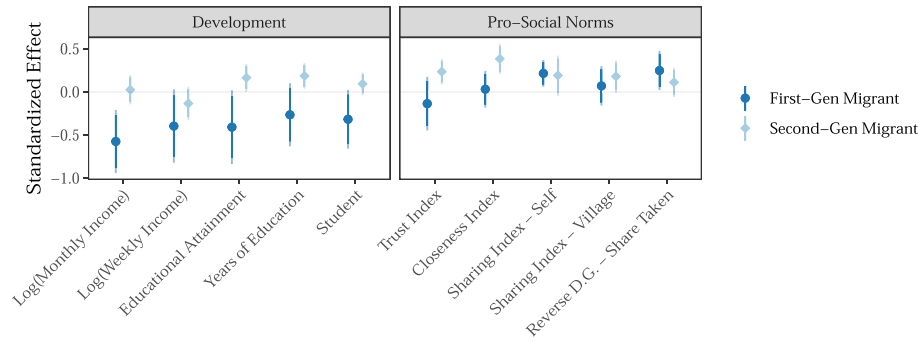


FIGURE VI

Development and Prosocial Norms by First- and Second-Generation Migrants

This figure presents estimates from estimating specification (1) for the subsample for first-generation migrants (dark blue circles; color version online) and second-generation or higher migrants (light blue diamonds) to Gemena. Data are from the survey conducted in Gemena. Prosocial norm indexes are defined as in Table IV. Educational attainment is a 0 to 3 categorical variable, where 0 = no schooling, 1 = primary schooling, 2 = secondary schooling, and 3 = postsecondary schooling. Standard errors are clustered at the origin village level. This figure presents 95% and 90% confidence intervals (with and without transparency, respectively). Regressions include nearest-concession fixed effects and control for age, age squared, sex, latitude, and longitude. All regressions include a local linear specification estimated separately on each side of the concession boundary and use a triangular kernel using a 100 km bandwidth from the former concession borders.

“treatments”—concessions, violence, and indirect rule—matter for understanding the comparative development of sub-Saharan Africa.

This study documents that former rubber concession areas have lower levels of education, wealth, and health than areas outside of the concessions. A likely mechanism is that inside the former concessions, chiefs are less likely to be elected, are more likely to be hereditary, and provide fewer public goods. Despite the negative effects on development and local institutions, we also find evidence that individuals inside the former concessions are more prosocial.

The results highlight that even a short exposure to extractive institutions can have a meaningful effect on the development of an area, particularly when local institutions are integrated into supporting the extraction. It is important to keep in mind our counterfactual; most of Congo was exposed to various forms of violence and colonial extraction. Thus we are capturing the effect

of relatively greater exposure, suggesting that we are providing a lower bound of an effect relative to no extraction.

We present the first quantitative evidence on the effects of this common form of economic organization and on an important historical event. These results suggest that concessions, where private companies are given state-like powers for the purpose of generating profit, can have significant and negative long-term consequences. These results have important implications for the development of the DRC and other parts of Africa, much of which was granted as concessions during the colonial era.

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SUPPLEMENTARY MATERIAL

An [Online Appendix](#) for this article can be found at *The Quarterly Journal of Economics* online.

DATA AVAILABILITY

Code replicating the tables and figures in this article can be found in [Lowes and Montero \(2021b\)](#) in the Harvard Dataverse, <https://doi.org/10.7910/DVN/6FBZNJ>.

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