A common explanation for African current underdevelopment is the extractive character of institutions established during the colonial period. Yet, since colonial extraction is hard to quantify and its exact mechanisms are not well understood, we still do not know precisely how successful the colonizers were in extracting wealth from Africans. In this paper, I tackle this issue by analyzing how trade monopsonies and coercive labor institutions reduced African gains from trade during the colonial period. By using new data on prices to agricultural producers in French Africa, I show that (1) the monopsonistic character of colonial trade implied a reduction in prices to producers way below world market prices; (2) coercive labor institutions allowed the colonizers to reduce prices even further; (3) as a consequence, colonial extraction cut African gains from trade by over 60%.
I Introduction

Many leading hypotheses about current African underdevelopment emphasize the role of colonialism. If the early literature underlined how colonial rule relegated Africa to exporter of primary commodities (Rodney, 1972), more recent works have instead focused on the long-term consequences of colonial extractive institutions (e.g. Acemoglu et al. 2001, 2002; Englebert 2000; Herbst 2000; Nunn 2007). Yet, to explain how colonial institutions affect current development, we need to understand the extent of extraction during the colonial period. Many of the institutions established by the colonizers were, in fact, maintained in the post-independence period. Moreover, the extent to which they were extractive in the colonial period affects how extractive they are after independence (Acemoglu et al. 2001; Bates 1981). However, since colonial extraction is hard to quantify and its exact mechanisms are unclear, we still do not know precisely how successful the colonizers were in extracting wealth from Africans.

This paper investigates this issue by exploiting the peculiar structure of labor and trade policies employed by the French colonizers. The focus on trade in the French colonies offers two main advantages for understanding the mechanisms of extraction in the colonial period. First, because of the low population densities of French Africa and the high cost of labor relative to land, the colonizers faced there powerful incentives to use coercive labor institutions. Second, focusing on trade allows us to use price data in order to evaluate colonial extraction. By using the gap between prices to African agricultural producers and world market prices as a measure of extraction, I analyze how colonial trade monopsonies and coercive labor institutions affected African gains from trade during the colonial period.

Because of limited data on colonial institutions and prices in Africa, this question has so

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1Extractive institutions can be defined as those arrangements “designed to extract incomes and wealth from one subset of society [masses, African populations] to benefit a different subset [elite, colonizers]” (Acemoglu and Robinson 2012).

2When coercion is a feasible option, a higher land/labor ratio might not translate into higher wages, but in an increase of coercion of labor (Domar 1969; Fenske 2013) tests this hypothesis in the African context showing that lower population density is correlated to the extent of indigenous slavery.
far remained unanswered. On one hand, historians have collected information about colonial institutions, but they have not attempted to systematically quantify the level of extraction. On the other hand, economists have overlooked the temporal variation in colonial extraction, increasing the risk of “compression of history” and making it difficult to understand how extractive institutions persist over time (Austin 2008).

My first contribution then is to provide a new yearly dataset of labor institutions and prices paid to African producers for the main commodities exported from each French colony between 1898 and 1959. I collected the data on labor institutions from historical and ethnographic studies and the data on prices from a variety of colonial publications, including, but not limited to, statistical reports of the Ministry of the Colonies, customs statistics, and *Bulletins Economiques* of the different colonies.

My second contribution is to use these data to understand how colonial extractive institutions affected African prices. The main difficulty in answering this question is that, since extractive institutions were used in all colonies, we cannot observe colonial trade in absence of extraction. However, since in a competitive market the prices to African producers should be equal to the difference between world market prices and transport costs, we can use this measure as a counter-factual.

Building on this insight, I proceed in three steps. First, I use my price dataset to check whether colonial extraction (monopsony and coercive labor institutions) implied a reduction in the prices to African producers. I show that the prices to Africans were reduced by about 30% with respect to what they would have been in absence of monopsonies and coercive labor institutions. Moreover, the level of extraction varied substantially across the different colonies and economic activities and decreased in the second half of the colonial period.

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3Previous works by economists exploited spacial variation in some colonial policy or institution, observed in one point in time. [Huillery (2009)](#) studies the impact of colonial investments in education in French Africa. [Gallego and Woodberry (2010)](#) and [Nunn (2010)](#) analyze the effect of colonial missionary activity on schooling and religious conversion. [Michalopoulos and Papaioannou (2011)](#) estimates the effect of arbitrary colonial borders on civil war. [Berger (2009)](#) studies the modern impact of colonial policies on public good provision in Nigeria [Cogneau and Moradi (2014)](#) analyzes the effect of colonial policies on education and religion across the border between the French and British partitions of Togoland.
Second, I use newly collected data on labor institutions to disentangle the effect of coercive labor institutions on prices to producers from the effect of monopsony. I present evidence that the level of coercion of labor affected the extent of price reduction. Prices to Africans were reduced by 25% with respect to competitive prices if the colonizers used free peasant production, but they were reduced by almost 40% for crops that were produced under compulsory cultivations.

To make sure that the relationship between prices and institutions is not spurious, I need to consider potential omitted variables. One candidate is the price elasticity of African supply. The colonizers might have in fact established coercive institutions and offered lower prices in colonies/crops where Africans responded less to price incentives. To account for this problem, I exploit the panel structure of the data and the historical evidence on change in institutions. Since the transition from compulsory to free production at the end of the colonial period was affected more by the political climate before independence than by changes in elasticity of supply, I can reduce the omitted variable bias by controlling for colony/commodity and year fixed effects.

Finally, I construct lower bounds for the losses that monopsony and coercive labor institutions together implied for African welfare: on average, colonial extraction reduced African gains from trade by over 60%. Moreover, by exploiting the insight of a simple model of colonial trade under extractive institutions, I am able to disentangle the effects of monopsony from those of coercive labor institutions. I show that, when the latter were used, they accounted for at least 60% of the total losses.

The paper is structured as follows. Section II provides some historical background about French colonies in Sub-Saharan Africa, monopsonistic trading companies, and labor institutions. Section III proposes a theoretical model of colonial trade under extractive institutions. The following three sections test the implications of the model: Section IV explores the effect of colonial extraction on prices to Africans, Section V focuses on the impact of coercive labor institutions, and Section VI provides lower bounds for the reduction in the gains from trade.
II Historical Background

Most of the military conquest of French Africa occurred between 1880 and 1900. Towards the end of 19th century there still existed some small pockets of resistance (Mauritania did not fall under full French control until 1936), but the conditions were ready for the development of the colonial system (Coquery-Vidrovitch, 1969; Suret-Canale, 1971).

The French government organized the colonies in two federations: French West Africa (1895)—including Mauritania, Senegal, French Sudan (now Mali), Niger, Upper Volta (now Burkina Faso), Guinea, Ivory Coast, and Dahomey (now Benin)—and French Equatorial Africa (1908)—including Gabon, Congo, Ubangi-Shari (now Central African Republic), and Chad. After WW1, part of Togo and almost all of Cameroon were added to the French colonies in continental Sub-Saharan Africa (see Figure I).

The extension of French possessions was reflected in the heterogeneity of their natural environment, including, from the coast towards the interior, tropical forests, savannas, and arid-desertic regions. The coastal forestry regions were suitable to produce bananas, coffee, cocoa, and rubber, while the drier interior areas were suitable for peanuts and cotton. In general, Western colonies were more prosperous than Equatorial colonies and, with the exception of the peanut-producing areas of Senegal, coastal regions were usually wealthier with respect to interior regions because of the higher value of their crops and lower transportation costs (Hopkins, 1973).

Figure II shows the evolution of the total value of exports (in constant 1900 francs, evaluated with prices in France) from French Africa between 1900 and 1960.4 Exports grew during the entire colonial period, slowed down throughout the Great Depression, and increased dramatically after 1945. On average, peanuts accounted for the highest share of exports (about

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4See Section IV.1 for details on the data.
30% of the total value), followed by rubber (about 18%), oil palm produces (15%), coffee, cocoa, and timber (each of them accounting for about 10%). Cotton and bananas accounted for the remaining exports. Ivory Coast, Senegal, and Cameroon were the richest colonies, generating 28%, 21%, and 16% of the total value of exports, respectively.

Given the variety of environments and commodities, the colonizers structured economic activity and trade in the colonies in different ways. In West Africa, exports were initially based only on African peasant production. European trading companies limited themselves to buying crops and reselling them at higher prices in Europe. After WWI, Europeans began to enter the productive sector, establishing plantations (e.g. cocoa and coffee in Ivory coast, bananas in Guinea) and exploiting forestry concessions. Mining was a minor activity. In Equatorial Africa economic activity was initially organized on the basis of concessionary companies with monopoly over given territories. African laborers were forced to collect crops, especially rubber, for the concessionaires who employed harsh coercive methods. The abuses of the concession system led to its termination in the 1920s, when trading companies on the model of West Africa were established (Suret-Canale, 1971).

The French administration fixed the import prices in France by ministerial decree, following world market prices, and the prices to African producers, usually as a percentage of the world market price. For example, cotton price paid to Ubangi-Shari farmers was 15% of the average FOB price of cotton in New York (DeDampierre, 1960).

Whether the economic activity was organized through European companies or African peasant agriculture, the French colonizers had incentives to reduce the cost of production in order to increase profit. Thus, the colonial government tried to establish de iure or de facto monopolies for the trading and concessionary companies in order to reduce prices and wages to Africans (Coquery-Vidrovitch, 1972; Manning, 1998; Suret-Canale, 1971; Thompson and Adloff, 1957).

At the beginning of the 20th century, trade in the Senegal/Mali region was controlled by a group of eight Bordeaux trading firms, while Guinea and Congo were in the hands of business
houses from Marseilles or Paris. Smaller traders were allowed a share of exports as long as they respected the prices fixed by the main trading firms. After WWI, the de facto monopsony of these companies grew stronger: economic crises eliminated competition from smaller companies, German business interests were canceled by the war, and protectionist measures were taken against British trade. Protectionist policies were not applied everywhere and did not completely eliminate non-French trade (especially in Guinea and Dahomey). Nevertheless, the number of the remaining trading firms became sufficiently small to allow agreement and ban entry into the African market ([Suret-Canale] 1971). As a result, at the beginning of WWII, fewer than a dozen companies monopolized almost all of trade from French West Africa and two French companies (Société Commerciale de l’Ouest Africain, Compagnie française de l’Afrique Occidentale) and a British one (Unilever) controlled between 50% and 90% of exports ([Suret-Canale] 1971, p. 167).

In addition to establishing monopsony power for the trading companies, the colonizers attempted to reduce price and wages to Africans by interfering with labor markets and implementing coercive institutions.[5] Since capital was relatively expensive, production relied on labor-intensive methods. French Africa’s low population densities and abundant cultivable land in the indigenous sector implied that African incentives to enter the wage labor force or to produce cash crops were insufficient. For these reasons, the colonizers put in place specific institutions such as compulsory African cultivations and various forms of forced labor in European plantations. These institutions, by reducing the outside options of Africans, had the goal to further increase the ability of the colonial governments to lower prices to producers.

Three main kind of institutions were used (free peasant production, compulsory peasant production, and concession/forced labor production) and the type of coercive arrangements available to the colonizers depended on whether agricultural production was African-based or European-based. When the colonizers limited themselves to trade and production was left to African peasants, the colonial governments could introduce compulsory peasant production.

[5] We can interpret these institutions as subsidies given by the colonial government to the European trading and concessionary companies.
In this case, they set quotas of produce that Africans had to cultivate or gathered and sell for a fix price to the colonizers. The most notable example of this institution were the cotton quotas established by Felix Eboué in Ubangi-Shari in 1924 \cite{DeDampierre1960}. Under this arrangement, every village had to produce amounts of cotton in proportion to its population and sell it to trading companies with monopsony power over given territories. The costs for the recruitment of cotton producers were borne by the colonial government, and payments were often in the form of tax vouchers. Cotton quotas were abolished in 1956, just four years before independence.

Alternatively, when the colonizers entered the productive sector, establishing concessions and plantations, forced labor could be implemented. It took the direct form of labor taxes and the indirect form of contract labor. With labor taxes, all males between 18 and 60 had to contribute a certain number of days of unpaid labor (usually from 8 to 12 per year) to whatever enterprise the administration assigned them. Labor taxes were used mostly for porterage and public works, but not infrequently for private enterprises, especially in the early days of the colonial period. They were finally abolished for both the private and public sector in 1946 \cite{Fall1993}.

Contract labor was a system of formal labor recruiting used mainly for private enterprises. While not forced labor, it was far from a free market system. The most important figure in this system was the labor recruiter who rounded up manpower in villages. Local chiefs received payments for every man supplied and were therefore encouraged to cooperate with the recruiter. The compulsory nature of this system decreased in the late 1930s, when freer forms of recruitment started to appear.

In addition to these institutions, the colonizers also used indirect methods, such as poll taxes.\footnote{Other institutions such as labor drafts, convict labor, and military labor worked in a similar manner.} Introduced to raise the revenue of colonial governments, they also served the function of forcing Africans to enter the wage labor force or to produce cash crops in order to earn the

\footnote{Given the low population densities, land alienation was a less attractive option to generate a labor force than it was in East Africa.}
money needed to pay taxes. In Equatorial Africa, for example, poll taxes were introduced in 1902 as a way to facilitate rubber collection for the concessionary companies.

However, coercive labor institutions were not implemented everywhere. When neither compulsory cultivations nor forced labor were used, the prices or wages were still fixed by the colonizers, but the African peasants could decide whether to work for the colonizers in the case of European-based production or how much crop to produce in the case of African-based production.

By exploiting newly collected data on labor arrangements, quantities, and prices in each colony/commodity/year (see Section IV.1 and V for details), I evaluate the importance of the three main institutions: free peasant production, compulsory peasant production, and concession/forced labor production. Table I reports the shares of the total value of exports under the three institutions, from 1900 to 1960. Since the kind of institution may have affected the prices paid to African producers, the value of exports is computed using prices in France. Column (1) shows the shares of institutions considering the whole French Africa for the entire colonial period. Free peasant production was used in the majority of cases, accounting for almost 60% of the total value of exports; concession and compulsory production followed with about 30% and 10% of the export value, respectively. Column (2) presents the export share by institutions in West and Equatorial Africa. Free peasant production was much more diffuse in West African colonies, where it accounted for almost three fourths of exports in contrast with only one fourth of exports from Equatorial Africa. In contrast, concession production and especially compulsory production were employed more frequently in Equatorial Africa.

Given such a variety of labor arrangements, one might ask which factors affected the kind of institutions that were implemented. Overall, the choice seems to be affected more by factors related to the characteristics of crops, such as economies of scale and whether they were indigenous or introduced by the colonizer, than to the characteristics of colonies, such as settler mortality or population density. Simple crop fixed effects account in fact for a large
portion of the variance in institutions, while the explanatory power of colony fixed effects is much lower. Table II shows that, in a simple regression of labor institution dummies on crop, colony, and year fixed effects, crops explain 50% of the variation in institutions, while colonies and years only 7% and 1%, respectively.8

Free peasant production was used for crops with limited economies of scale or those that were already produced by Africans (peanuts, palm kernels, and cocoa in the late colonial period). Compulsory peasant production was implemented for crops that were introduced by colonizers for which Africans had not entered market production (cotton, wild rubber, and cocoa in the early colonial period). Concession production with various forms of coercion for African workers was used for commodities whose production needed large capital investments and was characterized by large economies of scale (bananas, coffee, timber, plantation rubber).

Timber, peanuts, palm kernel, and bananas, which were almost always produced using the same institutions across regions and periods, accounted for about 60% of the total value of exports. Nevertheless, some variation in institutions existed across regions within the same crop. Coffee was mostly produced with concessions in Equatorial Africa, while some free peasant production was used in West Africa. Cotton was cultivated via compulsory production in the Equatorial colonies, but with both compulsory production and concessions in the Western colonies. Compulsory production was used for cocoa and rubber in Equatorial Africa, while concessions and some free peasant production were employed in West Africa.

Over time, Africans started responding more to price incentives and, especially after WWII, the political pressure to abolish coercive institutions increased. As a result, we observe a transition towards free peasant production in most colonies and crops. At the

8We observe a strong correlation between crops and institutions. However, it is also possible that institutions are assigned by exogenous administrative decisions and that the colonizers then choose the crops that are more suitable for those institutions. Nevertheless, if this were the case we should observe much bigger colony fixed effects. Moreover, the historical evidence supports the view that crops affect institutions. For example, poll taxes were introduced in Equatorial Africa to facilitate the collection of rubber for the concessionary companies and compulsory quotas were established in Ubangi-Shari in order to increase cotton production.
onset of independence, free peasant production accounted for almost 70% of the total value of exports, with the remainder produced under concessions.

III A Model of Colonial Extraction

Although both economists and historians agree on the importance of colonial institutions, the extent of extraction has been difficult to assess. How much did colonial extractive institutions reduce African prices and gains from trade?

In order to answer this question, we need to identify the proper counterfactual. To do so, I outline a simple model of colonial trade under monopsony and coercive labor institutions. For the purpose of the model, institutions are treated as exogenous, and I will address the issue of their origin in the empirical part of the paper.

There are two groups of actors: African Peasants and Trading Companies. The African Peasants produce one crop and sell it to the Trading Companies. The Trading Companies set the price to producers and resell the crop at the world market price in Europe[9]. Given the price to producers \( p_A \), the African Peasants produce the quantity \( Q \) in order to maximize

\[
\Pi_A = p_A Q - C(Q),
\]

where \( C(Q) \) is a convex cost function. The FOC implies that the quantity is such that the marginal cost is equal to the price and the African supply function is

\[
Q(p_A) = MC^{-1}(p_A),
\]

where \( MC \) is the marginal cost function. Given this supply function, the Trading Companies choose the price \( p_A \) to maximize

\[
\Pi_C = (p - t - p_A)Q(p_A),
\]

where \( p \) is the (exogenous) world market price and \( t \) are transportation costs. The price paid to Africans varies according to the kind of institutions governing trade and production: perfect competition among trading companies, simple monopsony, monopsony and coercive labor institutions. Let us consider each of the three cases.

1. Perfect Competition

Suppose that there are (infinitely) many trading companies competing for African production. If one company sets a price \( p_A < p - t \), then a second company might set

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[9]The traded quantity from Africa is too small to affect world prices. See Table XI.
a higher price, buy the entire production, and still make a positive profit. The equilibrium price to Africans is just the difference between price in Europe and transport costs,

\[ p_A = p - t \]  \hspace{1cm} (1)

In this case, the profit of the Trading Companies is zero.

2. Simple Monopsony

Suppose that one Trading Company has the right to buy all African production. In this case, the FOC for the Trading Company’s maximization problem implies

\[ p_A = p - t - \frac{Q(p_A)}{Q'(p_A)} \]  \hspace{1cm} (2)

Since both \( Q(p_A) \) and \( Q'(p_A) \) are positive, the price to Africans is lower under monopsony than under competition. In this case, the Trading Company makes a positive profit.

3. Monopsony and Coercive Labor Institutions

Suppose that, in addition to monopsony, the Trading Company has access to coercive labor institutions (various forms of forced labor and compulsory cultivations) in order to force African Peasants to produce more than they would produce at any given price. We can model African’s supply function under coercive institutions as \( Q_c(p_A) = Q(p_A + c) \), where \( c \) is the level of coercion. In this case, the FOC implies

\[ p_A = p - t - \frac{Q(p_A + c)}{Q'(p_A + c)} \]  \hspace{1cm} (3)

Since \( Q(.) \) is increasing and concave, \( \frac{Q(p_A + c)}{Q'(p_A + c)} > \frac{Q(p_A)}{Q'(p_A)} \). Thus, the price under monopsony and coercive labor institutions is lower than the price under simple monopsony. As a consequence, the profit of the Trading Company is higher in this last case.
Let us now consider the implications of these institutional arrangements for African gains from trade.

- **Simple Monopsony**

  Since the price under simple monopsony is lower than the price under competition, the traded quantity will also be lower. African gains from trade are thus lower under simple monopsony than under competition. Without coercive labor institutions the marginal cost of each unit is always lower than the price, so Africans still get some gains from trading, but less than if they were facing competition among trading firms.

- **Monopsony and Coercive Labor Institutions**

  With coercive labor institutions, the price is lower than under simple monopsony. Given the presence of coercion, the traded quantity is higher, but Africans will produce the additional quantity at a cost higher to the price. For this reason, African gains from trade are lower under monopsony and coercive labor institutions than under simple monopsony. Moreover, notice that, because the Africans receive a price lower than the marginal cost, they might be worse off with respect to not trading at all.

The model yields three predictions about the features of colonial extraction in French Africa:

1. Prices to Africans were lower than they would have been with competition.
2. They were further reduced with respect to monopsony prices by the presence of coercive labor institutions.
3. Extractive institutions reduced African gains from trade.

In the rest of the paper, I will empirically test these results.

**IV Result 1: Prices to Africans and Competitive Prices**

In this section I explore the first result of the model, checking whether the prices to Africans in the French colonies were lower than competitive prices.
IV.1 Data

To test this hypothesis, I use newly-collected data on prices in Africa, prices in France, and transport costs. I focus on nine main commodities exported by French Africa: peanuts, palm kernels and oil, cotton, cocoa, coffee, rubber, timber, and bananas. The commodities included in the dataset account for 80% of the value of all exports from West and Equatorial Africa during the whole colonial period.

Prices in Africa and Quantities Exported

Colonial customs statistics reported the total quantity and value for each exported commodity from each colony every year. These statistics were registered at the local customs offices and then aggregated at the colony level. The reported values were usually official market prices in Africa (valeurs mercuriales), established by decree by the General Governor of the colonies on the basis of reports of local commissions of evaluation. After World World II, the reported evaluations were often values of the commodities at the loading port, including transportation costs to the port and exit taxes.¹⁰

Using these customs statistics, I collected data on prices in Africa and quantities exported from each colony for nine main commodities between 1898 and 1959. I exploited numerous yearly issues of different colonial publications, including, but not limited to, statistical reports of the Ministry of Colonies, Bulletins Economiques of the various colonies, and Annuaire Statiques of West and Equatorial Africa.¹¹

Given the variety of the sources and the length of the period considered, the names of the territorial units for which the custom statistics are reported change over time and sometimes data are reported only for larger territorial units. To solve these issues, I first tracked the variation in the names of colonies. Then, I assigned each commodity from a larger territorial unit to the smallest territory (colony or group of colonies) that I could identify by excluding

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¹⁰These values are a good proxy for the actual prices to producers: detailed data on prices to farmers, inland transport cost, and tariffs from the late 1950s show that, after controlling for transportation costs, differences in prices at African ports are almost exclusively due to differences in prices to producers. See Table III.

¹¹See the appendix for more details on the sources.
those colonies which do not produce that specific commodity. I deflated all prices in 1900 French francs.

**Prices in France**

I collected prices in France from various issues of the *Statistiques Mensuelles du Commerce Extérieur de la France*, a monthly publication by the *Direction Générale des Douanes* reporting the total values and quantities of the commodities imported from the French colonies in every year. As a control, I also used different issues of the *Annuaire Statistiques de France* reporting similar information. I deflated all prices in 1900 French francs.

Not all exports from French Africa went to France. Nevertheless, given the importance of the French market, using export prices in France is a good approximation. By 1949, France was the destination of about 80% of the total exports originating from its African colonies (Duignan and Gahan [1975]). Moreover, French prices are highly correlated with world market prices, as shown in appendix A.1.

**Transport costs**

Since extensive data on transportation costs between Africa and France are not available, I constructed estimates of shipping costs for each colony-commodity-year in my dataset according to the following procedure. First, I computed the distance to Marseilles from the closest African port for each colony. Then, I used data on average freight rates from the West African coast to France for the main exports in 1938 to compute the average shipping cost per km for each commodity in 1938. Finally, I multiplied this measure by the distance to Marseilles for each colony (both West and Equatorial Africa) and by an index of transportation costs between 1898 and 1959 with base 1938=1 from Mohamed and Williamson (2004). In the empirical analysis, I will consider also inland transport.

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12 For example, all cocoa exports 1898-1907 recorded as from French Congo (including Gabon and Congo) are assigned to Gabon because there was no registered cocoa production in Congo before 1927. Territorial units involved are AEF, French Congo, AOF, and Senegal-Haut Senegal-Niger.


14 The main ports are identified from the map reported at page 149 of Duignan and Gahan [1975]. The distance to Marseille is computed by using http://ports.com/sea-route.

15 Documents et statistiques - Ministère de la France d’Outremer, Service de statistique, 1949-52.

16 I used the global real freight rate deflated by commodity prices, from table 3 of the paper.
costs, by controlling by the distance of each colony to the coast.

Overall, the dataset includes 1717 observations (colony-commodity-year) and I have data on prices in Africa, prices in France, and transportation costs for 1466 of them. The years covered are: 1898-1914, 1920-1951, 1953, 1956, 1958, and 1959. Table IV reports the summary statistics.

IV.2 Empirical Strategy

Equations (2) and (3) imply that with perfect competition \( p_A = p - t \), while under monopsony and coercive labor institutions \( p_A = p - t - \frac{Q(p_A + c)}{Q'(p_A + c)} \), where \( p_A \) is the price to Africans, \( p \) is the price in France, \( t \) is transport costs, and \( Q(.) \) is the African supply function. Defining the elasticity of African supply with respect to the price as \( \epsilon(p_A) = Q'(p_A + c) \frac{p_A}{Q(p_A + c)} \), we can rewrite the expression for the price to Africans under extractive institutions as:

\[
p_A = \frac{\epsilon(p_A)}{1 + \epsilon(p_A)} (p - t) \tag{4}
\]

We can thus test whether the prices to Africans were lower than they would have been with competition by running the following regression

\[
p_{A,cit} = \beta (p_{cit} - t_{cit}) + u_{cit} \tag{5}
\]

where \( c \) refers to the commodity, \( i \) to the colony, \( t \) to time, and \( u_{cit} \) is the error term. Under the null hypothesis and no colonial extraction, \( \beta = 1 \).

However, the estimation of \( \beta \) is likely to be inconsistent because transport costs \( t \) might not include all of the costs that the trading companies had to face to export commodities.

\[17\] Notice that as the elasticity of African supply increases the gap between price to Africans and price in France minus transport cost decreases. The colonizer offers higher prices to those colonies/commodities with higher elasticity of supply.\[18\]

In equation (5) the coefficient \( \beta \) is equal to \( \frac{\epsilon(p_A)}{1 + \epsilon(p_A)} \), and thus it might depend on \( p_A \). This is not an issue if we assume a supply function with constant elasticity of supply, such as the one originated from a Cobb-Douglas production function with decreasing return of scale.
from Africa to France (e.g. loading and storage costs, taxes and tariffs, insurances). Suppose that the true regression is \( p_{A,cit} = \beta(p_{ct} - t_{cit} - c_{cit}) + \epsilon_{cit} \), where \( c_{cit} \) represents other omitted costs. Assume \( \text{Cov}(p, \epsilon) = 0, \text{Cov}(t, \epsilon) = 0, \) and \( \text{Cov}(c, \epsilon) = 0 \). Standard results imply that, estimating \( \beta \) by OLS from (5),

\[
\text{plim}_{\beta_{OLS}} = \beta(1 - \frac{\text{Cov}(p,c) - \text{Cov}(t,c)}{\text{Var}(p-t)}).
\]

If \( \text{Cov}(p,c) - \text{Cov}(t,c) > 0 \), then the estimated coefficient is biased against the null hypothesis of no extraction.

Fixed transport costs (loading and unloading, warehousing, insurance, docking fees, etc.), inland transport costs from the interior to the port, and taxes and tariffs in Africa and in France are likely to be omitted costs. Even if it is reasonable to think that the correlation of fixed and inland transport cost with \( t \) is positive (implying a potential bias in favor of the null), the correlation between prices in France and omitted costs could also be positive, leaving the direction of the bias ambiguous.

Suppose, for example, that the price of a commodity in France is equal to the price of that commodity in a big supplier country plus fixed transport costs and shipping costs from there to France. If fixed transport costs in this country are the same or correlated with fixed transport costs in Africa, then \( \text{Cov}(p,c) > 0 \). Moreover, if transport costs depend on some characteristics of commodities (perishability, stowage factors, etc.), inland and fixed transport costs might be positively correlated and consequently also inland transport costs and prices in France would be positively correlated. Finally, the colonizers might tax more heavily commodities with higher values, implying again \( \text{Cov}(p,c) > 0 \).

To reduce the impact of omitted variables, I pursue two strategies. First, I control for observables including proxies for fixed and inland transportation costs. Second, I control for unobservables using fixed effects.

**Controlling for observables**

To control for fixed transport costs, I use the value of fixed transport costs estimated by Maurer and Yu (2008, p.693) for the Panama Canal: 2.12 $ per ton in 1925 (3.12$ minus 1$ of Panama Canal tolls). Considering an exchange rate of 21 francs per $ in 1925 and deflating in 1900 francs, this corresponds to 9.64 1900 francs per ton in 1925. I multiply this value by...
the index in Mohammed and Williamson (2004) with base 1925 to get fixed transport costs for every year. Notice that including this fixed cost measure might mean double-counting fixed costs since they could be already included in my original shipping cost data.

To control for inland transport costs, for each colony I include in the regression the average distance from the interior to the coast. Moreover, since the ratio volume/weight is an important determinant of both fixed (loading and warehousing) and inland transport costs, I also control for each commodity’s stowage factor.

**Controlling for unobservables**

I model unobservable costs as $c_{cit} = k_{ci} + \theta_t$. The first component $k$ captures the differences in costs due to each commodity-colony; the second component $\theta$ captures the variation over time, common to all commodities-colonies. This is a mild assumption: I allow unobservable costs to vary across commodity-colony and time, just assuming a common trend over time in all colonies and commodities. In the empirical specification, I implement this idea by using commodity/colony and time fixed effects. In this way, the relationship between price in France minus transport costs and price in Africa is identified exclusively from the variation within each commodity/colony over time, after taking into account common time shocks affecting all commodities and all colonies.

I estimate the following regression

$$p_{A,cit} = \beta(p_{ct} - t_{cit} - f_{cit}) + (X_{cit}\delta) + k_{ci} + \theta_t + \epsilon_{cit}$$

where $f$ is the proxy for fixed transport costs, $X$ is a vector of control variables including distance from the coast and commodity’s stowage factor (excluded when I include fixed effects), and $k$ and $\theta$ are commodity/colony and time fixed effects, respectively. If there is no extraction, $\beta = 1$ (null hypothesis). If there is extraction, $\beta < 1$.

A last concern regards measurement errors in my estimation of shipping costs described

---

19GIS World Geography Datasets, Portland State University.
in Section IV.1. Classic measurement error in \( t \), in fact, would bias the coefficient \( \beta \) towards zero, in favor of my hypothesis. To check whether this affects the results, I run an alternative specification in which shipping costs are estimated directly from the data. To do so, I exclude \( t \) from the regression and I control for the interaction of distance to France with decade/commodity dummies. I run the following regression

\[
 p_{A,ct} = \alpha + \beta_1(p_{ct} - f_{ct}) + W_{ct} \times D_i \eta + \epsilon_{cit} \tag{7}
\]

where \( W_{ct} \) is a matrix of decade by commodity fixed effects and \( D_i \) is the distance from France. Each element of the vector of coefficients \( \eta \) measures the shipping cost per km for each commodity and decade.

### IV.3 Results

Before presenting the results of the regressions, let me show some preliminary evidence by comparing price gaps between Africa and France to those between US and UK. The idea is that if the Africa-France price gap was larger than the price gap between the United States and Britain, this would suggest that the difference between prices in Africa and in France was not due exclusively to trading costs.

To check this, I collected yearly data on wholesale cotton prices in New York and Liverpool between 1898 and 1938. Table V reports the percentage price gap in the two markets for 5-year periods. The results show that, on average, the percentage price difference between France and the colonies was about 12 times higher than the difference between UK and US.

Given its magnitude, this result is unlikely to be driven by differences in shipping costs. In the period under consideration, overall shipping costs from Africa to France were about 4 times higher than between US and UK. Since prices in Africa were about half of prices in

\[21\] If I interacted the distance with year/commodity dummies, I would have too many fixed effects and it would be difficult to estimate precisely the parameters.

\[22\] My sources are the Historical Statistics of the United States (1975) and the Mitchell’s Abstract of British Historical Statistics (1988).

\[23\] Costs per km are on average 3.4 times higher between Africa and France than between US and UK.
the US, if the price gap was due only to shipping costs, then the Africa-France relative price gap should have been only twice the US-UK price gap. Similarly, the result is not driven by inland transport costs which accounted for a small portion of the total costs.

Table VI presents the results of regression (6). Column (1) reports the simple regression of price in Africa on the difference between price in France and shipping and fixed transport costs: the coefficient is significantly less than 1 and we can reject the null hypothesis that the price to Africans was just equal to the price in France minus trading costs.

In column (2) I control for other omitted costs, by including stowage factors and distance to the coast. Since prices in Africa are measured at the export port after WWII, I only include the distance from the coast for the years before 1945. The main result is unaffected. In column (3) I control for unobservable costs, by using commodity/colony and year fixed effects. Since fixed effects absorb all the variation in stowage factor and distance from the coast, I exclude these control variables from this specification. The coefficient of interest is still significantly less than 1.

The results of Table VI are unlikely to be driven by omitted costs. First, including fixed effects, the $R^2$ does not increase much: omitted costs are not a big determinant of the price in Africa. Second, consider that the price in Africa is on average 55% of the price in France and observable trading costs are about 5%: if the difference was just due to omitted costs, unobservable costs should be 8 times the observable costs. Finally, consider also that the ratio between origin FOB prices and destination CIF prices from the FAO Agricultural Trade Database since 1960 is 89%, much larger than the 55% ratio observed in the French colonies.

In column (4) I run regression (7), where shipping costs are estimated directly from the data. The coefficient of interest is again significantly less than 1. Moreover, since it is smaller than in column (1), this suggests that the bias of the estimates in column (1) is against my

(Maurer and Yu 2008, table 4). Conversion rates are from www.measuringworth.com.) The distance between cotton producing French Africa to France (about 7300 km) is 15% higher that the distance from New York to Liverpool (about 6400 km).

24 According to the estimates of column (2) of table VI, one standard deviation increase in distance from the coast makes the price to Africans decrease by only .03 standard deviations.
hypothesis. My estimates of transport costs are not affected by classic measurement errors and they are likely to overestimate real transport costs.

The evidence shows that prices in Africa were lower than competitive prices. Was the extent of price reduction common to all colonies and crops? To answer this question, I constructed an index measuring how much the price to Africans under monopsony and coercive labor institutions was reduced as a proportion of how much it should have been under competition and free labor

\[
E = \frac{p_A^{competition} - p_A^{extraction}}{p_A^{competition}} = \frac{p - T - p_A}{p - T} = 1 - \frac{p_A}{p - T}
\]  

where \( T \) includes shipping costs, fixed costs, and inland transport costs.\(^{25}\)

On average, prices to Africans were reduced by about 30% because of colonial extraction. Table VII reports the average index for the different commodities in West and Equatorial colonies. The average reduction varied across commodities: the price was reduced by more than 40% for rubber and timber, by 35-40% for cotton and bananas, by 25-30% for cocoa, coffee, and peanuts; and by 20-25% for palm kernel and palm oil. Overall, the effects of colonial extraction were more severe in Equatorial Africa (reduction of 37%) than in West Africa (29%) and the difference was particularly large for palm kernel, coffee, palm oil, and timber.

Figure III shows the proportional reduction of prices to Africans due to colonial extraction over time, for an average commodity/colony. Excluding WWII, over time prices to Africans approach competitive prices. Looking at the figure, we can observe that there was a change around the middle of the colonial period: before 1930, the presence of monopsony reduced prices to Africans by 30-50%; after 1930, instead, prices were reduced by only about 20%.

Overall, the evidence suggests that monopsonies and coercive labor institutions reduced prices to African producers with respect to competitive prices. Moreover, we observe a large

\(^{25}\)Since the trading costs \( T \) tend to be overestimated, the index is sometimes greater than 1 (if \( T > p \)) or less than 0 (if \( T > p - p_A \)). In my analysis, I will therefore exclude all observations whose index is not between 0 and 1.
variation in the extent of price reduction across colonies and across commodities. Can labor institutions explain this variation?

V Result 2: Labor Institutions and Prices to Africans

In this section, I explore the second result of the model. Did coercive labor institutions allow the colonizers to reduce the prices even with respect to monopsony prices?

To test this hypothesis, I collected data about labor institutions in the French colonies of West and Equatorial Africa between 1898 and 1959. Three main kinds of labor institutions were used.

- **Free peasant production**: the colonizer fixed the prices, but the African peasants were free to produce how much they wanted at the given price.

- **Compulsory peasant production**: the colonizer fixed both prices and compulsory quotas of production that had to be met by the African peasants.

- **Concession production**: production was run by the colonizer who used various levels of compulsion to get African labor force.

Historians and ethnographers have gathered information about the institutional arrangements used in the production of different crops in the various colonies, in general works about French colonization or country-specific studies. For example, Coquery-Vidrovitch (1972) wrote about rubber quotas in Congo in 1910s, while Suret-Canale (1971) analyzed free peasant production of peanuts in Senegal. By systematically extracting information from this literature, I was able to associate one of the three labor institutions - free production, compulsory production, or concession production - with each colony, commodity, and year.\(^\text{26}\)

As shown in Section II, most of the variation in institutions was across crops: peanuts and palms were mostly produced by free peasant production; cotton and rubber by compulsory

\(^\text{26}\)See the appendix for the sources.
peasant production; timber, coffee, and bananas were usually produced in European conces-
sions. Equatorial colonies relied heavily on concessions and compulsory production, while in
West Africa free peasant production was more diffused. Over time, we observe a decrease in
the level of compulsion and an increase in the extent of free peasant production.

I start the analysis of the impact of extractive institutions on prices to Africans by treating
institutions as exogenous. I will address the endogeneity issue later in this section. To check
whether coercive labor institutions can explain price gaps, I regress the price to Africans on
institution dummy variables

\[ p_{Acit} = \alpha + \beta_1(\text{COMPULSORY}) + \beta_2(\text{CONCESSION}) + Z_{cit}\gamma + \eta(p - T)_{cit} + \epsilon_{cit} \]  

(9)

where free peasant production is the omitted category, \( Z_{cit} \) is a vector of control variables
(including elasticity of African supply and colony/commodity, and year fixed effects) and
\((p - T)_{cit}\) is the competitive price.

We expect \( \beta_1 < 0 \): the prices should be lower under compulsory peasant production than
under free peasant production. Instead, we expect \( \beta_2 > 0 \): the prices should be higher when
European companies run production than when production is run by African peasants. In
the case of concessions, in fact, since the profit from colonial trade has to be shared between
the trading and the concessionary company, the prices at African ports should be higher.
Notice that this does not necessarily mean that the level of extraction from African workers
is lower under concession production, but just that the export prices of commodities should
be higher with respect to peasant production\(^{27}\)

A potential concern with this approach is that the price elasticity of African supply might
have affected both prices and institutions. The colonizer might have, in fact, given lower
prices to those colonies/commodities that responded less to price incentives (low elasticity of

\^{27} We can write a similar model to that of section II in which: 1) Africans choose the number of workers
\( L \) to maximize \( wL - c(L) \), where \( w \) is the wage and \( c(L) \) convex is the outside option; 2) the concessionary
company chooses \( w \) to maximize \( p_A f(L(w)) - wL \), where \( f(\cdot) \) is the production function; 3) the trading
companies chooses the price \( p_A \) to pay to the concessionary company.
supply). At the same time, the colonizer might have needed to establish coercive institutions to stimulate production where Africans responded less to price incentive. If this was the case, the coefficient $\beta_1$ would be biased in favor of my hypothesis and the negative relationship between compulsory production and prices would be spurious.

To solve this problem, I use two strategies. As a first strategy, I exploit the model FOC to directly compute the elasticity of supply $\epsilon(p_A) = Q'(p_A) \frac{p_A}{Q(p_A)}$ for the different colonies/crops/years. We have data on prices $p_A$ and quantities $Q$, but we have no measure of the derivative of African supply with respect to price $Q'(p_A)$. Nevertheless, the FOC for the Trading Company’s maximization problem implies $p_A = p - t - \frac{Q(p_A)}{Q'(p_A)}$ that we can rewrite as $Q'(p_A) = \frac{Q(p_A)}{p - t - p_A}$. Thus, we can express the elasticity of supply as a function of only known variables as $\epsilon(p_A) = \frac{p_A}{p - t - p_A}$.  

Using this measure, I can check whether the elasticity of supply affects institutions and prices. I first regress the free peasant dummy on the elasticity of supply with a probit model. I omit concession production observations, so that the coefficient measures the effect of elasticity on the probability of using free vs. compulsory peasant production. Column (1) of Table VIII shows the results: the coefficient of elasticity of supply is positive, but the marginal effect is very small.

I then check whether elasticity affects prices, by regressing price to Africans on elasticity and controlling for competitive prices. The results are reported in column (2). The coefficient of elasticity of supply is non-significant. We get similar results if we control for colony/commodity and year fixed effects. Notice that since my expression of elasticity is a positive function of the price to Africans $p_A$, the estimate of the coefficients tends to be biased away from zero: the real impact of elasticity on prices is even smaller.

This provides evidence that African elasticity of supply was not an important determinant of prices or institutions. Thus, the omitted variable problem is not very serious.

As a second strategy, I estimate regression [9] with colony/commodity and year fixed effects. Since transport costs tend to be overestimated, for some observations $p - t - p_A < 0$ and the estimated elasticity is negative. I omit these observations for all the subsequent analyses involving elasticities.

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28 Since transport costs tend to be overestimated, for some observations $p - t - p_A < 0$ and the estimated elasticity is negative. I omit these observations for all the subsequent analyses involving elasticities.
effects: the relationship between institutions and prices is identified by variations within the same commodity and the same colony over time, taking into account common time shocks.\footnote{The crops/colonies that experienced variations over time from compulsory cultivation to free peasant production are: all cotton producing colonies; cocoa in Congo and Gabon; rubber in Cameroon, Congo, Gabon, and Ubangi-Shari. Most changes in institutions happened in the post-WWII period.}

Intuitively, this is a solution if the change in institutions within each colony/crop over time did not depend on changes in the elasticity of supply. Both the results of Table \textbf{VII} and the historical evidence support this view: the transition from compulsory to free production was common to almost all colonies/crops at the end of the colonial period and it was more likely to reflect the political climate before independence (taken into account by year fixed effects) than changes in elasticity of supply.

Table \textbf{IX} reports the estimates of regression \textbf{(9)}. In column (1) I regress price in Africa on institution dummies, competitive price, and fixed effects. The coefficient of compulsory production is negative and significant: within each commodity/colony a change over time from free to compulsory peasant production was associated with a decrease in prices. The coefficient of concession production is positive and significant: the prices at African ports were higher under concession production than under free peasant production. This provides further evidence that institutions are important: the pressure to reduce prices in Africa was lower when production was based on European concessions instead of African peasant production.

In column (2) I control directly for the elasticity of supply. As expected, the coefficient of elasticity is positive, but not significant, and the main result remains unchanged. In column (3) I control for another potential determinant of prices, the size of the market, by including the total quantity produced as a control variable. The effect of larger markets is not significant the coefficients on institutions are not affected.

The use of compulsory production allowed the colonizers to reduce the prices to Africans even with respect to monopsony prices. The effect of institutions on prices is not only statistically significant, but also economically meaningful. Considering that the average
price in Africa for free peasant production is .37 francs per kg, a change in institutions from free to compulsory production implies an average reduction in prices by about 45%.

The evidence shows that the type of institutions put in place by the colonizers affected the price received by African producers. Prices were lower than what they would have been with competition between trading companies and coercive labor institutions allowed the colonizers to reduce prices even further. Using these results, I can now ask how much monopsonies and coercive labor institutions reduced African gains from trade.

VI Result 3: Colonial Extraction and Gains from Trade

In this section, I explore the third claim of the model: colonial extraction reduced African gains from trade. The idea is to measure gains from trade as the surplus of African producers, computed as the difference between price received and cost of production, times quantity produced. Using an insight from the theory, I construct lower bounds for the reduction of gains from trade due to colonial extraction and I disentangle how much of this reduction was due to monopsonies and how much was due to labor institutions.

Figure IV describes the loss of gains from trade under the different institutional arrangements. Subscripts \( C \), \( M \), and \( ME \) denote competition, monopsony, and monopsony with extractive labor institutions, respectively. Taking competition as a benchmark, area 1 is the African loss due to monopsony. The sum of areas 1, 2, 3, 4 is the loss due to monopsony and extractive labor institutions (areas 1 and 2 are the loss due to the reduction in price; areas 3 and 4 are the loss due to receiving a price lower than the marginal cost). The sum of areas 1, 2, 3, and 4 is slightly larger than \((p_C - p_{ME})Q_{ME}\), which can be computed as a lower bound for the absolute loss.

We can also construct a lower bound for the relative loss. Since the supply function is convex and \( Q > 1 \), the African gains from trade under competition is less than \(\frac{1}{2}p_CQ_{ME}\). A
lower bound for the relative loss is then $\frac{(p_C - p_{ME}) Q_{ME}}{2 p C Q_{ME}}$, that is \[ L = 2 (1 - \frac{p_{ME}}{p_C}) \] Notice that this lower bound for the relative loss is equal to twice the price gap index, defined in equation (8), where $p_A = p_{ME}$ and $p - T = p_C$.

Table X presents the results. On average, Africans lost at least 65% of the possible gains from competitive trade due to colonial extraction (including monopsonies and extractive institutions). It is important to remember that exports to Europe accounted for a large part of African income, while imports from Africa accounted for a relatively small proportion of French GDP. Given the volume of trade, colonial extraction implied small gains for Europeans at a cost of big losses for Africans.

Column (1) reports the reduction in gains from trade for the different commodities: the reductions were particularly high for rubber and timber (at least 85% of the gains), at least 70% for cotton and bananas, at least 50% for coffee, peanuts, and cocoa, and at least 40% for palm kernel and oil. Notice that the crops produced under free peasant production, such as peanuts and oil palm produces, suffered the minor losses of gains from trade.

Columns (2A) and (2B) report the lower bounds for the periods before and after 1930. On average, the losses due to extraction were lower in the second part of the colonial period (at least 47% vs. at least 73%). This change involved all commodities, with the exception of bananas and only marginally rubber. Again, this is evidence of the importance of institutions: in the second half of the colonial period coercive labor institutions started to disappear and African prices increased.

Column (3A) and (3B) compare West and Equatorial Africa. For almost all commodities,

---

\[ \text{ ***The underlying assumption to construct this lower bound is that the quantity produced under monopsony and extractive institutions is higher than the quantity produced under competition. If this was not true, then the loss would be lower than areas 1, 2, 3, and 4. The historical evidence, however, is consistent with this assumption: one of the reasons why the colonizers introduced extractive institutions was in fact to increase African production.***} \]

\[ \text{ ***Since price gaps were anomaly higher during WWII, I exclude the years 1939-1945 from the computations in column (2B).***} \]
the Equatorial colonies, characterized by the presence of more coercive labor institutions, lost more from colonial extraction than Western colonies (on average, at least 74% vs. at least 58%).

To disentangle the effects of coercive labor institutions from those of monopsony, notice that area 1 of Figure IV represents the loss of gains from trade due to monopsony, while areas 2, 3, and 4 represent the loss due to coercive labor institutions. Thus, we can construct an upper bound for the absolute loss due to monopsony as \((p_C - p_M)Q_{ME}\). The upper bound for the share of loss due to monopsony is then \(\frac{p_C - p_M}{p_C - p_{ME}}\). By consequence, coercive labor institutions account for at least

\[
1 - \frac{p_C - p_M}{p_C - p_{ME}}
\]

of the total loss due to extraction.

To compute this measure, we need data on \(p_{ME}\), \(p_C\), and \(p_M\). We have direct measures for the price under monopsony and coercive labor institutions \(p_{ME}\) and we can compute the price under competition \(p_C\) as the difference between prices in France and trading costs, but we do not observe the price under simple monopsony \(p_M\) for all observations.

To solve this problem, I use the results from the regression of prices on institutions (Table IX), where the coefficient \(\beta\) of the compulsory production dummy measures the effect of coercive labor institutions on prices (difference between \(p_{ME}\) and \(p_M\)). Using the estimate of \(\beta\), I can compute the price under simple monopsony as \(p_M = p_{ME} + \beta\).

Disentangling the effects of monopsony and coercive labor institutions, I estimate that the upper bound for the share of loss due to monopsony was on average (for all compulsory production observations) 37%. Thus, when coercive labor institutions were used, they accounted for at least 63% of the losses in gains from trade.

VII Conclusions

Extractive colonial institutions are considered one of the main causes of current African underdevelopment (Acemoglu et al., 2001; Nunn, 2007). Yet, since colonial extraction is
hard to quantify and its precise mechanisms are not well understood, we still do not know exactly how successful the colonizers were in extracting wealth from Africans.

In this paper, I investigated this issue by exploiting the peculiar structure of trade and labor employed by the French colonizers. By using a new dataset of prices in Africa and labor institutions, I showed that the colonizers were very successful in extracting income from Africans and that they were able to do so by reducing the prices to producers through a combination of trading monopsonies and coercive labor institutions. Without extractive institutions, colonial trade should have raised income for African populations. However, the lack of competition between trading firms and the presence of coercion of labor forced Africans to accept prices lower than their marginal cost of production, thus reducing their welfare. My estimates show that colonial extractive institutions reduced African gains from trade by at least 60%.

Having clarified the mechanisms and the extent of extraction during the colonial period, the next step is to understand the details of the impact of colonial extractive institutions on current economic development. The level of extraction, in fact, varied greatly across colonies and across crops and this variation can help explaining the different paths of growth in African countries and regions. Moreover, there are reasons to believe that the extractive character of colonial institutions persisted after independence. Preliminary results in appendix A.2 show that the price gap between prices in Africa and in France is still large in the post-independence period. Coercive labor institutions were abolished by independence, but trading monopsonies persisted and post-independence governments kept practicing price policies that discriminated against agricultural producers (Bates and Block, 2009). Our clearer understanding of extraction during colonialism calls now for future research aimed at examining how institutions established in colonial times still affect current agricultural trade policies and economic development.
A.1 Prices in France and World Market Prices

One of the assumptions of the model is that prices in France are exogenous and follow world market prices. In this section, I provide evidence in favor of this assumption by comparing prices in France to prices in Great Britain.

To do so, I use British commodity prices collected by Jacks et al. (2011) from various yearly statistical publications, such as Sauerbeck’s Prices of Commodities and The Statist’s Wholesale Prices of Commodities.\footnote{http://www.sfu.ca/ djacks/data/publications.} Since the prices are reported in different units (shillings per hundredweight, pence per pound, shillings per timber load), I convert all in pounds per kg.\footnote{The conversion rates used are: 20 shillings per 1 sterling; 50 kg per hundredweight; 1 timber load=50 cubic feet= 1.4 cubic meters=1.12 tons.} Then, I use the exchange rates dollar-sterling and dollar-franc reported by Officer (2013) to convert all prices in francs per kg.

The commodities for which I have both prices in France and in Great Britain are: coffee, cotton, palm oil, and timber.\footnote{British coffee is Brazilian from Rio; cotton is American-middling.} Because exchange rates are available only since 1913 and the WWII and post-war periods are characterized by strong appreciation and then depreciation of the franc, I focus my analysis on the period 1913-1940.

Figure VI compares British and French prices between 1913 and 1940 for the four commodities. For all of them, British and French prices follow the same trend: the data for French prices are closely tied to world market prices.

A.2 Post-Independence Prices

In this section, I explore preliminary data on prices in Africa and in France after independence. I collected the data from the FAO Trade Statistics Database (2013), reporting yearly CIF and FOB prices by country and commodity since 1961.

Figure VII reports the joint evolution of prices for four commodities: cocoa, coffee, cotton,
and peanuts. The price in Africa is the average of prices of all ex-colonies producing that commodity. The price in France is the CIF import price. All prices are in dollars per kg. The gap between prices in Africa and in France is small right after independence, but, with the exception of cotton, gets larger since the 1970s.

Figure VIII shows the price in Africa as a percentage of the price in France for cotton, between 1900 and 2010. I choose cotton because it is one of the commodities for which colonial institutions were more extractive. The general trend is increasing and the ratio of prices is higher after independence. Interestingly, prices in Africa catch up with prices in France already after WWII.

A.3 Data Sources

This section describes in detail the sources of the data on prices, quantities, and institutions.

Prices in Africa and Quantities. Prices are in 1900 French francs per kg. I obtain them by diving the total value by the total quantity of exports. Quantities are in tons. Cocoa and coffee are in grains; peanuts can be shelled or unshelled; cotton is ginned. Timber quantities are sometimes reported in cubic meters or steres and I convert them into tons by using the average specific weight of timber (0.8 tons per cubic meter).

Values in Africa are either in French francs or in francs CFA (Franc des Colonies françaises d’Afrique). The conversion rate is 1 franc CFA=1 FF before 1946, =1.7 FF between 1946 and 1948, =2 FF after 1949. Exchange rates between francs, pounds, and dollars come from Officer (2013). To deflate prices in 1900 FF, I use data from France-Inflation.com, reporting inflation rates since 1901. For 1898-1900, I assume the same inflation as in 1901.

The sources are: Statistiques coloniales. Commerce volumes from 1898 to 1906; Statistiques du commerce des colonies françaises, volumes from 1907 to 1914 (excluding 1908); Renseignements généraux sur le commerce des colonies françaises et la navigation volumes from 1920 to 1928; Bulletin Economique de l’Afrique Equatoriale française, volumes from

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35The price in Africa is the average price of all cotton producing colonies, excluding five years for which the price in Africa was higher than the price in France.


**Prices in France.** In 1900 French francs per kg. I obtain them by dividing the total value by the total quantity of imports to France from the colonies. The sources are *Statistiques du commerce extérieur de la France*, volumes from 1902 to 1959.

**Labor Institutions.** The main sources are: Berg (1965), Coquery-Vidrovitch (1972), Cordell and Gregory (1982), DeDampierre (1960), Duignan and Gahan (1975), Fall (1993), Gray and Ngolet (1999), Hopkins (1973), Suret-Canale (1971), Thompson and Adloff (1957), and the *Cambridge History of Africa* (1986). An appendix with the specific sources for each colony/crop is available from the author.

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36Details about the sources used for each specific colony, commodity, and year are available upon request.
REFERENCES


## Tables and Figures

### B.1 Tables

#### Table I
Share of Exports, by Institutions

<table>
<thead>
<tr>
<th></th>
<th>(1) All French Africa</th>
<th>(2a) French West Africa</th>
<th>(2b) French Equatorial Africa</th>
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<tbody>
<tr>
<td>free peasant production</td>
<td>0.57</td>
<td>0.70</td>
<td>0.26</td>
</tr>
<tr>
<td>compulsory production</td>
<td>0.10</td>
<td>0.02</td>
<td>0.29</td>
</tr>
<tr>
<td>concession production</td>
<td>0.33</td>
<td>0.28</td>
<td>0.45</td>
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</table>

The table shows the share of the total value of exports produced under each of the main labor institutions.

#### Table II
Variance of Institutions

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<th></th>
<th>% variance explained</th>
<th>F-stat</th>
<th>p-value</th>
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<td>crop fixed effects</td>
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<td>204.4</td>
<td>0.00</td>
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<td>colony fixed effects</td>
<td>0.07</td>
<td>15.4</td>
<td>0.00</td>
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<td>year fixed effects</td>
<td>0.02</td>
<td>1.2</td>
<td>0.16</td>
</tr>
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</table>

ANOVA of institutions, N=1717.

#### Table III
Components of Prices: Cocoa, 1958-59

<table>
<thead>
<tr>
<th></th>
<th>Togo</th>
<th>Congo</th>
<th>Ivory Coast</th>
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</thead>
<tbody>
<tr>
<td>price to producers</td>
<td>100</td>
<td>82</td>
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<td>transport to port</td>
<td>4</td>
<td>12</td>
<td>5</td>
</tr>
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<td>taxes, insurances, stockage</td>
<td>32</td>
<td>30</td>
<td>31</td>
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<td>price at African port</td>
<td>136</td>
<td>124</td>
<td>126</td>
</tr>
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</table>

Source: elaboration from *Documents et statistiques - Ministre de la France d’Outre-mer, Service de statistique*, 1958-59. Prices are in current francs per kg.
### Table IV
Summary Statistics

<table>
<thead>
<tr>
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<th>mean</th>
<th>st.dev.</th>
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<th>max</th>
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</tr>
</thead>
<tbody>
<tr>
<td>price in Africa</td>
<td>.71</td>
<td>1.18</td>
<td>.01</td>
<td>17.9</td>
<td>1714</td>
</tr>
<tr>
<td>transport cost</td>
<td>.04</td>
<td>.02</td>
<td>.02</td>
<td>0.06</td>
<td>1717</td>
</tr>
<tr>
<td>price in France</td>
<td>1.28</td>
<td>2.34</td>
<td>.06</td>
<td>19.63</td>
<td>1469</td>
</tr>
</tbody>
</table>

In 1900 French francs.

### Table V
Cotton Price Gap between UK and US vs. France and French Africa

<table>
<thead>
<tr>
<th></th>
<th>price UK- price US</th>
<th>price France- price Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>price US</td>
<td>price Africa</td>
</tr>
<tr>
<td>1898-1902</td>
<td>.12</td>
<td>.</td>
</tr>
<tr>
<td>1903-1907</td>
<td>.10</td>
<td>6.27</td>
</tr>
<tr>
<td>1908-1912</td>
<td>.09</td>
<td>1.62</td>
</tr>
<tr>
<td>1913-1917</td>
<td>.19</td>
<td>2.25</td>
</tr>
<tr>
<td>1918-1922</td>
<td>.12</td>
<td>.77</td>
</tr>
<tr>
<td>1923-1927</td>
<td>.06</td>
<td>1.40</td>
</tr>
<tr>
<td>1928-1932</td>
<td>.17</td>
<td>.32</td>
</tr>
<tr>
<td>1933-1938</td>
<td>.15</td>
<td>.54</td>
</tr>
</tbody>
</table>

Sources: see text.

### Table VI
Price in Africa vs. Price in France Net of Trading Costs

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>price in France net of shipping and fixed costs</td>
<td>.47***</td>
<td>.46***</td>
<td>.41***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.03)</td>
<td>(.03)</td>
<td>(.05)</td>
<td></td>
</tr>
<tr>
<td>price in France net of fixed costs</td>
<td>.29***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>stowage factor (m3/ton)</td>
<td>-.10**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>distance from coast*(year&lt;1945), 000s km</td>
<td>-.12*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>year FE</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>commodity * colony FE</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>distance<em>decade</em>commodity</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>R2</td>
<td>.77</td>
<td>.77</td>
<td>.83</td>
<td>.82</td>
</tr>
<tr>
<td>N</td>
<td>1466</td>
<td>1466</td>
<td>1466</td>
<td>1466</td>
</tr>
</tbody>
</table>

Results from regression (6). Standard errors clustered at the colony/commodity level are reported in parenthesis. *** p<10%, **p<5%, *p<10%.
### Table VII
Reduction of African Prices, as Percentage of Competitive Prices

<table>
<thead>
<tr>
<th></th>
<th>West Africa</th>
<th>Equatorial Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average commodity</td>
<td>.29</td>
<td>.37</td>
</tr>
<tr>
<td>Bananas</td>
<td>.36</td>
<td>.37</td>
</tr>
<tr>
<td>Cocoa</td>
<td>.27</td>
<td>.32</td>
</tr>
<tr>
<td>Coffee</td>
<td>.21</td>
<td>.30</td>
</tr>
<tr>
<td>Cotton</td>
<td>.37</td>
<td>.35</td>
</tr>
<tr>
<td>Palm kernel</td>
<td>.15</td>
<td>.30</td>
</tr>
<tr>
<td>Palm oil</td>
<td>.20</td>
<td>.28</td>
</tr>
<tr>
<td>Peanut</td>
<td>.21</td>
<td>.41</td>
</tr>
<tr>
<td>Rubber</td>
<td>.46</td>
<td>.46</td>
</tr>
<tr>
<td>Timber</td>
<td>.38</td>
<td>.46</td>
</tr>
</tbody>
</table>

The table shows the average of price reduction indexes defined in equation (8), by commodity and region.

### Table VIII
Effects of Elasticity of Supply on Institutions and Prices

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>free peasant production</th>
<th>price to Africans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elasticity of supply</td>
<td>.041**</td>
<td>.042</td>
</tr>
<tr>
<td>Competition price</td>
<td>(.020)</td>
<td>(.030)</td>
</tr>
</tbody>
</table>

R2: _. .80

N: 640 1158

Column (1) reports the result of a probit model regressing a free peasant production dummy on elasticity of supply. Column (2) reports a linear regression of prices to Africans on elasticity of supply. Standard errors clustered at the colony/commodity level are reported in parenthesis. **p<10%, ***p<5%, *p<10%.
### Table IX
Labor Institutions and Prices in Africa

<table>
<thead>
<tr>
<th></th>
<th>Dependent variable is price in Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>compulsory production</td>
<td>-.17***</td>
</tr>
<tr>
<td></td>
<td>(.06)</td>
</tr>
<tr>
<td>concession production</td>
<td>.38*</td>
</tr>
<tr>
<td></td>
<td>(.21)</td>
</tr>
<tr>
<td>competitive price</td>
<td>.42***</td>
</tr>
<tr>
<td></td>
<td>(.05)</td>
</tr>
<tr>
<td>elasticity of supply</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>(.001)</td>
</tr>
<tr>
<td>quantity (10,000s tons)</td>
<td></td>
</tr>
<tr>
<td>commodity*production territory FE</td>
<td>Yes</td>
</tr>
<tr>
<td>year FE</td>
<td>Yes</td>
</tr>
<tr>
<td>R2</td>
<td>0.85</td>
</tr>
<tr>
<td>N</td>
<td>1158</td>
</tr>
</tbody>
</table>

The omitted category is free peasant production. Standard errors clustered at the colony/commodity level are reported in parenthesis. *** p<10%, ** p<5%, * p<10%.

### Table X
Lower Bounds for Percentage Reduction of Gains From Trade

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2A)</th>
<th>(2B)</th>
<th>(3A)</th>
<th>(3B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>average commodity</td>
<td>.65</td>
<td>.73</td>
<td>.47</td>
<td>.58</td>
<td>.74</td>
</tr>
<tr>
<td>palm kernel</td>
<td>.39</td>
<td>.48</td>
<td>.27</td>
<td>.30</td>
<td>.60</td>
</tr>
<tr>
<td>palm oil</td>
<td>.46</td>
<td>.48</td>
<td>.38</td>
<td>.40</td>
<td>.56</td>
</tr>
<tr>
<td>coffee</td>
<td>.52</td>
<td>.76</td>
<td>.32</td>
<td>.42</td>
<td>.60</td>
</tr>
<tr>
<td>peanut</td>
<td>.55</td>
<td>.62</td>
<td>.39</td>
<td>.42</td>
<td>.82</td>
</tr>
<tr>
<td>cocoa</td>
<td>.60</td>
<td>.62</td>
<td>.44</td>
<td>.54</td>
<td>.64</td>
</tr>
<tr>
<td>bananas</td>
<td>.72</td>
<td>.63</td>
<td>.75</td>
<td>.72</td>
<td>.74</td>
</tr>
<tr>
<td>cotton</td>
<td>.73</td>
<td>.93</td>
<td>.46</td>
<td>.74</td>
<td>.70</td>
</tr>
<tr>
<td>timber</td>
<td>.86</td>
<td>.73</td>
<td>.63</td>
<td>.76</td>
<td>.92</td>
</tr>
<tr>
<td>rubber</td>
<td>.92</td>
<td>.92</td>
<td>.90</td>
<td>.92</td>
<td>.92</td>
</tr>
</tbody>
</table>

The table reports lower bounds for the relative losses of gains from trade due to colonial extraction. Lower bounds are estimated according to equation (10).
B.2 Figures

Figure I
French West and Equatorial Africa

Togo and Cameroon were not part of AOF and AEF, but they were traditionally included in West and Equatorial French Africa, respectively.
The total value of exports is in million of 1900 French francs, evaluated using prices in France net of trading costs. It includes all the main commodities (bananas, cocoa, coffee, cotton, peanuts, oil palm produces, rubber, and timber) and all colonies. Values are computed as 10-years averages to reduce the impact of outliers and to have at least one observation for each colony/commodity/decade. Missing data are interpolated.
Figure III
Reduction of African Prices, as Percentage of Competitive Prices

The figure shows the evolution of the average of price reduction indexes defined in equation (8), over all colonies and commodities, by year.
Figure IV
African Gains from Trade

$C$ subscript refers to competition, $M$ to monopsony, and $ME$ to monopsony and extractive labor institutions.
### Table XI

Shares of World Production, 1961

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Main Producer</th>
<th>Share Main Producer</th>
<th>Share French Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>Chad</td>
<td>0.2%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Rubber</td>
<td>Cameroon</td>
<td>0.4%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Palm oil</td>
<td>Cameroon</td>
<td>0.5%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Bananas</td>
<td>Cameroon</td>
<td>0.7%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Coffee</td>
<td>Ivory Coast</td>
<td>4.1%</td>
<td>5.9%</td>
</tr>
<tr>
<td>Palm kernels</td>
<td>Cameroon</td>
<td>5.0%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Cocoa</td>
<td>Ivory Coast</td>
<td>7.2%</td>
<td>14.9%</td>
</tr>
<tr>
<td>Peanuts</td>
<td>Senegal</td>
<td>7.2%</td>
<td>12.7%</td>
</tr>
</tbody>
</table>

The table shows the share for the main producing country in ex-French Africa and for the entire ex-French Africa as a proportion of the total world production for the different commodities in 1961. Source: elaboration from [FAO (2013)](http://www.fao.org). During the colonial period, these shares are even lower: in the late 1940s, coffee from Ivory Coast and peanuts from Senegal account for only 2% of world production, cocoa from Ivory Coast and palm kernels from Cameroon account for 4%.
MINISTÈRE DES COLONIES

STATISTIQUES DU COMMERCE
DES COLONIES FRANÇAISES
pour l'année 1906.

PUBLIÉES SOUS L'ADMINISTRATION
de M. BILLIES-ENROUX,
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Tome 1er
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FIGURE V
Example of Colonial Publication
**Figure VI**
Prices in France and UK

**Figure VII**
Post-Independence Prices
Prices are in dollars per kg.
FIGURE VIII
Price in Africa as Percentage of Price in France, Cotton