

# **The Long-Term Effects of Extractive Trade Policies: Evidence from Colonial French Africa**

Federico Tadei\*

*Economic History of Developing Regions (forthcoming)*

Despite having convincingly linked colonial *extractive institutions* to African *current poverty*, the literature remains unclear about which exact institutions are to blame. To address this research question, in this paper I identify trade policies as one of the main components of colonial extraction by showing their long-term effects on African economic growth. By using the gap between prices paid to African producers in the French colonies and competitive prices as a measure of rent extraction via trade monopsonies, I find a negative correlation between such price gaps and current development. This correlation is not driven by differences in geographic characteristics or national institutions. Moreover, it cannot be explained by the selection of initially poorer places into higher colonial extraction. The evidence suggests that trade monopsonies affected subsequent growth by reducing development in rural areas and that these effects persisted long time after independence.

*JEL Classification:* O43; N17

*Keywords:* Africa, Development, Institutions, Colonization, Trade

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\*Department of Economic History, Institutions and Policy, and World Economy, and BEAT - Barcelona Economics Analysis Team, University of Barcelona, Avenida Diagonal 690, 08012 Barcelona, Spain. Email: federico.tadei@ub.edu.

## 1. Introduction

Colonial *extractive institutions* are often considered one of the main causes of African *current poverty* (Acemoglu *et al.*, 2001; Nunn, 2007). These institutions, favoring non-democratic forms of governments and encouraging rent-seeking behaviors, reduced African incentives to accumulate physical and human capital and, persisting over time, hindered subsequent economic growth. A major limitation of the existing literature on this topic is that, since colonial extraction is a concept that is particularly hard to quantify, few studies have directly identified which specific colonial institutions we should blame for current African poverty. In addition, we have a limited understanding of why post-colonial governments tended to maintain institutions similar to the ones implemented by the colonial powers, despite their adverse impact on economic development.

In a recent work, Tadei (2017) looks at trade policies as one of the main components extraction in French Africa *during colonial times*. Under the French colonizers, trade monopsonies were in fact introduced to reduce prices to African agricultural producers below competitive prices and increase the profit margin of the European trading companies, cutting African gains from trade by a substantial amount. Yet, we do not know the extent to which the reduction in African prices during colonial times can explain African low incomes *today*. How much should we blame colonial trade monopsonies for current poverty?

In this paper, I address this research question by analyzing the long-term impact of colonial trade policies on current African economic development in the ex-French colonies. Following Tadei (2017)'s methodology, I construct district-level estimates of the strength of colonial monopsonies by using the gap between prices that the trading companies paid to African farmers and theoretical competitive prices that should have been paid in a competitive market. I compute district-level price gaps for the main crops and I combine them with GIS data on crop suitability in order to construct average extraction measures at the sub-national level. I show that such price gaps are strongly negatively correlated with current development, as proxied by luminosity data from satellite images (Michalopoulos and Papaioannou, 2013). The relationship is not driven by observable differences in land endowments, geography, disease environment, resources, population density, or access to markets. Moreover, it cannot be explained by differences in national institutions as it is robust to the inclusion of country fixed effects: the reduction of prices to Africans during the colonial period accounts for differences in development both across and within countries. Finally, places that faced higher levels of colonial extraction are characterized

today not only by lower levels of development, but also by slower economic growth, as measured by the change in luminosity over time.

A robust correlation however is insufficient to establish a causal link between colonial trade monopsonies and subsequent development. Despite controlling for a large number of factors, the correlation between price gaps and development might still depend on the fact that the colonizers imposed lower price to initially poorer areas. To address this concern, I use two strategies. First, I perform a placebo test by computing “theoretical” price gaps for urban districts, which pertain to the price gaps that these districts would have faced had they produced any crop. Through this analysis, I show that colonial extraction is not correlated with current development among urban districts. Second, I demonstrate that it was originally the richest areas, not the poorest ones, which faced higher levels of colonial extraction. Both historical evidence and quantitative data show that the colonizers introduced more extractive institutions in the more productive regions where the profit from extraction was higher than the cost of enforcing coercion. Based on this analysis, the negative relationship between price gaps and development is not only statistically significant, but also economically meaningful. For a country with median luminosity, a one-standard deviation increase in the strength of monopsonies (price gaps) will reduce development (luminosity) by about 10%. In addition, given the selection of initially richer areas into colonial extraction, the actual size of the effect is likely to be even larger. The magnitude of these results is puzzling and raises the following question: if these trade policies were so bad for economic development, why did post-colonial governments maintain them? To answer this question, I explore Bates’ (1981) hypothesis that trade monopsonies, despite hindering overall development, were actually beneficial to the urban-industrial sectors of African societies. The results of the present paper suggest indeed that colonies that experienced stronger monopsonies and larger price gaps have now more developed cities and a higher level of inequality between urban and rural areas. The economic benefits that urban-industrial sectors obtained may be the reason why trade monopsonies and extractive institutions persisted for a long time after independence, despite their negative influence on overall development.

After a short review of the relevant literature, the rest of the paper is structured as follows. Section 2 presents the historical background and discusses price gaps and luminosity data. Section 3 shows the results of the empirical analysis, both across and within countries. Section 4 tackles threats to identification and discusses potential mechanisms for the persistence of trade monopsonies. Section 5 provides concluding remarks.

## *Related Literature*

This paper contributes to the debate on the impact on African development of general colonial rule (Acemoglu *et al.*, 2001; Englebert, 2000; Herbst, 2000; Nunn, 2007) and specific colonial policies (e.g. education (Cogneau and Moradi, 2014; Huillery, 2009), transportation infrastructure (Jedwab and Moradi, 2016), missionary activity (Gallego and Woodberry, 2010; Nunn, 2010), borders (Michalopoulos and Papaioannou, 2016), settlement (Huillery, 2011), and trade (Bates, 1981; Rodney, 1972; Yeats, 1990).

Specifically, this paper advances this literature in several ways. First, it contributes filling the gap in the definition of colonial extractive institutions and identifies trade policies as one of the main features of colonial extraction. It emphasizes the importance of using direct data from the colonial period to measure institutions (Frankema and van Waijenburg, 2012), obtaining in such a way information about their extractiveness *de facto*, instead of focusing on institutions *de iure*. Second, it validates the price gap measure of colonial extraction from Tadei (2017) by showing its long-term effect on economic development. In doing so, it connects research emphasizing colonial institutions at the national level (Acemoglu *et al.*, 2001) to research focused on conditions at the local level (Michalopoulos and Papaioannou, 2013; Nunn and Wantchekon, 2011). By exploring the relationship between colonial extraction at the local level and current development, it reiterates the advantages of analyzing colonial institutions at the subnational level, within the same colonial power (Huillery, 2009). Third, it contributes to the debate on the interaction between geography, history, and institutions in shaping economic growth, across the world (Acemoglu *et al.*, 2002; Engerman and Sokoloff, 2002) and within Africa (Gennaioli and Rainer, 2007; Fenske, 2013; Nunn and Puga, 2012).

## **2. Historical Background and Data**

About one third of Sub-Saharan Africa and one fifth of its population was subject to French colonial rule between around 1880 and 1960. Compared to the neighboring British colonies, the French territories were much poorer. For this reason, the colonizers, instead of establishing plantations and other productive investments, for the most part limited themselves to trade with African populations. Trading companies bought agricultural production at low prices from African producers and resold it at higher prices in Europe. However, since population density was low and labor expensive, the “free market” price of crops would have been too high, eliminating any profit

for the trading companies (Coquery-Vidrovitch, 1969; Suret-Canale, 1971). In order to maintain profits, the companies lobbied the colonial government to establish trade monopsonies and specific labor institution (Manning, 1998; Suret-Canale, 1971; Thompson and Adloff, 1957). Trade monopsonies were common in almost all colonies (around World War II, fewer than a dozen companies monopolized all of trade from West Africa - Suret-Canale, 1971), while labor institutions varied across colonies, crops, and over time. They ranged from free labor, as in the case of peanuts production in Senegal, to compulsory cultivations, as in the case of cotton in Ubangi-Shari or rubber in Congo (Coquery-Vidrovitch, 1972; De Dampierre, 1960; Fall, 1993).<sup>1</sup> Their role was to reduce the outside options available to African producers, forcing them to accept the low prices offered by the colonial trading companies. These institutional arrangements proved extremely effective in allowing the colonizers to pay African producers prices much below world market prices, cutting African gains from trade by a substantial amount during the colonial period (Tadei, 2014, 2017).

With the approaching of independence of African colonies, coercive labor institutions were abolished, while at the same time trading monopsonies persisted. Post-colonial governments continued to operate the same monopsonistic institutions (i.e., *caisses de stabilisation* or marketing boards) that the colonial governments had created since 1954. These institutions forced farmers to sell their production for a fixed price through a government agency, which controlled buying and exporting. Their formal objective was to stabilize producer prices against fluctuation of world prices, by offering them lower prices when world prices were high and by subsidizing farmers when world prices were low. Nevertheless, the surplus extracted by marketing boards was rarely used to increase producer prices during years when world prices fell (Bates, 1983). For example, Nabe (1999) noticed how prices to cocoa producers in Togo as share of competitive prices decreased after the establishment of marketing boards, while the surplus of the marketing board itself increased. In fact, marketing boards quickly became a way to extract resources from farmers in order to benefit with low prices urban-industrial sectors and exporters (Barrett and Mutambatsere, 2005; Bates, 1983). There was, in fact, a remarkable continuity between colonial trading companies and post-colonial marketing boards. Often, the trading companies that enjoyed monopsony power during the colonial period were also the same companies that received export licenses from the marketing boards (Van der Laan, 1987).

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<sup>1</sup> Peanut production in Senegal was based on free labor in the XX century. In the XIX, forms of forced labor were also used (Moitt, 1989; Cappelli and Baten, 2017).

Since the 1990s, political pressure from international organizations and the start of structural adjustment programs resulted in the elimination or reduction of the power of marketing boards (e.g. in 1991-1994 in Cameroon and in 1998-2002 in Senegal). The effects of these liberalizations were mixed: on one hand, competition increased in the internal market, but on the other decreased in the exporting markets. In some cases, such as with cocoa in Cameroon and peanuts in Senegal, prices to producers increased. In other cases, rising taxes on agriculture overcompensated the benefits brought about by the absence of marketing boards, such as with cocoa in Ivory Coast (Gilbert, 2009; Lopez and Hathie, 1998). Wherever liberalization reforms were not successfully executed, reestablishing marketing boards reemerged as an option in subsequent years (Barrett and Mutambatsere, 2005).

Overall, there are several reasons why we could expect trade monopsonies to have a negative effect on subsequent economic growth. First, they were an inefficient way to organize production and trade, due to poor management and ineffective supply chains. Abbott (2013) suggests that a key reason for the elimination of marketing boards during the period of structural adjustments was the inefficiency of such institutions, as demonstrated by the fact that they often required substantial loans from governments and international organizations and were characterized by heavy and ineffective bureaucracies (Gilbert, 2009).

Second, the non-competitive system of price setting encouraged rent-seeking behaviors on the part of trading companies, marketing boards, and government officials. Exporting companies, whether private or state-owned, enjoyed monopsonistic rents (Abbott, 2013). Marketing boards, controlling the crucial export sector, obtained substantial power (Gilbert, 2009), which was used by politicians to gain influence, rewarding supporters with jobs (Williams 2009) and using the revenues extracted from farmers to finance infrastructure projects and industrialization in cities (Bates, 1981; Williams, 2009). Such problems were further worsened by the lack of transparency of marketing boards' accounting practices (Gilbert 2009) and had important consequences. It has been argued that cocoa rents increased corruption in Ghana (Frimpong-Ansah, 1991) and played a role in the Ivory Coast conflict (Global Witness, 2007).

Finally, the reduction of prices impoverished African farmers, who constituted the majority of the population, discouraged investments in agriculture, and reduced overall production. (Bates, 1981; Williams 2009). It is worth pointing out that, since post-independence marketing boards were a direct expression of colonial trade monopsonies, the same theoretical reasons why we would expect a negative impact on development of marketing boards can also apply to colonial

monopsonies. Ultimately, whether colonial trade policies negatively affected subsequent growth is an empirical question.

### *Price Gaps*

To test whether a negative correlation exists between colonial trade monopsonies and current development, we need a measure of the extent of monopsonistic power during colonial rule. The approach of this paper is to compare prices to African producers to counterfactual prices that should have been paid with competition among trading companies. The intuition is that without monopsonies the price to producers should have been equal to the world market price net of trading costs. To implement this idea, I use the price gap index from Tadei (2017), defined as

$$G = 1 - p_A / (p - t) \quad (1)$$

where  $p_A$  is the price received by African producers,  $p$  is the price at the French port, and  $t$  are trading costs.

We can interpret price gaps as the share of the competitive price (price in France minus trade costs,  $p - t$ ) that was extracted as profit by the colonial trading companies: the larger the share, the higher the level of coercion employed and the strength of trade monopsonies. The underlying assumption here is that larger differences between competitive prices and actual prices received by farmers are due to colonial extraction. Given that the enforcement of trade monopsonies was often facilitated by the use of coercive labor institutions, which reduced the outside option of African farmers, we can verify this assumption by checking whether we observe larger price gaps in the presence of labor coercion. The available evidence suggests that this is likely to be the case. Farmers producing commodities under regimes of compulsory cultivation (e.g. rubber in French Congo or cotton in Ubangi-Shari and Chad) faced larger price gaps (Tadei, 2014). In general, price differentials tended to be larger in Equatorial Africa than in West Africa, consistently with the higher reliance on extractive institutions in the Equatorial colonies (Coquery-Vidrovitch, 1972). In addition, price gaps declined after World War II, as the rising of independence movements made the use of coercive institutions more politically costly (Tadei, 2017). Moreover, the larger price gaps in the Equatorial colonies are also consistent with the fact that trade monopsonies in French Equatorial Africa were established *de iure* by the colonial government, while in West Africa they



came into being *de facto* as trade concentrated over time in the hands of a few firms (Coquery-Vidrovitch 1972; Manning 1998; Suret-Canale 1971; Thompson 1957).

The original data used to construct the price gap measure were collected by Tadei (2017) from the following sources. Prices at the French port  $p$  come from the *Statistiques Mensuelles du Commerce Extérieur de la France*, an annual statistical publication reporting total value and quantities of imports to France from the colonies. The reason for using French port prices and not world prices is that most of the exports from French Africa went to France (about 80% in 1949; Duignan and Gann 1975). By using French port prices, we are implicitly assuming that in the absence of trade monopsonies, the African colonies would have still traded with France, with the only difference being that they would have received the competitive price (French price minus trade costs) for their goods and not the monopsonistic price.<sup>2</sup> Producer prices  $p_A$  were reconstructed by Tadei (2017) by subtracting inland trade costs (transport, processing, warehousing, port costs, and export taxes) from African port prices. The sources for African port prices are annual colonial customs statistics, available in several reports of the Ministry of Colonies, *Bulletins Economiques*, and *Annuaire Statistiques* of West and Equatorial Africa. Trade costs  $t$  include shipping and insurance costs, together with the inland trade costs mentioned above. Please see Tadei (2017) for further details on the estimation of these costs and their sources.

As African farmers faced different prices in different regions of the same colony (Coquery-Vidrovitch 1972, Suret-Canale 1971), the level of analysis must be sub-national. To do so, I calculated price gaps for every crop and district (second-level administrative divisions of the ex-colonies) and weighted them by crop suitability, in order to construct an average measure for each district. Variation in price gaps data at the district level comes then from two main sources: variations in African producer prices (constructed as differences between port prices and inland trade costs) and variations in the crop-mix of commodities produced across districts.

More specifically, to compute district-level price gaps, I proceeded in the following way. As a first step, to take into account price shocks in specific years (e.g. fluctuation of supply due to climatic conditions), I computed the average of price gaps across all years from 1920 to 1929 for each crop/district. I used data from the 1920s for two reasons. First, it is the decade with the largest price gaps (Tadei, 2017). Trade monopsonies got stronger after World War I and the effect of the Great Depression and the upcoming independence had not yet been felt. Second, data from

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<sup>2</sup> In other words, the counterfactual that we are considering to compute price gaps is not absence of colonization (or colonization under a different colonial power), but simply colonization without monopsonies.

the 1920s are rich enough to construct price gaps for most of the French colonies in the sample. Price differentials were thus calculated for four main agricultural commodities, accounting for about two third of the total value of exports from French Africa: cocoa, cotton, palm kernels, and peanuts. These commodities were mostly produced by African farmers unlike, for example, coffee or bananas that were more often produced within European plantations (Frankema and van Waijenburg, 2012 p. 915; Suret-Canale, 1971 p. 219-235). For this reason, African prices of such commodities do not include the profit of the European planter and are a better measure of the income of African producers.

Next, to construct a price gap index that is specific for each district I weighted price gaps at the district/crop level by crop suitability (potential productivity per hectare). The reason for this weighting scheme is that I wanted to measure the price reduction that an average producer in each district faced, assuming that larger shares of the labor force were allocated to the production of commodities for which each district had a comparative advantage. To measure suitability, I used agro-climatic attainable yields, with low level of inputs and rain-fed agriculture. Attainable yields are calculated by the FAO's Global Agro-Ecological Zones project and are based on crop-specific requirements of temperature, radiation, and moisture and the prevailing climate the period 1961-1990. In addition to attainable yields, FAO's database also provides information on total production capacity, which is obtained by combining agro-climatic attainable yield with other climate-related constraints (e.g. pests, diseases, and workability), slope of the terrain, and crop-specific soil fertility. Yet, given that in African countries the conditions of the land endowment changed dramatically over time (Austin, 2008 and 2015), using total production capacity, which is based on current soil fertility, would not be a good proxy for crop suitability during colonial times. Agro-climatic attainable yields are instead less likely to change and are a better measure of the comparative advantage that each district had for specific crops.

### *Luminosity*

As a proxy for current local economic development, I used luminosity data from satellite images of the world at night in 2015. The use of luminosity as measure of development in Africa builds upon the work of Michalopoulos and Papaioannou (2013). Given the high correlation with wealth, electrification, and schooling, their study showed that light density at night is particularly useful as a proxy for economic activity in areas where no other local-level measures are widely available, such in the case of Sub-Saharan Africa. Data used in the present study comes from the Earth

Observation Group of the NOAA National Geophysical Data Center (2017), a dataset that reports the intensity of light radiation at a 15 arc-sec resolution (about 0.5 square km) for the entire globe. Each pixel is assigned a value representing luminosity from cloud-free visible and stable lights from cities and other human settlements. Luminosity data are cleaned up not to include temporal lights and background noise (stray light, lightning, lunar illumination, and cloud-cover). To measure development at the district level, I averaged pixel-level luminosity at the desired level of aggregation by using GIS. In most specifications, I focus on luminosity per capita by controlling for population density.

### 3. Colonial Price Gaps and Current Development

**Figures 1 and 2** present preliminary evidence on the relationship between price gaps and luminosity. **Figure 1** represents French Sub-Saharan Africa. The colored area is the focus of the analysis, including all districts for which it was possible to construct price gaps. As my measure of colonial extraction concerns rural areas, I excluded non-rural districts, defined as districts with luminosity above the 10<sup>th</sup> percentile.

[Figure 1]

**Figure 2** compares price gaps and luminosity among districts. It is easy to notice a negative correlation between the two variables: districts with price gaps *below* the median tend to have *above* median luminosity, and vice-versa. In particular, areas below the median price gap of 50% have mean luminosity more than three times higher than in other areas.

[Figure 2]

**Figure 3** shows the scatterplot of the relationship between (log) luminosity and (log) price gaps. I used logs to reduce the impact of extreme observations and to have a more direct interpretation of regression coefficients as elasticities. The presence of a negative correlation is clear.

[Figure 3]

Moreover, as shown in **Figure 4**, this relationship is not driven by differences in population densities, since it holds also if we use (log) light per capita instead that (log) light density as a measure of economic development.

[Figure 4]

To formally analyze the correlation between lights and price gaps, I ran the following regression

$$\log(L_i) = a + b \log(G_i) + c X_i + u_i \quad (2)$$

where  $\log(L_i)$  is the natural logarithm of the average luminosity of pixels in district  $i$ ,  $\log(G_i)$  is the natural log of price gap,  $X_i$  is a vector of control variables,  $a$  is a constant, and  $u_i$  is the error term. In all specifications, I controlled for (log) population density instead of using light per capita as dependent variable to allow for a non-unitary elasticity of luminosity with respect to population. Additional control variables include a variety of geographic, economic, and ecological factors, such as the percentage of land covered by desert or water, land suitability for agriculture, elevation, malaria, land area, distance to the closest port, to the capital city, and to the national border, and presence of oil or diamonds. These are the same control variables used by Michalopoulos and Papaionnaou (2013) in their analysis of the impact of precolonial centralization on current development, as proxied by luminosity.

It is important to include these control variables for several reasons. The percentage of land covered by desert and water is useful to control for the blooming of satellite light images due to deserts and water bodies. In addition, the presence of deserts or water is likely to affect the establishment of productive agricultural activities. Including land suitability for agriculture allows us to further control for the presence of unproductive land and for potential rural economic development. Elevation is important as Nunn and Puga (2012) showed that ruggedness of the terrain is negatively related to slave exports and Michalopoulos (2012) demonstrated that variability in elevation is positively correlated with ethnic fractionalization. The inclusion of the malaria index is warranted by several studies showing the impact of malaria and disease environment on development (Gallup and Sachs, 2001). The distance to the port is included to take into account variations in the access to world markets, while adding the distance from the capital and the national border allow us to control for the lower level of development in peripheral areas (Michalopoulos and Papaioannou, 2013). Finally, it is important to control for oil and

diamonds both for their positive impact of income and negative impact on the quality of institutions (Sala-i-Martin and Subramanian, 2013). Please see the Data Appendix for detailed definitions and sources for all these variables.

**Table 1** reports the OLS cross-sectional estimates. Since the original price data are at the colony level, I clustered standard errors at the country level.<sup>3</sup> The simple regression of (log) light on (log) price gap is shown in column (1). The coefficient is negative and statistically significant. The result is unaffected when I controlled for (log) population density in column (2). Price gaps are negatively correlated with both light density and luminosity per capita. In column (3) I controlled for geographic characteristics (including land area, percentage of land covered by water and desert, elevation, malaria suitability index, and presence of oil and diamonds) and location (distance from country border, closest colonial port, and capital city). Despite this rich set of controls, the coefficient of price gaps, even if decreases in absolute value, remains negative and highly significant. In column (4) and (5), I controlled for precolonial state centralization, without and with the full set of geography and location control variables. These specifications are due to Michalopoulos and Papaioannou (2013), who showed that the political centralization of ethnic groups in the precolonial period is positively correlated to current luminosity. Since data on precolonial institutions are not available for all districts, the sample size is smaller. However, the coefficient of price gaps is virtually unaffected. Interestingly, the coefficient of precolonial centralization (non-reported) is not statistically significant. This complements the finding in Michalopoulos and Papaioannou (2013) and could be explained by the “direct rule” style of the French, which reduced the importance of precolonial institutions. In column (6), I added an Equatorial Africa dummy to make sure that the relationship between price gaps and luminosity is not driven by unobservable differences between the two main regions in which colonies were divided: West and Equatorial Africa. The results are unaffected. Finally, in column (7) I controlled for present-day national institutions by including six variables from the Worldwide Governance Indicators (World Bank, 2017) measuring voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. The coefficient of price gaps is still negative and significant, but it drops slightly in magnitude, suggesting that at least part of the impact of trade monopsonies on development acted through a negative effect on the quality of institutions. Across all specifications, the relationship between price gaps and development is not

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<sup>3</sup> Price gaps at the district level are calculated from data on port prices, inland trade costs, and soil suitability. Since port prices are measured at the colony level, a shock in prices would affect all districts in the same colony, making the errors for districts in the same colony correlated.

only statistically significant, but also economically meaningful: a 1% increase in price gap is associated with an over 2% decline in luminosity. To get a better idea of the intensity of the relationship, consider that, for a median district, a one-standard deviation increase in (log) price gap is associated with a decrease in (log) luminosity of about 10%.

[Table 1]

To make sure that this relationship is not driven by differences in other countrywide characteristics, **Table 2** reports the results including country fixed effects. In this case, the coefficient of price gap estimates the relationship between colonial price gaps and luminosity across districts, within each country. Columns (1) to (3) correspond to the same specifications of **Table 1**, adding country fixed effects: column (1) reports the simple regression without controls, column (2) controls for population density, and column (3) includes geographic characteristics and location controls. Controlling for distance to border, capital and closest port is particularly important to take into account inland trade costs in fixed effect regressions. The variation in price gaps across districts in the same colony depends in fact on differences in port prices across commodities, in the commodities produced by each district, and in inland trade costs (producer prices are estimated as the difference between port prices and trade costs from port to producer). Without controlling for distance, we could not be sure whether differences in price gaps reflect variations in colonial extraction or simply differences in inland trade costs and infrastructure. In all specifications, the coefficient of price gaps remains negative and significant, and similar in magnitude to the specifications without country fixed effects. In column (4), I included precolonial state centralization and the coefficient of price gaps is still negative and significant. Price gaps explain the variation in luminosity not only across countries, but also among the districts within the same country.<sup>4</sup>

[Table 2]

In **Table 3**, I show that these results are not due to the specific way in which I controlled for population density or to sampling choices. The basic specification is the regression of (log) light

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<sup>4</sup> I cannot estimate specifications (6) and (7) of table 1 with country fixed effects, as they include country-invariant variables.

on (log) price gap including population density, geography, and location controls. For each regression, I reported first the cross-sectional estimates and then the fixed effects results (*b* rows) In rows (1) and (1b) I excluded population density and included instead a non-linear function of (log) total population kinked at 50,000 people. This specification is due to Cogneau and Dupraz (2014), who showed that there is a non-linear relationship between population density and luminosity, flat at low levels of population and positive at higher levels. In rows (2) and (2b), I checked the sensitivity of results to the presence of sparsely populated areas, by excluding districts with less than 50,000 inhabitants. In rows (3) and (3b), I weighted each district by its population. The idea is to measure the effect of price gaps on the majority of African population and not on the average inhabitant of sparsely populated regions (Cogneau and Dupraz, 2014). In rows (4) and (4b), I included districts above the 10<sup>th</sup> percentile of luminosity. The main results are confirmed across all specifications: the relationship between price gaps and luminosity is always negative and statistically significant.

[Table 3]

#### 4. Causality and Persistence

The evidence provided in the previous section suggests the presence of a robust negative correlation between colonial price gaps and current luminosity, which cannot be explained by differences in population, geographical characteristics, natural resources, or national institutions. Nevertheless, despite the large set of control variables employed, we might still be concerned that other unobservable factors could drive the relationship between price gaps and development. For example, the colonizers might have reduced prices to Africans to a larger extent in districts that were already poor in the colonial period. This might be the case if poorer districts responded less to price incentives, making coercion an attractive option to increase production. If these districts continued to be the poorest today, then the observed correlation would be spurious.

To partially control for these unobservable factors, I conditioned on lagged value of luminosity. Although it would be ideal to measure luminosity during colonial times, unfortunately, such information is not obtainable. The first year for which luminosity data is available is 1992. However, recognizing the limitations of such analysis, we can still check the results by including (log) light in 1992 as a control variable. **Table 4** shows the results. Column (1) reports the simple regression, column (2) controls for population density, and column (3) includes geography and

location controls. Columns (4) to (6) report the same specifications, also adding country fixed effects. Across all specifications, the coefficient of price gaps is negative and significant: colonial price reduction not only explains present-day differences in the level of development, but also differences in economic growth, both across and within countries.

[Table 4]

Nevertheless, we might still worry that districts which were on a lower trajectory of economic growth during colonial times experienced higher levels of colonial extraction. If the same trajectory persisted between 1992 and 2012, the relationship between price gaps and current luminosity would not be causal. To address this, I showed that it was the areas on a higher, and not lower, trajectory of economic growth that faced higher levels of colonial extraction. To better explain why this is may be the case, it is important to consider the colonizer's incentives to reduce prices to Africans. Since enforcing trade monopsonies and coercive labor institutions is costly, the colonizer would have likely only implemented them if the benefits of doing so were large enough. In those colonies that were more suitable for export crops, the incentives to reduce prices would thus have been higher. **Figure 5** provides evidence in favor of this hypothesis by analyzing the relationship between price gaps and agricultural export potential per capita, before the full establishment of colonial institutions. Export potential was constructed by taking total land productivity (sum of productivity per acre for the four crops – cocoa, cotton, peanuts, and oil palm - times land area) divided by total population in 1850. District population in 1850 was estimated by applying each district's share of the total country population in 2000 to the total colony population in 1850 (data from Frankema and Jerven, 2014). The correlation between export potential and price gaps is positive: if a district was particularly suitable for agricultural exports, then it faced a larger relative reduction in producer prices. Given the importance of export agriculture for African development, the figure demonstrates that it was the (potentially) richest and not the poorest regions that selected into colonial extraction.

[Figure 5]

It is worth emphasizing that this type of selection is not unique to colonial trade and labor policies. Nunn (2008) previously showed that it was the richer and more densely populated areas that selected into the slave trade, while Huillery (2011) provided evidence that European settlers



established themselves in the initially more prosperous areas of West Africa. Additional regression results confirm this view. We can take (log) population density in 1850 as a proxy for early economic development and directly include it as a control variable in the main specification (column 3 of table 1). Even doing so, the coefficient of price gaps is still negative and statistically significant (coeff.= -1.91\*\*, st.err=0.75, R<sup>2</sup>=0.48, N=425). The negative association between trade monopsonies and current development (luminosity) is not driven by a greater use of monopsonistic policies in the originally poorest regions. As expected, the coefficient of current population density is positive (more densely populated areas have more lights), while the one of population density in 1850 is negative, suggesting again that regions that were richer in the past tend to be poorer today.

A placebo test further demonstrates that the relationship between price gaps and development is indeed causal. To carry out this sub-analysis, I examined the correlation between “theoretical” price gaps and luminosity in urban districts. Price gaps in urban districts can be interpreted as the gaps that these areas would have faced if they had produced any crop. We can compute them by estimating producer prices in urban districts as the difference between African port prices and inland transport costs. If the association between price gaps and development is causal, we should observe no relationship among urban districts since they did not actually face any reduction in agricultural prices. On the other hand, if the negative correlation between price gaps and development was due only to the selection of areas on a lower trend of economic growth, then we should observe this correlation also among urban districts. **Table 5** shows the results: there is no negative correlation between price gaps and development in urban districts. The coefficient of interest is actually positive and not statistically different from zero, with or without control variables.

[Table 5]

The evidence suggests that the reduction of prices to agricultural producers during the colonial period substantially lowered subsequent economic growth in rural areas. This raises a puzzle: as previously mentioned, after independence, post-colonial governments tended to maintain institutions, such as marketing boards and *caisses de stabilization*, similar to the trade monopsonies established by the colonizers. Since trade monopsonies were so detrimental to development, it seems counterintuitive that independent African countries, whose farmers constituted the majority of the population, maintained such institutions. A possible explanation of

this paradox comes from Bates' (1981, 1983) analysis of agricultural price policies in the post-colonial period. In post-independence Africa, farmers, instead of directly selling their production in the world markets, had often to sell it at a fixed price to marketing boards with monopsony power. Originally created to insure farmers against fluctuations of crop prices (paying them prices lower than world market when the price was high and higher than world market when the price was low), they soon became a way to extract income from rural areas. One of the beneficiaries from this institutional arrangement were the urban elites, who gained both from lower agricultural prices and from income transfers from rural to urban areas. Since post-colonial governments had most of their political supports in cities, these discriminatory policies against farmers tended to persist, despite their overall negative effect development (Bates, 1981).

The data used in this paper allow us to provide some preliminary evidence in favor of this hypothesis. If the reason why extractive institutions persisted is that they benefited urban elites, we should observe higher level of luminosity in the urban areas of the colonies that faced larger reductions of agricultural producer prices. We have to look at the colony, instead that at the district level, because redistribution of resources happened to be from rural to urban districts in the same colony and not from rural to urban areas in each districts. To check this, we can look at the relative difference in luminosity between urban and rural areas. I computed a measure of rural-urban inequality at the colony level, dividing the country-average luminosity in urban districts by the country-average luminosity in rural districts. **Figure 6** plots average (log) light inequality on average (log) price gap at the colony level: there is positive relationship between price gaps and urban-rural inequality. Colonial policies reducing prices to agricultural producers negatively affected subsequent economic growth in rural areas, but positively affected development in urban areas. The differential impact between urban and rural areas is likely to be the reason why extractive colonial policies persisted after independence.

[Figure 6]

## 5. Conclusions

Despite having shown that colonial extractive institutions matter for development, the previous literature has been generally unclear about the exact kind of institutions to blame. In this paper, by using direct data from the colonial period, I identified trade policies as one of the main component of colonial extraction and analyzed their long-term effects.

I showed that areas that faced stronger trade monopsonies, as measured by larger gaps between actual prices to African agricultural producers and prices that they should have received in a situation of free trade, are poorer today. For a median district, a one-standard deviation increase in the strength of monopsonies is associated with a 10 % decline in economic development, as measured by luminosity. The results do not depend on differences in geographic characteristics, natural resources, location, or population density. Moreover, they are not driven by differences in national institutions and they hold both across and within countries. In addition, the correlation between price reduction and development cannot be explained by the selection of initially poorer places into colonial extraction: the evidence suggests that it was actually the originally richest, and not the poorest areas, which faced more extractive monopsonies. In terms of the question as to why such institutions, which were so bad for development, persisted after independence, I presented preliminary evidence suggesting that trade monopsonies were actually beneficial to the urban sectors of African societies. The different effects in rural and urban areas may be the reason why extractive institutions persisted way after independence.

Overall, these findings provide evidence for the importance of going beyond the general concept of extractive institutions and identifying precisely the mechanisms and magnitude of colonial extraction. Only by pointing out in detail what extractive institutions are, we will be able to fully understand how African historical experiences continue to affect development.

## **Acknowledgements**

This paper is based on a heavily revised version of the last chapter of my dissertation. I would like to thank my advisor Jean-Laurent Rosenthal for his excellent guidance. I also thank Philip Hoffman, Sergio Espuelas, the Editor of this Journal, and anonymous referees, for their helpful comments.

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## Data Appendix: Variables Definition and Sources

**Agricultural suitability.** Within district pixel-average of a 0-1 index measuring land quality for cultivation. Data are from the Global Land Use Database of the SAGE Center for Sustainability and the Global Environment. Available at <http://www.sage.wisc.edu/iamdata/>.

**Crop suitability.** For each of the four crops, kg per hectare at the pixel level. Data are from the agro-climatically attainable yield for low input level rain-fed (crop) for baseline period 1961-1990 from FAO (2014).

**Desert.** Within district pixel-average of percentage of total land that is covered by desert, from FAO (2014).

**Diamond.** Dummy equal to one if any pixel of the districts falls into a diamond mine from Gilmore et al. (2005), available at <http://www.prio.org/data>.

**Distance to border, capital, and port.** Linear distance in km of the centroid of each administrative district to the closest port, computed with GIS.

**Districts.** The shape for current administrative units come from the GADM database of Global Administrative Areas. I eliminated from the map the district that were included in the British Cameroon.

**Elevation.** Within district pixel-average of median elevation in meters, from FAO (2014).

**Equatorial.** Dummy equal to one if the district belongs to Congo, Gabon, Chad, Central African Republic, or Cameroon.

**Light.** Within district pixel-average of luminosity at night. Data for 2015 come from the VIIRS DNB Cloud Free Composites, which reports the intensity of light radiation at a 15 arc-sec resolution. Available at: [https://ngdc.noaa.gov/eog/viirs/download\\_dnb\\_composites.html](https://ngdc.noaa.gov/eog/viirs/download_dnb_composites.html). Data for 1992 come from the DMSP-OLS Nighttime Lights Time Series, available at <https://ngdc.noaa.gov/eog/dmsp>. Resolution: 30 arc-sec. The source is the Earth Observation

Group of the NOAA National Geophysical Data Center (2017). Log (light) is defined as the natural logarithm of (0.0001+ mean light). Light per capita is defined as total area\*average pixel-luminosity/total population.

**Institutions.** Measures of voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption from from the Worldwide Governance Indicators (World Bank, 2017).

**Malaria.** Within district pixel-average of malaria prevalence index. Data come from Gething *et al.* (2011)

**Oil.** Dummy variable which assumes value of one if oil is present in the district (Lujala *et al.*, 2007), available at [http://www.prio.org/Data/Geographical-and-Resource-Datasets/ Petroleum-Dataset-v-12/](http://www.prio.org/Data/Geographical-and-Resource-Datasets/Petroleum-Dataset-v-12/).

**Population and population density.** Population density is total population in 2000 divided by land area. Data come from FAO (2014).

**Precolonial state centralization.** Average of index of precolonial centralization for all ethnic groups falling in each district. The measure of ethnic state centralization comes from the Ethnographic Atlas by Murdock (1967), which reports categorical values from 0 to 4 according to the level of complexity of political organization, from tribal level to state level.

**Price gaps.** Reduction of prices at the African port relative to world market prices net of trading costs, defined in equation (1). Raw data come from Tadei (2017).

**Water.** Within district pixel-average of percentage of total land that is covered by water bodies, from FAO (2014). Log (water area) is the natural log of (1+ share of territory covered by water bodies).

## Figures and Tables\*

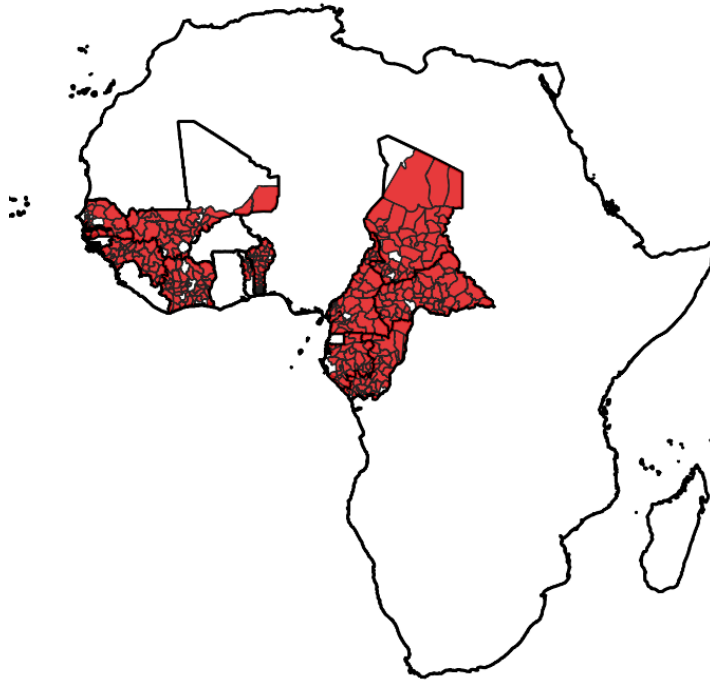


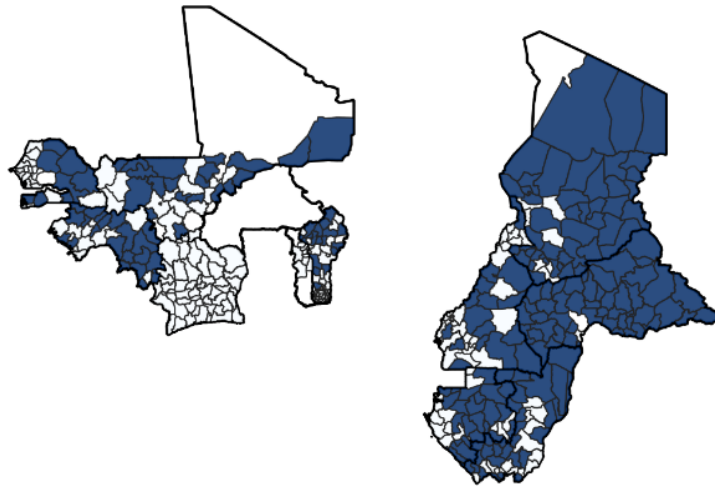
Figure 1

### Area of Analysis

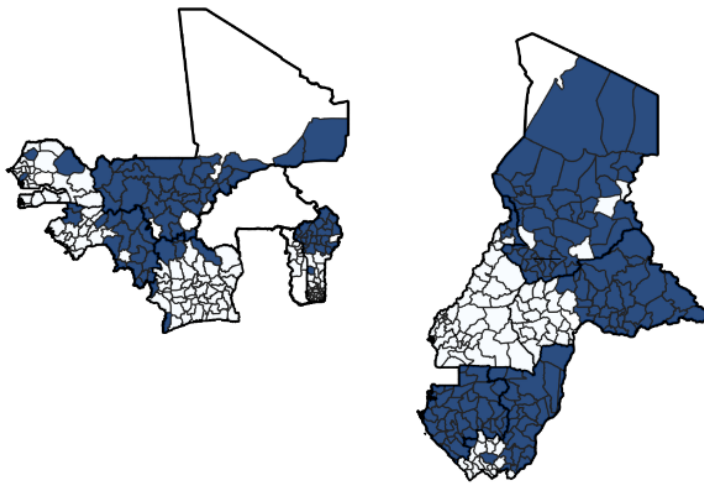
The figure represents the sample of districts used in the paper. The analysis focuses on the districts in the red area, where: 1) the price gap measure is available; 2) population is rural (luminosity below the 10<sup>th</sup> percentile).

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\*Scatterplots are produced by using the plotplain Stata code, developed by Bischof (2016), “New Figure Schemes for Stata: plotplain & plotting”.



(a) Luminosity



(b) Price Gap

Figure 2

### Average Current Luminosity and Colonial Price Gap by District

The panels report average luminosity (a) and average price gap (b) in each district. Dark districts are below median luminosity and above median price gap.

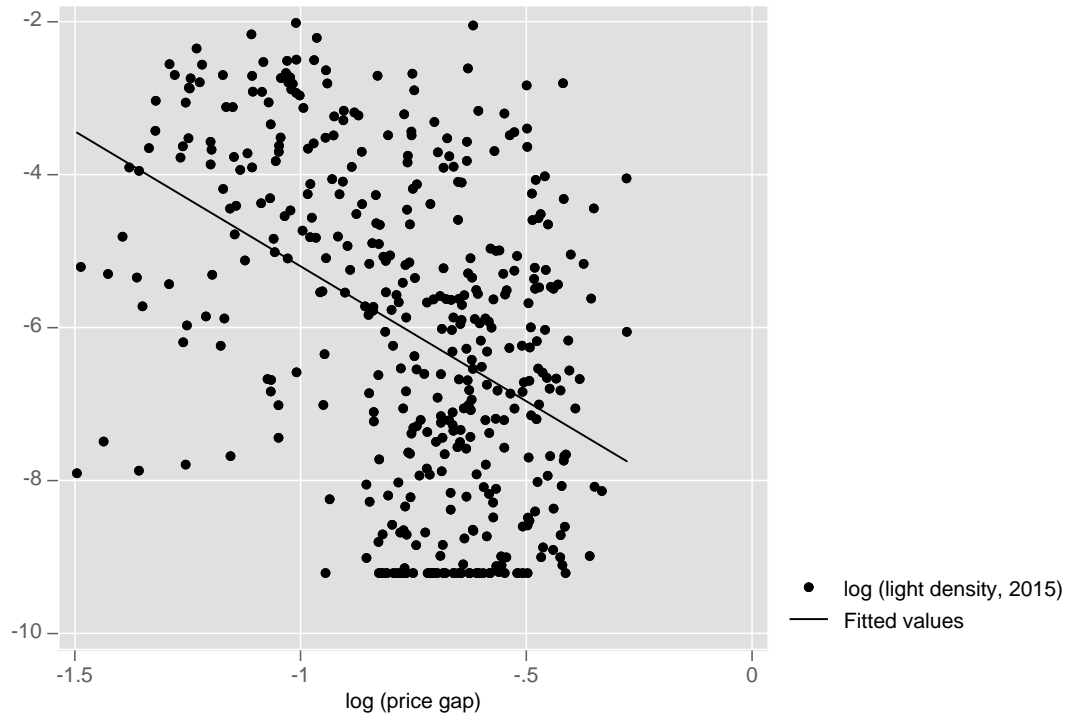


Figure 3

### Colonial Price Gaps and Current Light Density

The panel reports the scatterplot and linear fitting for the regression of log (light) and log (price gap). Coeff.=-3.53, st. err.=1.19 (clustered at the country level),  $R^2=0.18$ ,  $N=425$ .

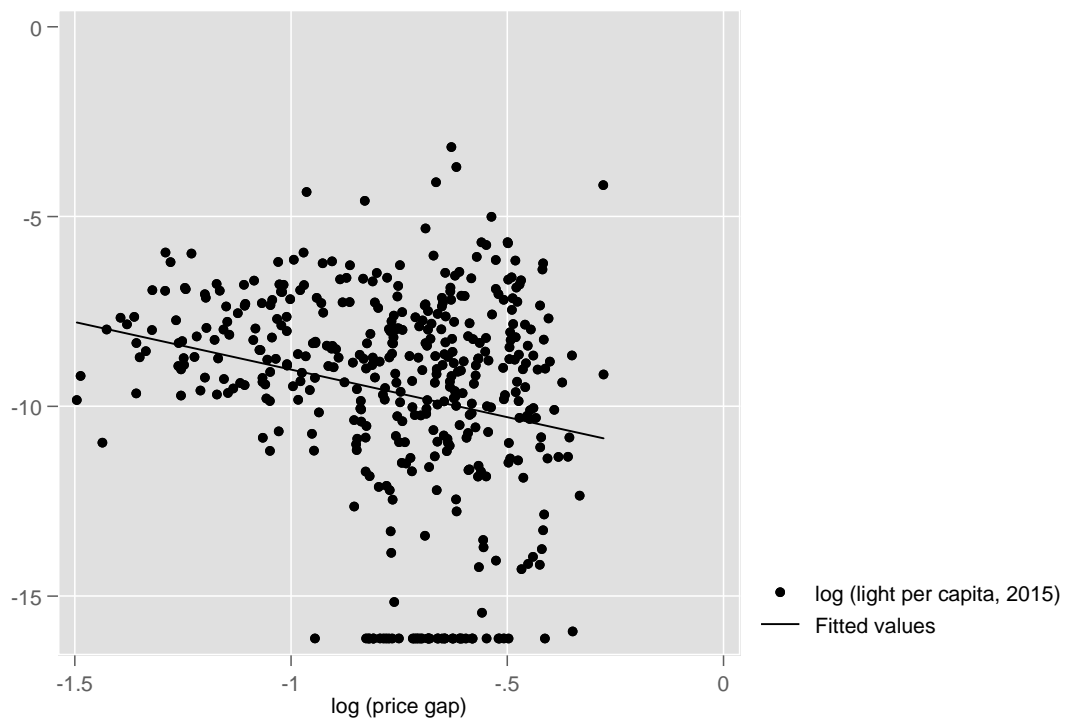


Figure 4

### Colonial Price Gaps and Current Light Per Capita

The panel reports the scatterplot and linear fitting for the regression of log (light per capita) and log (price gap).  
 Coeff. = -2.50, st. err. = 1.26 (clustered at the country level),  $R^2 = 0.05$ ,  $N = 425$ .

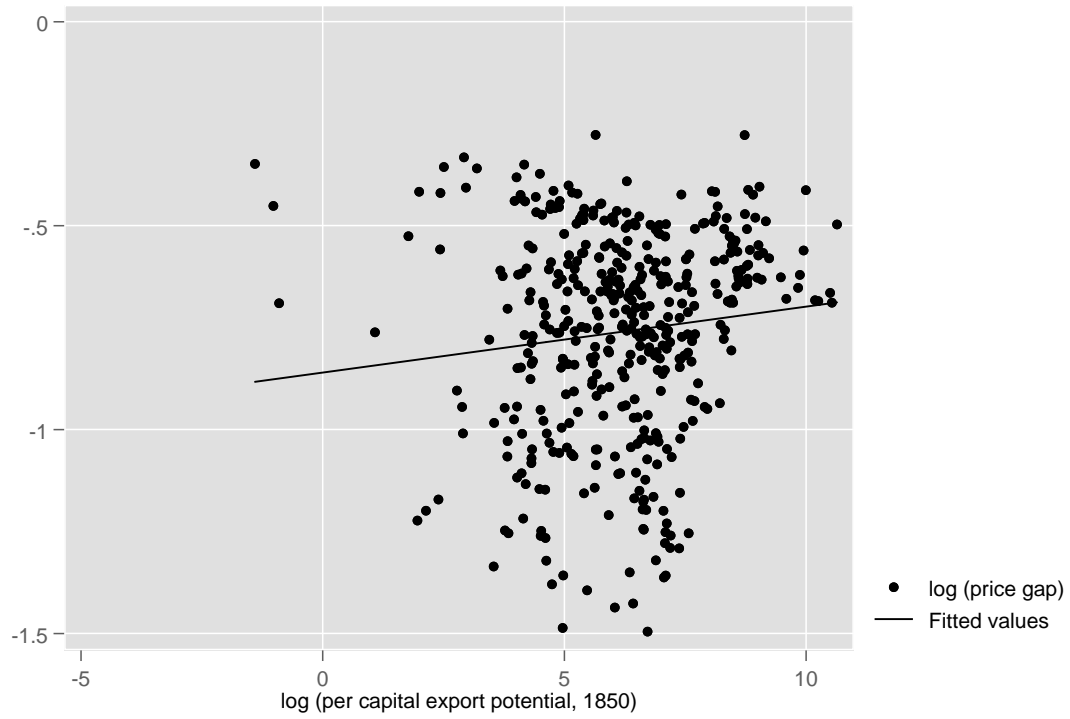


Figure 5

### Colonial Price Gaps and Export Crop Suitability

The figure reports the scatterplot and the linear fitting for the regression of (log) price gap on the (log) export potential per capita in 1850. Coeff. = 0.016\*\*, st. err. = 0.07,  $R^2=0.01$ ,  $N=425$ . Standard errors are not clustered.



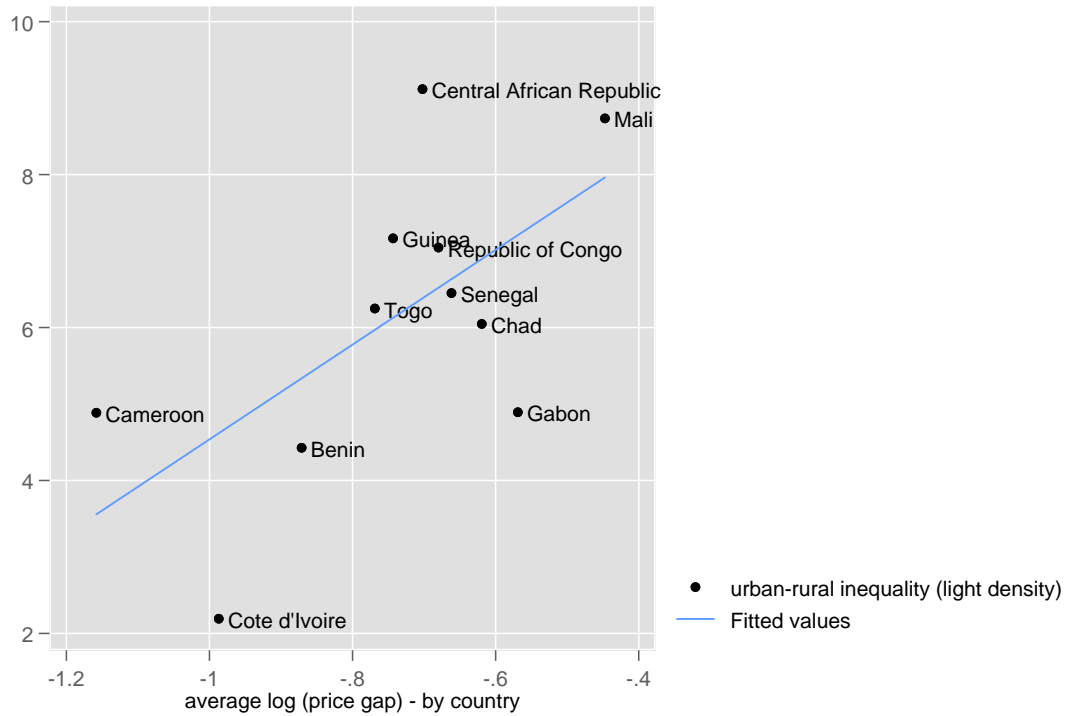


Figure 6

### Colonial Price Gaps and Urban-Rural Light Inequality

The figure report the scatterplot and linear fitting for the regression of log (light inequality) and country-average log (price gap). Light inequality is defined for each country as the average (log) luminosity in urban districts minus the average (log) luminosity in rural districts. Coeff. = 6.20\*\*, st. err. =2.61,  $R^2=0.39$ ,  $N=11$ .

Table 1

## Colonial Price Gaps and Current Development: Cross-Sectional Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log (price gap)	-3.529** (1.191)	-2.394** (1.032)	-2.060** (0.838)	-2.341** (0.965)	-1.967** (0.718)	-2.241** (0.938)	-1.897* (0.962)
Population density		Yes	Yes	Yes	Yes	Yes	Yes
Geography controls			Yes		Yes	Yes	Yes
Location controls			Yes		Yes	Yes	Yes
Precolonial centralization				Yes	Yes		
Equatorial Africa dummy						Yes	
Institutional controls							Yes
N	425	425	425	366	366	425	425
R <sup>2</sup>	0.183	0.334	0.474	0.369	0.526	0.479	0.565

The table reports OLS estimates of the relationship between colonial price gaps and current development, as proxied by (log) luminosity. Robust standard errors clustered at the country level are reported in parenthesis. \*\*\* p<10%, \*\*p<5%, \*p<10%.

Table 2

## Colonial Price Gaps and Current Development within Countries: Fixed Effects Estimates

	(1)	(2)	(3)	(4)
Log (price gap)	-2.372**	-1.865*	-2.545**	-2.311**
	(0.832)	(0.953)	(0.944)	(0.898)
Population density		Yes	Yes	Yes
Geography controls			Yes	Yes
Location controls			Yes	Yes
Precolonial centralization				Yes
Country fixed effects	Yes	Yes	Yes	Yes
N	425	425	425	366
R <sup>2</sup>	0.073	0.148	0.209	0.207

The table reports OLS estimates of the relationship between colonial price gaps and current development, as proxied by (log) luminosity, including country fixed effects. The R<sup>2</sup> measures the explained variance within countries. Robust standard errors clustered at the country level are reported in parenthesis. \*\*\* p<10%, \*\*p<5%, \*p<10%.

Table 3

## Robustness Checks

	log (price gap)	st.err.	N	R <sup>2</sup>	country FE	specification
(0)	-2.060**	(0.838)	425	0.474		basic
(0b)	-2.545**	(0.944)	425	0.209	Yes	basic
(1)	-2.068**	(0.832)	425	0.474		spline function for population at 50,000
(1b)	-2.510**	(0.937)	425	0.214	Yes	spline function for population at 50,000
(2)	-2.480***	(0.707)	307	0.485		excluding if population < 50,000
(2b)	-2.715**	(0.858)	307	0.209	Yes	excluding if population < 50,000
(3)	-2.759***	(0.624)	425	0.469		population weights
(3b)	-3.135***	(0.713)	425	0.587	Yes	population weights
(4)	-2.610*	(1.204)	472	0.453		include "urban district" (top 10th percentile light)
(4b)	-4.033**	(1.494)	472	0.317	Yes	include "urban district" (top 10th percentile light)

The table reports OLS estimates of the relationship between colonial price gaps and current development, as proxied by (log) luminosity. In fixed effects specifications, denoted by the letter *b*, the R<sup>2</sup> measures the explained variance within countries. Robust standard errors clustered at the country level are reported in parenthesis. \*\*\* p<10%, \*\*p<5%, \*p<10%.

Table 4

## Colonial Price Gaps and Economic Growth, Across and Within Countries

	(1)	(2)	(3)	(4)	(5)	(6)
Log (price gap)	-2.755** (0.911)	-2.142* (0.969)	-1.874* (0.915)	-2.248** (0.7689)	-1.848* (0.956)	-2.489** (1.007)
Log (light, 1992)	Yes	Yes	Yes	Yes	Yes	Yes
Population density		Yes	Yes		Yes	Yes
Geography controls			Yes			Yes
Location controls			Yes			Yes
Country fixed effects				Yes	Yes	Yes
N	425	425	425	425	425	425
R <sup>2</sup>	0.298	0.376	0.486	0.111	0.163	0.220

The table reports OLS estimates of the relationship between colonial price gaps and current development, as proxied by (log) luminosity, within and across countries, controlling for economic development in 1992. The R<sup>2</sup> of fixed effects regressions measures the explained variance within countries. Robust standard errors clustered at the country level are reported in parenthesis. \*\*\* p<10%, \*\*p<5%, \*p<10%.

Table 5

## Colonial Price Gaps and Current Development in Urban Districts (Placebo Test)

	(1)	(2)
Log (price gap)	1.126	0.469
	(1.002)	(1.018)
Population density	Yes	Yes
Geography controls		Yes
Location controls		Yes
N	47	47
R <sup>2</sup>	0.234	0.484

The table reports OLS estimates of the relationship between colonial price gaps and current development, as proxied by (log) luminosity, among urban districts (luminosity above 10<sup>th</sup> percentile). Robust standard errors clustered at the country level are reported in parenthesis. \*\*\* p<10%, \*\*p<5%, \*p<10%.