The Origins of Colonial Investments in Former British and French Africa*

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Abstract

Recent literature has documented the economic and political consequences of colonialism, but we have little systematic evidence about the origins of colonial investments despite their long-term impact. Combining multiple data sources, I present evidence that they were very unequally distributed across the districts of 16 British and French African colonies. How did colonial states allocate their investments? Some focus on ethnic disparities in colonial treatment, following a divide and rule logic, while others emphasize the role of natural resources. I argue that observable geographic features led some places to become centers of pre-colonial coastal trade, which increased later colonial investments not only in infrastructure but also in health and education. Although the context was highly extractive, pre-colonial commerce also helps explain the limited diffusion of investments within each colony. A de facto decentralized colonial state and European settlement are two of the mechanisms behind the persistence of inequality over time.

Keywords: public investments, colonialism, inequality, Africa, trade, geography.

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1 Introduction

The last two decades have seen a surge in the literature examining the economic and political consequences of colonialism, notably in Africa, the Americas and South Asia.¹ Existing claims about the effects of colonial institutions, investments and practices are wide-ranging.² Some of this literature uses instances of arbitrary or “as-if” random variation in a particular aspect of colonial rule to identify those consequences, such as spatial discontinuities in agricultural revenue collection systems in India (Banerjee and Iyer, 2005), in extractive forced labor in Peru (Dell, 2010), or in missionary school location in Benin (Wantchekon, Novta and Klasnja, 2015). However, colonial investments are likely not random beyond some particular instances. Explaining their origins is important because they fundamentally affected welfare and development during colonial rule as well as contemporary economic development (Huillery, 2009). Yet, we know little about the quantitative distribution of colonial investments and about the causes underlying their distribution.

Combining multiple original and existing data sources, I present systematic evidence that colonial investments were very unequally distributed across and within 16 British and French colonies in East and West Africa.³ This paper focuses on the large within-colony variation in investments across colonial districts. This focus allows us to hold institutions constant, since in East and West Africa they varied little within each colony. Investments in some districts were orders of magnitude larger than in others in the same colony, also when taking population into account (Figure 1). These district inequalities exist for the three main types of investments—education, infrastructure and health—in both empires (Figures 4-6, p. 17) and they do not diminish during the colonial period.

Why did Europeans invest much more in some districts than others? The most immediate explanation concerns a divide and rule logic, whereby the European colonizer discriminated between ethnic groups to prevent coordinated opposition to imperial rule. Existing literature provides

¹See Nunn (2009) for a concise review on the long-term economic effects of colonialism.
²For example, see Acemoglu, Johnson and Robinson (2001) and Mahoney (2010) on the effects of colonial institutions; Huillery (2009) and Cagé and Rueda (2016) on investments; and Guardado (2014) and Wilkinson (2015) on colonial practices.
³Using the current names, the sample comprises Benin, Burkina Faso, Cote d’Ivoire, Ghana, Guinea, Kenya, Malawi, Mali, Mauritania, Niger, Nigeria, Senegal, Tanzania, Sierra Leone, Uganda and Zambia.
Note: The graphs show the distribution of investments by district in two former colonies. The left graphs show the raw number of public health staff (doctors and nurses) and students per colonial district while the right graphs adjust that number per 100,000 people. While the order of districts in the right graphs somewhat changes, inequality remains remarkably similar.

qualitative and historical evidence that treatment was indeed unequal across groups and regions, but the causes underlying this inequality remain unclear. Horowitz (1985) termed this inequality the “ethnic distribution of colonial opportunity”: some groups and regions benefited more from, or were less harmed by, colonialism than others. For instance, in 1960 “the Kakwa and Lugbara [in Northwestern Uganda] had between them a single student enrolled in Makerere University”, the first university in East Africa. “The Baganda [in Central Uganda], though only 16 percent of the population, comprised nearly half” of the student body (Horowitz, 1985, p. 151, p. 239). Investments were also unequal in other domains of the British and French colonial state, notably
economic activity (Cooper, 1996) and colonial army recruitment. It is less clear whether a particular ethnic or local characteristic can explain these inequalities systematically.

Recent research has shown that higher levels of pre-colonial political centralization across ethnic groups, a highly visible characteristic that can be used to divide and rule, improve current socioeconomic outcomes. For instance, the British found it convenient to co-opt the existing social structure of the Buganda Kingdom and invested more in that region than elsewhere in Uganda. However, there are opposite examples as well: because the Hausa States in Northern Nigeria were more politically developed than the rest of the colony, Lugard (1922) decided they should be ruled indirectly and hence received lower investments. I find that colonial district investments were not affected by pre-colonial kingdoms and I find little support for other possible explanations, such as pre-colonial ethnic diversity and fragmentation (Alesina, Baqir and Easterly, 1999; Easterly and Levine, 1997) lowering investments across districts. Divide and rule was an important ruling strategy, but it may have been context-specific rather than systematically relying on some ethnic or regional characteristic.

I argue instead that focusing on the economic logic of colonialism allows us to better understand variation in infrastructure, education and health investments. European colonialism was first and foremost an exploitative enterprise with economic profit as one of its main motivations (Young, 1994; Suret-Canale, 1971; Darwin, 2012; Diamond, 2005), and natural resources were central to the colonial enterprise. Curtin et al. (1995, p. 447) explains that “European capital was invested where exploitable resources promised the most extractive returns” (Huillery, 2010, p. 271). For instance, the British took control of Ghanaian gold and Sierra Leonean diamonds because they enjoyed a first-mover advantage over the French. Wantchekon and Stanig (2015, p.5) show that...
“colonial infrastructure can be predicted [...] by the presence of extractive resources (mines and quarries) but not by soil quality.” Using novel historical data, I also find that infrastructure is predicted by natural resources. However, the effect is modest and does not spill over into education or health investments, which served less extractive purposes.

The main reason why colonial administrators invested so much more in some districts than others lies in the role played by pre-colonial coastal trade. Early commerce provides a common origin to later investments in infrastructure, education and health in both empires, a finding consistent with accounts of historical trade in the Indian and Atlantic oceans (Hourani, 1995, p. 83; Curtin et al., 1995). Besides providing quantitative support for existing historical work, I identify the causal effect of coastal trade by using natural harbors and capes as an instrumental variable.\textsuperscript{7} Early explorers and traders in the Age of Sail possessed very limited information about the territory (Foster, 1967), so locational fundamentals (Davis and Weinstein, 2002) such as natural harbors and capes influenced where they landed and therefore the location of initial trading posts between the 16th century and the 19th century—the period of slavery and the Triangle trade.\textsuperscript{8} This trade, of which slavery was an important component (Nunn, 2008), in turn explains later colonial settlement and investments.\textsuperscript{9}

The relevance of pre-colonial commerce is not restricted to these early coastal “development hubs”: geodesic distance from early trading centers helps explain the limited diffusion of investments from these early enclaves to the rest of the colony. As Bates (1974, p. 464) put it, “originating in ‘nodes’ or ‘central places’, modernity then spreads or ‘diffuses’ into the more remote regions of the territory.” This diffusion is very limited because colonialism in most of East and West Africa was short-lived and shallow compared to other regions such as South Asia, where existing geographical ties: the Niger delta, basis of future Nigeria; the Gambia estuary, Sierra Leone and the Gold Coast” (Chi-Bonnardel, 1973, p. 50).

\textsuperscript{7}Jha (2012) first used natural harbors as an instrument in South Asia. Capes (e.g. Dakar) are also a reasonable predictor of trading posts in Africa, which has many fewer natural harbors (e.g. Mombasa).

\textsuperscript{8}Europeans sold manufactured goods to Africa in exchange for slaves that were sold in the Americas. The Americas, in turn, provided cotton, sugar and other primary commodities to Europe.

\textsuperscript{9}For most of East and West Africa, “pre-colonial” refers to the period starting in the 1500s up to the 1885 Berlin Conference and “colonial” refers roughly to the period between 1885 and 1960.
research shows that trading companies were central and had a long-lasting influence on economic development and interethnic tolerance (Jha, 2012; Gaikwad, 2014).10

The autonomy of local colonial administrators and European settlers are two important reasons why pre-colonial trading areas received much higher colonial investments. First, the lack of a central planner, and hence the high autonomy of administrators in an effectively decentralized state, meant that redistributive or long-term strategic investments (e.g. the Uganda Railway) to develop the periphery were the exception rather than the norm. Second, Europeans settled in the few districts with basic infrastructure already in place and sometimes acted as a lobby with interests in trade and agriculture (Gardner, 2012), likely contributing to regional economic inequality. European settlers are hardly a root cause for variation in investments or institutions (Acemoglu, Johnson and Robinson, 2001) but a mechanism to explain the persistent inequality in investments. They only came to East and West Africa in any significant numbers in the 20th century, 400 years after the Triangle trade had begun. Unlike in neo-Europes and many Spanish American colonies, there were fewer than 10,000 settlers prior to 1940 in all 16 colonies under study except for Kenya.11

Given a de facto decentralized colonial state and the spatial concentration of settlers, the early advantages of pre-colonial trading centers persisted into the colonial period: they became centers of economic activity that benefited from complementarities between investments in infrastructure, education and health. The pattern is consistent with a logic of increasing returns (Krugman, 1991b, Pierson, 2000) and with urban agglomeration economies (Krugman, 1991a; Rosenthal and Strange, 2004), albeit in a very different context: instead of firms in a private market, the agents are colonial state administrators allocating public finances.

In sum, this paper makes three contributions. First, I show that pre-colonial commerce played a central role for subsequent colonial development even in the very exploitative context of East and West Africa, where slaves were a central export and commerce was much less developed than

10 The British East India Company lasted almost three centuries while the British Royal Africa Company lasted only one. French chartered companies in Africa such as the French West India Company or the Senegal Company were not prominent or long-lasting either.

11 According to census data collection in both empires, which had important limitations (Frankema and Jerven, 2014).
in India (Jha, 2012; Gaikwad, 2014) or China (Jia, 2014). Investment diffusion within a colony is also in part the result of early trade, suggesting that its importance extends beyond the first trading hubs in each colony. Second, I build upon the literature in ethnic politics and economic history. The former provides ample case study evidence of the differences in opportunities and exploitation across regions and ethnic groups, in line with a logic of divide and conquer, while the latter highlights the commercial motivation behind European imperialism. I argue that the root cause for these differences is economic. Finally, I contribute a dataset with new sources on colonial investments—which allow me to quantify spatial inequality—, historical natural resources and geographic subnational data spanning colonies of two empires.

2 Locational fundamentals and pre-colonial trade

“It is not an exaggeration that between 1550 and 1800 Europeans learned virtually nothing new about the lands beyond the African coastline. [...] By 1875, in fact, European possessions in Africa still only comprised the coastal forts and trading stations and a few tiny colonies.”

Foster (1967, p. 45, 51)

Locational fundamentals are observable geographic characteristics of a territory that “change little over time—even if their economic meaning may have evolved. For example, there are advantages of being near a river [or] on the coast, on a plain instead of a mountain or desert, etc.” (Davis and Weinstein, 2002, p. 1270). Locational fundamentals are important to understand early spatial patterns of economic activity in pre-industrial contexts, where geography greatly affects mobility and economic activity (Diamond, 2005).

Early European exploration and commerce in Africa was difficult partly because much of the Western and Eastern coastline did not possess geographic features amenable to docking ships. For instance, much of the Windward and Gold Coasts in present-day Cote d’Ivoire and Ghana are comprised of shallow waters (Curtin et al., 1995). Given the absence of man-made docks, Europeans landed where coastal geography was favorable. Europeans observed variation mostly in geographic
characteristics because knowledge about socioeconomic and other characteristics of the territory was very limited until the 19th century (Foster, 1967; Chi-Bonnardel, 1973). Geography was especially important during the Age of Sail (1500s-1800s), when navigation technology depended much more on environmental factors and wind patterns than in the later Age of Steam (1800s-) (Feyrer and Sacerdote, 2009). Hence, the few natural harbors and capes (locational fundamentals) that existed were valuable to Europeans engaged in the trade, including the shipment of slaves since the 1600s (Figure 2).

Figure 2: Timeline of major colonial events in East and West Africa

1450 1600 1850 1890 1960
Early exploration Pre-colonial Triangle trade Settlement Colonial period
1885 Berlin Conference

Note: Dates are approximate. Pre-colonial trade and colonization periods vary between colonies.

For instance, the Portuguese and later the French first landed in three places as they descended through the Northwest African coast. One was Ras Nouadhibou (Cap Blanc), currently in the border between Western Sahara and Mauritania. They also established trade in what would later become the cities of Saint Louis and Dakar in Senegal because the former is a natural harbor formed by the Senegal river mouth and the latter is in a cape (Cap-Vert).

Other factors influenced the location of trade during early exploration, such as the presence of natural resources in the few areas that had long extracted them. The most famous cases in the colonies under study are the diamond mines of Sierra Leone and the Gold Coast (current Ghana), where the British disrupted a Trans-Saharan gold trade that had existed for centuries (Young, 1994, p. 134). Even then we can see some geographic logic: two key locations where the British landed were the natural harbor of Tagrin Bay in Freetown and Cape Coast in Ghana, a country without natural harbors. East Africa has a longer history of navigation than West Africa because of Arab explorations of the Indian Ocean and the Arab slave trade (Hourani, 1995, p. 83). However, an

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12Young (1994, p. 103) provides a brief discussion of chartered companies in Africa and their relation to the colonial state.
equivalent logic applies. Mombasa, a natural harbor, and Zanzibar, an island, became centers of Arab-African trade centuries before the Europeans arrived in the 1500s. Horowitz (1985, p. 151) suggests a similar logic to explain interactions between European colonizers and local populations in the early colonial period in Africa and Asia: “groups located near the colonial capital, near a rail line or port, or near some center of colonial commerce—the sitting of which was usually determined by capricious factors, such as a harbor or a natural resource to be exploited—were well situated to take up opportunities as they arose.” In sum, locational fundamentals led to differences between certain areas in West and East Africa, which became engaged in Atlantic and Indian commerce, and the rest of the territory.

2.1 Early trade and colonial investments

Proximity to trading centers became perhaps even more advantageous during the colonial period. As Europeans increased effective control of the colonies in the early 20th century, trading posts became central points for the international shipment of goods produced elsewhere in the colony, strengthening linkages to the international economy, as Laitin (1982) explains for the case of Western Nigeria. Lagos and other early commercial centers such as Abidjan and Freetown became the colonial capitals, adding a political dimension to their economic preeminence within the colony. Capitals were rarely chosen for their central geographic location within the colony, as it became the case in independent Nigeria (Abuja) and Cote d’Ivoire (Yamoussoukro). For one thing, colonial state borders were not even defined by the time the capital was chosen. While economic activity spread, its persistent concentration in a few places in each colony had spillover effects on other colonial investments, notably hospitals and schools such as the École William Ponty in Gorée (Senegal) and Fourah Bay College in Freetown (Sierra Leone). In other words, investments in education and health partly followed basic infrastructure investments. It was cheaper for colonial officials to establish facilities such as schools and hospitals in places where basic infrastructure was already in place and hence where initial costs were lower.
Similar patterns of concentration and persistence of economic activity have been theorized elsewhere, originally in Krugman’s (1991b) application of increasing returns theory to economic geography. 13 Similarly, each colony had a few districts with basic infrastructure—the industrial core—while the majority was part of a periphery that was largely agricultural, pastoral or nomadic and where colonial state reach was very limited (Herbst, 2000; Jackson and Rosberg, 1982). Because parts of the hinterland were not well-known even after colonial borders were defined, initial costs of investment in a new location, including transportation costs, were compounded by uncertainty about the future profitability of investments. An increasing returns logic, compounded with a financially poor colonial administration that could not afford risky investments of uncertain profitability, are two reasons why we should observe persistence in the spatial distribution of economic activity during the colonial period. These two reasons also suggest that new investments elsewhere in the colony might be a function of proximity to early commercial centers: all else equal, investments in less remote areas are less costly and less uncertain.

3 Colonial state: structure and administration

The ‘command and control’ of this [British] empire was always ramshackle and quite often chaotic. To suppose that an order uttered in London was obeyed round the world by zealous proconsuls is an historical fantasy (although a popular one).

Darwin (2012, p. xii)

This section dispels the popular conception of the colonial state as a highly organized entity with a central planner following clear investment rules. In reality, the colonial state in East and West Africa was decentralized and district administrators often acted autonomously in both empires. Decentralization and autonomy arguably favored the persistence of pre-colonial patterns of economic activity into the colonial period. Since these claims are context-specific, I first explain why decision-making was not centralized, as one might expect. I then reinforce that idea by

13 He explains why countries develop an “industrialized core” while the rest remains an “agricultural periphery.” Krugman’s (1991b, p. 483) key insight is that, “in order to realize scale economies while minimizing transport costs, manufacturing firms tend to locate in the region with larger demand, but the location of demand itself depends on the distribution of manufacturing.”
providing relevant background on the administrative structure and public finances of the British and French colonial state.

3.1 The lack of clear investment rules

Colonial documents do not present a systematic investment strategy within or across colonies. Investments were not proportional to district population (cf. Figure 1), since the needs of the local population were not a major concern: colonial officials on the ground responded to their superiors (upward accountability), not to the colonized (downward accountability). Investments were more responsive to European settlers, but ultimately colonial officials were not accountable to the settler minority either. The interests of the British Colonial Office or the French Ministry of the Colonies did not necessarily coincide with those of settlers, itself a diverse group comprising administrators, traders, farmers, missionaries and sundry Europeans (Darwin, 2012). Granting additional land to European farmers, for instance, risked alienating the local population even further. Some settlers in Kenya created the European Taxpayer’s Protection League to shift the tax burden (further) away from Europeans to the local population (Gardner, 2012, p. 98), hoping to benefit from public investments without paying for their cost. In sum, investments were not simply a function of the settler population.

The lack of a systematic investment strategy is perhaps the most surprising aspect of colonial policy if we use Weberian states as reference categories. It is less surprising if we consider that communication and knowledge of the territory were also limited, which made policy coordination difficult between the core and the periphery (Darwin, 2012, p. xii; Delavignette, 1968, p. 63). British and French colonial officials routinely applied for grants in aid to the respective ministries with the goal of conducting infrastructure projects and complement colonial tax and tariff revenues. Yet, the metropole precisely strove to reduce the quantity of funds, especially of grants-in-aid, available to colonial governments (Constantine, 1984, p. 14, p. 84; Gardner, 2012, p. 9), resulting in financial uncertainty and short-term local decision-making.
While expenditures presumably responded to particular needs, “no explicit investment strategy can be found in [French colonial] local budgets. Motivations reported at the beginning of each local budget explain the general level of annual resources but do not motivate the spatial distribution of public goods provision” (Huillery, 2009, p. 181). British local budgets present a remarkably similar focus on detailed descriptions and administration rather than policy: “colonial tax and spending patterns did not follow a similar logic throughout British Africa” (Frankema, 2011, p. 147) in part because “[Britain] did not strive to apply a common financial policy to the various dependencies” beyond “general instructions [...] from the Secretary of State for the Colonies” (Stammer, 1967, p. 194).

3.2 Autonomous administrators in a decentralized colonial state

Examining British and French colonial institutional structures provides some further insights on why the state was decentralized and decision-makers were rather autonomous. It also provides us with a better understanding of the public finances of the colonial state and on their similarities between these two empires. These similarities are not emphasized in the literature because much historical work on colonial policy focuses on how French ideas of assimilation and direct rule differed from British ideas of association and indirect rule (Crowder, 1964; Strang, 1994; Sharkey, 2013) and because studies of colonial finance and administration tend to focus on one empire (Delavignette, 1968; Suret-Canale, 1971; Constantine, 1984; Gardner, 2012).14 At the top of the colonial hierarchy, there were the Ministry of the Colonies in Paris and the Colonial Office in London. These ministries sent a Governor to the colony that acted as the main link between the metropole and the civil servants in the colony, which included administrators, teachers, judges, engineers, doctors and nurses. Each district (or cercle) was led by a district head called District Commissioner (Commandant de Cercle).

District heads stationed far from the colonial core had much latitude in local policy and implementation because of physical distances and poor transportation and communication networks.

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14 There are historical studies spanning both empires on other issues, notably economic history (Hopkins, 1973) and labor policy (Cooper, 1996).
“The administrative organization was officially centralized but effectively decentralized,” making district heads “the real chiefs of the French empire” (Huillery, 2009, p. 181; Delavignette, 1968). They oversaw the administration, taxation, justice and other public services in both empires (Suret-Canale, 1971, p. 72). District heads were also in charge of relations with village chiefs, and the former partly relied on the latter for policy implementation and revenue collection. “Local chiefs [in British colonies] had a guise of autonomy in their local jurisdictions, but they were actually guided and supervised by the British colonial administrators” (Strang, 1994, p. 149). Similarly, local chiefs in French West African villages were an autonomous and useful but ultimately subordinate figure whose “influence [was limited] to small areas” (Huillery, 2009, p. 181). Lugard (1922) devised his theory of indirect rule with the British Empire in mind, but its practice extended to parts of the French empire. Since the colony was not an organized entity with a central planner and clear investment rules, I turn to quantitative data sources to understand what factors underpinned the spatial distribution of colonial public investments.

4 Data

4.1 Sources

To the best of my knowledge, this paper presents the most extensive data on investments at the colonial district level for French West Africa (collected by Huillery, 2009) and for the main eight British colonies under the Colonial Office (original data collection): Benin (formerly Dahomey), Burkina Faso (Upper Volta), Cote d’Ivoire, Ghana (Gold Coast), Guinea, Kenya, Malawi (Nyasaland), Mali (French Soudan), Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Tanzania (Tanganyika), Uganda, Zambia (Northern Rhodesia). One important advantage of focusing on these colonies is their rather homogeneous institutional structure within each empire (Section 3). Unlike French Algeria or British Southern Africa, most of East and West Africa was not integrated

\[\text{Sharkey (2013) considers the difference in that regard between the two empires a matter of degree, consistent with the move by Gerring et al. (2011, p. 378) “to understand systems of [direct and indirect] rule along a continuum that reflects the degree of central control.”}\]
into the French and British empires until late in the 19th century.\footnote{There are exceptions. Part of the hinterland in Senegal and Ghana had been colonized much earlier, while Zambia was incorporated as Northern Rhodesia into the Colonial Office only in 1924. Tanzania, then Tanganyika, was under German occupation prior to World War I and incorporated to the British Empire as a League of Nations Mandate only in 1922.} Due in part to their similar colonial experience, all 16 colonies became independent around 1960.

Another important advantage is that record-keeping procedures were very similar within each empire, since all administrators reported to the Ministry of the Colonies in Paris and the Colonial Office in London. \textit{Huillery (2009)} collected the original French records for selected years in the 1910-1939 period.\footnote{Technically the panel extends to 1956, but data are mostly missing post-1939.} I collected British colonial records from 1915, 1920, 1927, 1928 and 1938 as a function of availability of disaggregated data. They often contain detailed information on demographics, education, health, infrastructure investments and other activities (Figure A.9 shows a page of a British Blue Book and a page of a French Compte Définitif). I georeference colonial investments by taking advantage of detailed colonial maps with district boundaries, which enable the use of districts as the units of analysis (Figure A.10 presents a map published by the Colonial Office).\footnote{Colonial district boundaries are relevant today. With some exceptions, many have changed little over time and around 80\% of them remain in place today. Districts today are often partitions of a larger colonial district.}

Colonial records are not without problems, however. Data on infrastructure, health and education is presented at the town or district level in some years but is too aggregated in others and table formats often change, making comparisons across years challenging. They also contain data gaps, such that some data are available in some years but not others. Further, population censuses were far from accurate. In the early colonial period, some data may have been educated guesses rather than censuses in the way they are currently conducted (\textit{Cooper, 2005; Frankema and Jerven, 2014}).

To explain colonial investments, I collect a set of sources that provide information on the physical, geographic, social and economic characteristics of the territory. To test whether observable ethnic characteristics affect colonial investments, I draw on Murdock’s (1959) dataset of pre-colonial ethnic group characteristics because it provides useful proxies of pre-colonial economic and political development, such as intensity of agriculture, settlement patterns, the size of local
communities and level of political centralization. I also code two pre-colonial ethnic characteristics. I use two indicator variables to code whether the district was located in a pre-colonial kingdom or in an acephalous society (Olson, 1996; Encyclopedia Britannica, 2016), thereby extending Huillery’s coding for French colonies to British ones. The other is an ordinal variable for low, medium, or high historical presence of Islam across districts, improving a rough map by Bartholomew (1913).

New data on trade and natural resources allows me to test economic explanations of colonial investments. The sources for pre-colonial trading posts come from Slave Voyages (2013), Curtin et al. (1995) and Huillery (2009). Data for natural harbors and capes comes from Ramsar (2016) and Ports.com (2016), which contain information on multiple geographic characteristics. To explain investment diffusion, I calculate the geodesic distance from each district capital to the closest trading post. Natural resources data comes from Hubert’s (1922) map (Figure A.11), likely the most comprehensive on the issue for pre-1940 West Africa. The other is a detailed worldwide map by Kuhne (1927). I complement these two main sources with an early publication by the United States Geological Services (USGS, 1921) that also has world coverage but is much less detailed.

The data also contain several geological, physical and geographic controls. Huillery (2010) collected several of these physical and geographic attributes for French West Africa, such as distance between the district capital and the coast, altitude and the presence of navigable rivers—which I complement with a map by C.S. Hammond (1921). I extend those variables to include British colonies and collect additional ones. Altitude, for instance, is a rough proxy for disease environment, notably for malaria (World Health Organization, 2016), but to better capture disease environment I use a geocoded map of malaria prevalence around 1900 (Lysenko and Semashko, 1968) and FAO tsetse fly data (Alsan, 2015). Those data are important in tropical Africa, “often referred to as the white man’s grave” (Darwin, 2012, p. 138).

19Tables A.4 and A.5 provide the list of natural harbors and capes as well as of trading posts and include tests of covariate balance for both indicator variables.
4.2 Descriptive statistics

Infrastructure investments levels varied widely by colony (Figure 3). For instance, if we consider investments per capita, levels of investments in Ghana are similar to those in Guinea but much higher than those of any other British colony.\textsuperscript{20} Since colonies received little aid from the metropole, differences in budgets are largely due to differences in the revenue raising capacity of colonial governments (Hopkins, 1973, p. 190).

Figure 3: Infrastructure expenditures in British and French colonies (1910-1939, in 1910 FRA)

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure3}
\end{figure}

Note: Expenditures in infrastructure per colony varied widely absolutely and per capita. Except for Ghana, per capita investments in British colonies were lower.

I quantify inequality in investments by computing Gini indices by colony (Figures 4-6).\textsuperscript{21} The indices are calculated using district-level investments. While the literature computes regional Gini indices (Milanovic, 2016), regions and districts are not individuals and hence the administrative

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\textsuperscript{20}The denominator includes African and European population, but because colonies had only a few thousand Europeans the results are almost identical if we exclude Europeans.

\textsuperscript{21}Figures A.3-A.8 present the data by district.
divisions of the state affect those indices. In the case of infrastructure expenditures, they are around or even above 0.7 in the average British colony and around 0.6 in the average French colony. They are usually around or above 0.4 for education (proxied by students per district) and health (proxied by doctors and nurses per district). Inequality is especially high in British colonies compared to French ones. This could be in part the result of the redistributive federal budgets in French West Africa, while between-colony variation could be the result of many colony and empire factors beyond the scope of this paper. To visualize the variation, Figure 7 maps infrastructure expenditures along with the presence of the most valued natural resources by district. The correlation pattern varies by colony, seemingly high in Ghana but nonexistent in Nigeria, and overall it appears weaker than one might expect.

Figure 4: Infrastructure Gini indices by colony

Note: To quantify inequality, each colony’s Gini index is calculated using district investments (rather than individual income, which colonial data do not provide) as the units of analysis.

Infrastructure expenditures in a district-year amount to around 50,000FRA on average, in 1910 real French francs, in each empire (Table A.1). They are a bit more evenly spread in French West Africa, as also shown by the figures plotting Gini indices. French per capita expenditures (96,000FRA) are three times British expenditures (31,000FRA), but much of the difference is

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22 Interstate inequality could be altered by redrawing district boundaries. While it happened sometimes, I find that over 80% of colonial district boundaries in the 1920s and 1930s persist today.

23 Gini indices generally use individual income data to measure economic inequality, where 0 means perfect equality and 1 perfect inequality. If investments were perfectly equal across districts, the Gini index would be 0. If one district received all investments and the others received nothing, it would be 1.
driven by low investments in British East African colonies—the French had no colonies in East Africa. Within West Africa, expenditures per capita are “only” 40% higher in French colonies (Table A.2). Investments are higher in West Africa for internal and external reasons. The region was richer than East Africa already in the pre-colonial period and conquest started earlier, two factors which may have resulted in a more developed tax and tariff system during colonialism. Colonial records show that most expenditures were devoted to buildings and premises of various sorts, such as residences of district officers in both core and remote areas, port authorities, and various transportation expenditures such as railroads, roads, bridges and harbors (Table A.3).
Figure 7: Public infrastructure investments by district (1910-1939 average) and location of base and noble metals (1922)

Note: This map illustrates the colonies under study, their levels of infrastructure investments, and whether a district contained some base metal (e.g., iron, zinc) and some precious metals or stones (gold, silver or diamonds). The correlation appears to exist in some countries (Ghana) but not in others (Nigeria). There is much variation within colonies, some perhaps unexpected. The northernmost district in Mali, formerly French Soudan (SOU), had high per capita investments because of Timbuktu.

The average British and French district received close to no investments in sewage and water sanitation or in electricity and lighting, infrastructure systems that were too costly for meager colonial budgets.

5 Results

This section begins by examining the role of pre-colonial trade on colonial investments. The focus is on coastal colonies, where accidential geography provides us with some exogenous variation in the establishment of pre-colonial trade. Next, I consider possible alternative explanations such as natural resources and ethnic characteristics. I then examine the diffusion of colonial investments in both coastal and inland colonies. Finally, I conduct some exercises to determine whether investment
inequalities in 1910 increase, remain stable, or decrease during the colonial period up to World War II (1939).

I first model the relationship between coastal geography, on the one hand, and pre-colonial trade and investment outcomes, on the other, in coastal colonies (Table 1). The reduced form equation takes the following form:

$$\log(Y_{ij}) = \beta_0 + \beta_1 G_{ij} + L^T \beta_2k + N^T \beta_3k + S^T \beta_4k + \eta_j + \epsilon_{ij}, \quad (1)$$

where $Y$ is the colonial investment of interest in district $i$ in colony $j$. These are district infrastructure expenditures (adjusted to 1910 French francs), an indicator for the presence of a railroad in the district, the number of students and the number of health staff. Infrastructure, education and health outcomes are logged to increase normality. $G$ stands for natural harbors and capes, $L$ stands for other locational fundamentals, $N$ for natural resources and soil quality, $S$ for colonial district population, area and pre-colonial socioeconomic characteristics. $\eta$ are colony fixed effects that are included in all models. They account for colony-specific variation in issues ranging from different baseline levels of investments to possibly different reliability of the colonial records across colonies.

The two-stage least squares (2SLS) models follow an analogous logic to equation 1 but instrument pre-colonial trade. The exclusion restriction claim is that natural harbors and capes affect colonial investments because they enabled pre-colonial trade in the first place. Many mechanisms may account for the relationship, however, such as early investments in forts and European settlement, which I explore later. The model is as follows:

$$T_{ij} = \gamma_0 + \gamma_1 G_{ij} + L^T \gamma_2k + N^T \gamma_3k + S^T \gamma_4k + \eta_j + \nu_{ij} \quad (2)$$

$$\log(Y_{ij}) = \beta_0 + \beta_{IV} \hat{T}_{ij} + L^T \beta_2k + N^T \beta_3k + S^T \beta_4k + \eta_j + \epsilon_{ij}, \quad (3)$$

where $T$ is the presence of a pre-colonial trading post and all other variables follow the notation described above (equation 1).
Table 1: First-stage effect of geography on pre-colonial trade and reduced form effect of geography on colonial investments

<table>
<thead>
<tr>
<th></th>
<th>First-stage</th>
<th>Reduced form</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>(Natural harbor or cape)</td>
<td>(0.47** (0.11))</td>
</tr>
<tr>
<td>Colony FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Locational fundamentals</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Natural resources and</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>soil quality</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Socioeconomic</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Districts (N)</td>
<td>211</td>
<td>211</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.36</td>
<td>0.37</td>
</tr>
<tr>
<td>A-P F statistic</td>
<td>16.66</td>
<td>16.03</td>
</tr>
</tbody>
</table>

Notes: † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$. Robust standard errors in parentheses. The first-stage models show that districts with a natural harbor or a cape were more likely to have a center of pre-colonial trade. The reduced form models show that districts with a natural harbor or a cape received higher investments in all investments except for railroads, as expected. Given the highly unequal investment distributions, outcomes are logged to reduce dependence on extreme observations. The number of observations varies by colonial investment because the dataset lacks student data for Mauritania and public health staff data for Conakry. The Angrist-Pischke first-stage F-statistic is between 12 and 16 in all models, above the Stock and Yogo convention of 10 for weak instruments. The controls include the presence of a navigable river, indices for rugged terrain, tsetse fly and malaria, indicators for the presence of noble and base metals, a soil quality index, African population, area and district socioeconomic characteristics (ethnic diversity, Islam prevalence, intensity of agriculture, settlement patterns, pre-colonial political centralization and indigenous slavery).

Table 2: Second-stage results for the effect of pre-colonial trade on colonial investments

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure</th>
<th>Railroad</th>
<th>Education</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td>OLS IV</td>
<td>OLS IV</td>
<td>OLS IV</td>
<td>OLS IV</td>
</tr>
<tr>
<td>Pre-colonial trading post</td>
<td>1.97* (0.78)</td>
<td>3.88** (1.41)</td>
<td>0.01 (0.12)</td>
<td>0.03 (0.24)</td>
</tr>
<tr>
<td>Colony FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Locational fundamentals</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Natural resources and</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>soil quality</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Socioeconomic</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>characteristics</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Districts (N)</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.44</td>
<td>0.41</td>
<td>0.34</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Notes: † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$. Robust standard errors in parentheses. The table presents OLS results alongside 2SLS (IV) results. The controls are identical to those listed under Table 1.
Results from Table 1 strongly suggest that accidented geography affected the location of posts (first-stage models 1 to 3) and that it also affected infrastructure, education and health investments (reduced form models 4 to 7).\textsuperscript{24} Next, I estimate the effect of pre-colonial trading posts on colonial investments using ordinary least squares (OLS) models alongside the second stage of the two-stage least squares (2SLS or instrumental variable (IV) models). Since the outcome is logged to reduce right-skew, the percent change in $Y$ can be interpreted as $100\beta_{IV}$. The presence of a pre-colonial trading post increases expenditures in infrastructure and the number of students by about 200-300% and the number of health staff by around 100-300%, depending on the specification. The magnitude varies but the effect is large across specifications. Pre-colonial trade does not increase the likelihood of having a railroad. This null effect on railroads makes sense, since railroads were inland investments, and suggests that a different logic may account for transportation infrastructure, as discussed below, since railroads served extractive purposes further inland while early trade usually took place in coastal areas.

5.1 Other explanations

Investments are likely explained by other factors beyond pre-colonial trade. I consider some plausible complementary explanations, notably natural resources and ethnic characteristics in Table 3. Explanatory variables in the table are also present in equations 1-3 as controls. They are included simultaneously because pairwise correlations between them are always below 0.4, reducing multicollinearity concerns.\textsuperscript{25} Infrastructure expenditures are higher and railroads more likely in districts with noble metals (gold, silver) or diamonds, where they are associated with a 68% increase in infrastructure expenditures.\textsuperscript{26} However, the effect does not extend to non-extractive investments (education and health) and base metals, a less valuable but abundant type of metal in West Africa (Figure A.11), do not affect any investments.

\textsuperscript{24}The instrument and the main predictor are balanced across a set of observable pre-colonial characteristics (Tables A.4 and A.5).

\textsuperscript{25}The exception is a 0.59 correlation between distance from the coast and the tsetse fly index (Alsan, 2015).

\textsuperscript{26}Benin, Kenya, Malawi, Niger and Uganda did not have any gold, silver or diamonds as of 1920. The other 11 colonies had at least one of these three resources.
Table 3: The limited role of alternative explanations

<table>
<thead>
<tr>
<th>Geography</th>
<th>Infrastructure</th>
<th>Railroad</th>
<th>Education</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-colonial trading post</td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>(Coastal)</td>
<td>(All)</td>
<td>(Coastal)</td>
<td>(All)</td>
<td>(Coastal)</td>
</tr>
<tr>
<td>1.76** (0.64)</td>
<td>1.64* (0.64)</td>
<td>0.08 (0.11)</td>
<td>0.04 (0.11)</td>
<td>2.00** (0.40)</td>
</tr>
</tbody>
</table>

**Geography**
- Distance to coast, 100km
  - -0.18 (0.13) -0.17† (0.10) -0.02 (0.02) -0.04* (0.08) -0.18† (0.09) -0.10 (0.07) -0.09† (0.05) -0.06† (0.03)

- Navigable river (1910)
  - -0.85† (0.46) -0.30 (0.40) -0.24** (0.08) -0.20** (0.07) -0.15 (0.31) -0.19 (0.24) -0.10 (0.18) -0.06 (0.14)

- Terrain ruggedness
  - 0.50 (0.88) 0.77 (0.69) 0.05 (0.12) 0.05 (0.10) 0.64 (0.73) 0.32 (0.54) -0.09 (0.29) -0.05 (0.22)

**Natural resources**
- Noble metals (1920)
  - 0.68† (0.36) 0.46 (0.37) 0.19* (0.09) 0.20* (0.08) -0.25 (0.41) -0.22 (0.32) -0.20 (0.21) -0.13 (0.18)

- Base metals (1920)
  - 0.19 (0.43) 0.32 (0.41) -0.04 (0.09) -0.01 (0.07) 0.15 (0.23) 0.34 (0.22) 0.22 (0.17) 0.21 (0.14)

- Soil quality index (2000)
  - 0.03 (0.22) 0.19 (0.20) 0.04 (0.03) 0.02 (0.03) 0.25 (0.19) 0.08 (0.13) -0.06 (0.09) -0.04 (0.06)

**Disease environment**
- Malaria prevalence (1900)
  - -0.67† (0.36) -0.39 (0.30) -0.11* (0.05) -0.09* (0.04) -0.13 (0.30) 0.03 (0.30) -0.19 (0.22) -0.12 (0.14)

- Tsetse fly index (1970)
  - -0.22 (0.44) -0.38 (0.36) -0.04 (0.08) -0.06 (0.06) -0.19 (0.29) -0.04 (0.22) -0.08 (0.19) -0.01 (0.14)

**Ethnic and demographic characteristics**
- Ethnic fractionalization
  - 0.57 (1.08) -0.53 (0.96) -0.41** (0.15) -0.30* (0.12) -0.82 (0.70) -1.07† (0.59) -0.42 (0.39) -0.35 (0.29)

- Political centralization
  - 0.61 (0.39) 0.33 (0.32) 0.09* (0.05) 0.05 (0.04) 0.14 (0.24) -0.02 (0.18) 0.04 (0.13) 0.01 (0.09)

- Prevalence of Islam (1910)
  - -0.55 (0.35) -0.56† (0.33) -0.03 (0.05) -0.04 (0.05) -0.68** (0.23) -0.74** (0.22) -0.15 (0.13) -0.17 (0.12)

- African population, logged
  - 0.71** (0.25) 0.64** (0.23) 0.10* (0.04) 0.08* (0.03) 1.11** (0.21) 0.89** (0.18) 0.45** (0.11) 0.38** (0.09)

Colony FE: Yes

<table>
<thead>
<tr>
<th>Districts (N)</th>
<th>211</th>
<th>312</th>
<th>211</th>
<th>312</th>
<th>202</th>
<th>288</th>
<th>210</th>
<th>311</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2$</td>
<td>0.42</td>
<td>0.44</td>
<td>0.31</td>
<td>0.31</td>
<td>0.47</td>
<td>0.57</td>
<td>0.33</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Notes: † p < 0.10, * p < 0.05, ** p < 0.01. Robust standard errors in parentheses. The number of observations varies by colonial investment because the dataset lacks student data for Mauritania and public health staff data for Conakry. It also varies by whether the sample is restricted to coastal colonies or the full sample is included.
One of the main explanations for colonial inequality concerns the divide and rule strategy (Horowitz, 1985). While the practice was common, it remains unclear whether there was a systematic heuristic behind it. For instance, did Europeans invest more in pre-colonial kingdoms because they were more developed to begin with and hence initial costs were lower? This finding would be consistent with existing literature, which shows that pre-colonial kingdoms provide better public services and are more developed today (Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013; Bandyopadhyay and Green, 2016). Also, colonialists might have invested less in more ethnically diverse districts if these were more difficult to control. I find very modest support for these hypotheses using several proxies.

Using Murdock’s (1959) map of ethnic homelands, I construct an index of ethnic fractionalization at the district level and find that it only reduces the likelihood of a railroad in the district. The same applies if I use a raw measure counting the number of ethnic homelands per district. Perhaps surprisingly, higher pre-colonial political centralization does not increase investments. An alternative specification using a pre-colonial kingdom indicator is not significant across investments either, and bivariate correlations are usually below 0.1. Pre-colonial kingdoms provide better public services and are more developed today, but higher levels of colonial investments do not appear to be the mechanism behind this finding. A simple ordinal measure for prevalence of Islam (minority, mixed or majority) suggests that more Muslim districts seem to have fewer students, but causality remains unclear. In Nigeria, for instance, the Muslim North was ruled indirectly, and hence investments were lower. However, (Lugard, 1922) suggests that the reason for indirect rule is the North’s higher political centralization under the Hausa States. I also test other characteristics such as settlement patterns of the ethnic group and indigenous slavery and find insignificant results. While divide and rule was a common strategy, especially in British colonies (Wucherpfennig, Hunziker and Cederman, 2015), some of the main observable ethnic characteristics mentioned in the literature do not predict investments systematically. These null results do not rule out alternative explanations. Rather, they suggest that “ethnic” divide and rule strategies may have been context-specific instead of systematically relying on observable local characteristic.
Only two patterns emerge clearly from Table 3. First, African population is always positively correlated with investments. Investments may not have been blind to population and locals migrated to more developed districts. Second, the table also presents a correlational but coherent picture to account for the presence of railroads, the one investment that is not explained by pre-colonial trade. They were built in districts without rivers, such that the two appear to be substitutes; with natural resources, supporting an extractive logic; and that were less ethnically diverse, less malaria-prone and more populated. Beyond these two patterns, alternative explanations have a limited role in explaining colonial investments in infrastructure (other than railroads), health and education. For instance, distance to the coast, a standard control, is negative across investments as expected but not always significant. Similarly, coefficients for disease environment proxies are usually negative but often insignificant.

5.1.1 Differences by empire

I consider alternative explanations further by splitting the sample by empire, since considering them together may be masking relevant heterogeneity. While not the focus of this paper, I provide some correlational results in light of the literature comparing both empires (Hopkins, 1973; Cooper, 1996; Lee and Shultz, 2012). Figure 8 presents coefficients from the same models as in Table 3 but now split by empire. As expected, investments increase with population and pre-colonial trade in both empires.

Colonialists held many racial prejudices in both empires. However, British investments seem to discriminate more than the French based on district ethnic diversity or on an alternative measure using raw number of groups in the district. They also invest less in districts with more Muslim presence. We do not observe these correlational patterns in French colonies, consistent with the notion that the British practiced divide and rule more than the French (Wucherpfennig, Hunziker and Cederman, 2015). Finally, the estimates on pre-colonial political centralization are also insignificant in both empires.
5.2 Diffusion and persistence of colonial investments

How did investments diffuse within East and West African colonies from early enclaves to the rest of the colony? To the limited extent investments spread across districts, I examine whether early trade was relevant or instead its importance was circumscribed to these colonial development hubs. Colonial state expansion was progressive and limited because of European financial and manpower constraints. In this logic of gradual expansion, I test whether pre-colonial enclaves were important departing points to expand inland since there is evidence that “agglomeration economies attenuate with distance” (Rosenthal and Strange, 2004, p. 2120). I use linear models of the form:

\[
\log(Y_{ik}) = \beta_0 + \beta_1 T + \beta_2 DT + \beta_3 DC + \beta_4 P + \beta_5 E + \eta_k + \epsilon_{ik},
\]

where \( Y \) is the investment of interest, \( T \) is an indicator for pre-colonial trade post, \( DT \) is the distance between the district capital and the nearest pre-colonial trading post, \( DC \) is the distance between the district capital and the coast, \( P \) is logged population, \( \eta \) are country fixed effects. \( E \)
is the logged number of Europeans, a potentially relevant mechanism. I include a pre-colonial trading post indicator and the standard coastal distance measure to examine variation between districts without a trading post that is not already explained by coastal distance. I use geodesic distances between district capitals advisedly because it eliminates the endogeneity of man-made infrastructure such as roads and even local geography such as hills and rivers.

Table 4: Diffusion of investments (1910-1939) across districts within coastal colonies

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure</th>
<th>Railroads</th>
<th>Education</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td></td>
</tr>
<tr>
<td>Pre-colonial trading post indicator</td>
<td>1.46*</td>
<td>0.04</td>
<td>1.92**</td>
<td>1.25**</td>
</tr>
<tr>
<td></td>
<td>(0.66)</td>
<td>(0.12)</td>
<td>(0.41)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>Distance from post, in 100km</td>
<td>-0.27**</td>
<td>-0.05**</td>
<td>-0.14*</td>
<td>-0.06†</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.01)</td>
<td>(0.06)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Distance to coast</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>African population</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Districts (N)</td>
<td>211</td>
<td>211</td>
<td>202</td>
<td>210</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.38</td>
<td>0.20</td>
<td>0.42</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Notes: † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$. Robust standard errors in parentheses.

Table 5: European settlers as a colonial investment diffusion mechanism

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure</th>
<th>Railroads</th>
<th>Education</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td></td>
</tr>
<tr>
<td>Pre-colonial trading post indicator</td>
<td>0.38</td>
<td>-0.13</td>
<td>1.47**</td>
<td>0.79**</td>
</tr>
<tr>
<td></td>
<td>(0.62)</td>
<td>(0.12)</td>
<td>(0.40)</td>
<td>(0.20)</td>
</tr>
<tr>
<td>Distance from post, in 100km</td>
<td>-0.21**</td>
<td>-0.04**</td>
<td>-0.10*</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.01)</td>
<td>(0.05)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>European population, logged</td>
<td>0.99**</td>
<td>0.13**</td>
<td>0.48**</td>
<td>0.43**</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.02)</td>
<td>(0.13)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Distance to coast</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>African population</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Districts (N)</td>
<td>200</td>
<td>200</td>
<td>191</td>
<td>199</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.53</td>
<td>0.31</td>
<td>0.48</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Notes: † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$. Robust standard errors in parentheses.

Increasing distance from a pre-colonial trading post reduces all types of investments (Table 4). The results are not identified but suggest that the limited diffusion of colonial investments we observe is partly a function of early trade, consistent with Gaikwad’s (2014) findings in India. The negative effect of increasing distance from early trade likely goes through many channels, one
of which could be European settlers. They chose districts that were centers of economic activity, which should compound even further the advantages of early trading locations (such as Dakar and Lagos) and their surroundings (Thies and Abeokuta, respectively). Including European settlers in the model supports the idea that they are a relevant mechanism across investments (Table 5). The effect of distance from a pre-colonial post remains negative but is smaller across investments, consistent with the idea that settlers influenced the diffusion of investments.

I also examine the persistence of public investment inequalities during the 1910-1939 colonial period.\textsuperscript{27} Serial correlations show that inequalities are persistent in both empires for the three main public investments (infrastructure, education and health), especially in education and infrastructure (Figures A.1 and A.2). To examine whether these disparities increase, I use autoregressive models in the case of French West Africa (Tables A.6-A.8), where the panel structure is less unbalanced than in British colonies. Results are mixed in infrastructure, while in education and health initial disparities either remain constant or increase. Overall, the exercises in this section do not disentangle the mechanisms of persistence, as future research should. They show, however, that the importance of early trade extends beyond initial enclaves; that disparities in public investments tend to remain stable or increase; and that European settlers are a mechanism in this feedback loop of weakly increasing disparities within colonies.

\section{Conclusion}

In this paper, I present evidence that investments in infrastructure, health and education within British and French African colonies were strikingly unequal across districts. Using district-level data, I quantify this inequality in investments by constructing a Gini index for each of the 16 colonies and each of the main three investment categories. Inequality was around 0.7 in British colonies and around 0.5 in French colonies. Those regional inequalities are higher than in many countries in recent decades (Milanovic, 2016).

\textsuperscript{27}Pre-20th century differences in investments are difficult to measure mostly because systematic records for the pre-colonial period are scarce.
I provide evidence that pre-colonial trade, rather than natural resources or ethnic characteristics, is the root cause for this high within-colony inequality in investments. In doing so, the focus of the explanation shifts away from an identity logic to an economic logic. Divide and rule along regions and ethnic groups was common, especially in British colonies (Wucherpfennig, Hunziker and Cederman, 2015). However, I find little support for some of its observable implications. Instead of systematically relying on some ethnic or regional characteristic, divide and rule strategies may have been context-specific. To identify the impact of trade, I instrument pre-colonial trading posts with the presence of a natural harbor or cape—adapting Jha (2012) and Gaikwad’s (2014) instrument for the case of South Asia—to increase confidence in the causality of the estimates. Colony fixed effects increase comparability and account for institutional and other colony-level factors.

The positive effects of early trade on public investments are not circumscribed to those trading enclaves: infrastructure, education and health investments decrease the further a district is from a pre-colonial trading post. Findings in developed countries showing that “agglomeration economies attenuate with distance” (Rosenthal and Strange, 2004, p. 2120) may extend to colonies in their early stages of state formation and development. Yet, I show that investment inequalities across districts do not diminish during much of the colonial period (1910-1939). Those locations with an early geographic advantage, typically colonial capitals and trading posts, became centers of colonial economic activity and likely benefited from complementarities between investments, consistent with a logic of increasing returns. I also provide some evidence that European settlers are a mechanism behind this inequality. They came to East and West Africa in any significant numbers only in the 20th century, but they reinforced this feedback loop between pre-colonial trade and colonial investments.

More broadly, the findings speak to research that highlights the importance of pre-colonial trade for current development in Africa and South Asia. The pre-colonial slave trade had nefarious consequences at the “point of origin” or extraction (Nunn and Wantchekon, 2011). Perversely, it increased colonial investments and development at the African “point of destination” where the trade took place. This result is consistent with historical accounts in Africa (Curtin et al., 1995)
and with Gaikwad (2014), who shows that areas in India with pre-colonial trading ports are more
developed today. Compared to East and West Africa, Europe’s trade with India in textiles and
raw materials was much more advanced and industrialized. Yet, I find that pre-colonial trade
increased colonial development even in a highly extractive context where slaves a central export
until the 19th century.

There are at least two areas for further research. One concerns differences between empires.
Why were infrastructure, health and education investments in British colonies even more unequal
than in French ones? One reason could be institutional: French colonies had a redistributive federal
budget that aided poorer colonies while the British did not. Also, this paper finds weak evidence
that the British were more discriminatory in their investments insofar as, unlike the French, they
may have invested less in districts more ethnically diverse districts and in those with higher Muslim
presence. These patterns are consistent with existing literature, but they ought to be explored
further. A second area of future research concerns the consequences of colonial investments for
current welfare (Huillery, 2009). Existing research focuses on the long-term impact of colonialism,
but future research should aim to better understand and quantify the long-term impact of pre-
colonial trade and colonial investments on current outcomes in former British and French Africa.

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1401.


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Appendix A: Tables

Table A.1: Infrastructure expenditures (1910-1939 average) in East and West African districts (in 1910 FRA)

<table>
<thead>
<tr>
<th></th>
<th>Districts (N)</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Median</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>British colonies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure expenditures</td>
<td>200</td>
<td>44,086</td>
<td>153,461</td>
<td>0</td>
<td>2,834</td>
<td>1,551,032</td>
</tr>
<tr>
<td>Infrastructure exp. per 100,000 people</td>
<td>200</td>
<td>31,633</td>
<td>110,059</td>
<td>0</td>
<td>3,108</td>
<td>1,134,658</td>
</tr>
<tr>
<td>French colonies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure expenditures</td>
<td>112</td>
<td>51,240</td>
<td>130,562</td>
<td>0</td>
<td>12,112</td>
<td>1,150,341</td>
</tr>
<tr>
<td>Infrastructure exp. per 100,000 people</td>
<td>112</td>
<td>96,397</td>
<td>276,465</td>
<td>0</td>
<td>14,451</td>
<td>1,940,058</td>
</tr>
</tbody>
</table>

Note: Average expenditure per district was not very different across empires. However, per capita expenditures were higher in French colonies. British colonies spanned East and West Africa, while the French did not have colonies in East Africa.

Table A.2: Infrastructure expenditures (1910-1939 average) in West African districts (in 1910 FRA)

<table>
<thead>
<tr>
<th></th>
<th>Districts (N)</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Median</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>British colonies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure expenditures</td>
<td>66</td>
<td>107,974</td>
<td>249,909</td>
<td>0</td>
<td>20,117</td>
<td>1,551,032</td>
</tr>
<tr>
<td>Infrastructure exp. per 100,000 people</td>
<td>66</td>
<td>70,282</td>
<td>180,251</td>
<td>0</td>
<td>9,706</td>
<td>1,134,658</td>
</tr>
<tr>
<td>French colonies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure expenditures</td>
<td>112</td>
<td>51,240</td>
<td>130,562</td>
<td>0</td>
<td>12,112</td>
<td>1,150,341</td>
</tr>
<tr>
<td>Infrastructure exp. per 100,000 people</td>
<td>112</td>
<td>96,397</td>
<td>276,465</td>
<td>0</td>
<td>14,451</td>
<td>1,940,058</td>
</tr>
</tbody>
</table>

Note: Subsetting the data to West Africa shows that British expenditures were higher in the aggregate but still lower on a per capita basis.

Table A.3: Infrastructure expenditures by category (1910-1939 average) in East and West African districts (in 1910 FRA)

<table>
<thead>
<tr>
<th></th>
<th>Districts (N)</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Median</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>British colonies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buildings</td>
<td>200</td>
<td>18,364</td>
<td>79,394</td>
<td>0</td>
<td>1,175</td>
<td>974,900</td>
</tr>
<tr>
<td>Transportation</td>
<td>200</td>
<td>10,159</td>
<td>25,484</td>
<td>0</td>
<td>219</td>
<td>168,122</td>
</tr>
<tr>
<td>Sewage/water</td>
<td>200</td>
<td>8,784</td>
<td>45,625</td>
<td>0</td>
<td>0</td>
<td>487,848</td>
</tr>
<tr>
<td>Electricity/lighting</td>
<td>200</td>
<td>6,779</td>
<td>41,014</td>
<td>0</td>
<td>0</td>
<td>451,596</td>
</tr>
<tr>
<td>French colonies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buildings</td>
<td>112</td>
<td>22,688</td>
<td>87,264</td>
<td>0</td>
<td>5,854</td>
<td>907,381</td>
</tr>
<tr>
<td>Transportation</td>
<td>112</td>
<td>20,535</td>
<td>49,458</td>
<td>0</td>
<td>3,423</td>
<td>276,964</td>
</tr>
<tr>
<td>Sewage/water</td>
<td>112</td>
<td>7,238</td>
<td>30,153</td>
<td>0</td>
<td>409</td>
<td>220,133</td>
</tr>
<tr>
<td>Electricity/lighting</td>
<td>112</td>
<td>780</td>
<td>3,735</td>
<td>0</td>
<td>0</td>
<td>32,367</td>
</tr>
</tbody>
</table>

Note: Unpacking infrastructure expenditures shows that sewage/water and electricity/lighting was nonexistent in the median district. Investments were centered on buildings, presumably to affirm colonial presence, and transportation, presumably for revenue collection and extraction purposes.
Table A.4: Covariate balance between coastal districts with a natural harbor or cape (Yes) and those without (No)

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ethnic groups in the district</td>
<td>4.257</td>
<td>3.095</td>
<td>0.167</td>
</tr>
<tr>
<td>Ethnic Fractionalization Index</td>
<td>0.426</td>
<td>0.335</td>
<td>0.200</td>
</tr>
<tr>
<td>Gathering</td>
<td>0.104</td>
<td>0.218</td>
<td>0.180</td>
</tr>
<tr>
<td>Hunting</td>
<td>0.869</td>
<td>0.690</td>
<td>0.234</td>
</tr>
<tr>
<td>Fishing</td>
<td>1.106</td>
<td>1.585</td>
<td>0.022</td>
</tr>
<tr>
<td>Intensity of agriculture (none to irrigation)</td>
<td>2.936</td>
<td>3.279</td>
<td>0.143</td>
</tr>
<tr>
<td>Settlement patterns (nomadic to complex)</td>
<td>6.248</td>
<td>6.626</td>
<td>0.400</td>
</tr>
<tr>
<td>Political centralization (acephalous to kingdoms)</td>
<td>2.343</td>
<td>2.372</td>
<td>0.909</td>
</tr>
<tr>
<td>Slavery (absence to prevalent)</td>
<td>2.268</td>
<td>2.262</td>
<td>0.972</td>
</tr>
<tr>
<td>Prevalence of Islam (1910)</td>
<td>0.543</td>
<td>0.667</td>
<td>0.592</td>
</tr>
<tr>
<td>Malaria prevalence index (1900)</td>
<td>3.104</td>
<td>2.927</td>
<td>0.419</td>
</tr>
<tr>
<td>Tsetse fly prevalence index (1970)</td>
<td>1.822</td>
<td>1.603</td>
<td>0.420</td>
</tr>
</tbody>
</table>

Note: N=56. The table shows balance along a set of pre-colonial covariates except in fishing, measured as percentage of the population of the ethnic group engaged in fishing as defined in Murdock (1959). List of districts with a natural harbor: Boke, Calabar, Casamance, Conakry, Dakar, Dar es Salaam, Freetown, Lagos, Lamu, Mikindani, Mombasa, Owerri, Saint Louis, Sherbro, Sine Saloum, Tanga. List of districts with a cape: Ahanta, Baie du Levrier (Nouadhibou), Cape Coast, Dakar, Freetown, Keta, Warri.

Table A.5: Covariate balance between coastal districts with pre-colonial trading posts (Yes) and those without (No)

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural harbor or cape indicator (instrument)</td>
<td>0.265</td>
<td>0.545</td>
<td>0.034</td>
</tr>
<tr>
<td>Number of ethnic groups in the district</td>
<td>4.412</td>
<td>2.909</td>
<td>0.069</td>
</tr>
<tr>
<td>Ethnic Fractionalization Index</td>
<td>0.429</td>
<td>0.334</td>
<td>0.180</td>
</tr>
<tr>
<td>Gathering</td>
<td>0.202</td>
<td>0.061</td>
<td>0.090</td>
</tr>
<tr>
<td>Hunting</td>
<td>0.706</td>
<td>0.949</td>
<td>0.102</td>
</tr>
<tr>
<td>Fishing</td>
<td>1.298</td>
<td>1.267</td>
<td>0.884</td>
</tr>
<tr>
<td>Intensity of agriculture (none to irrigation)</td>
<td>3.168</td>
<td>2.906</td>
<td>0.261</td>
</tr>
<tr>
<td>Settlement patterns (nomadic to complex)</td>
<td>6.275</td>
<td>6.565</td>
<td>0.515</td>
</tr>
<tr>
<td>Political centralization (acephalous to kingdoms)</td>
<td>2.282</td>
<td>2.465</td>
<td>0.476</td>
</tr>
<tr>
<td>Slavery (absence to prevalent)</td>
<td>2.251</td>
<td>2.287</td>
<td>0.836</td>
</tr>
<tr>
<td>Prevalence of Islam (1910)</td>
<td>0.618</td>
<td>0.545</td>
<td>0.753</td>
</tr>
<tr>
<td>Malaria prevalence index (1900)</td>
<td>2.911</td>
<td>3.233</td>
<td>0.134</td>
</tr>
<tr>
<td>Tsetse fly prevalence index (1970)</td>
<td>1.663</td>
<td>1.858</td>
<td>0.472</td>
</tr>
</tbody>
</table>

Note: N=56. The table shows balance along a set of pre-colonial covariates except in the instrument, as expected, and marginally \( p < 0.1 \) in the number of ethnic groups and in the importance of gathering as an economic activity as defined in Murdock (1959). List of districts with a pre-colonial trading post: Accra, Ada, Ahanta, Assinie, Bagamoyo, Bassam, Calabar, Cape Coast, Casamance, Conakry, Cotonou, Dakar, Freetown, Keta, Kilifi, Kilwa, Lagos, Mombasa, Ouidah, Porto Novo, Saint Louis and Tanga.
Appendix B: Persistence during colonial times

Education inequalities seem persistent: serial correlations for the number of students and teachers in French West African districts are around 0.8 (Figure A.1) across years with sufficient data between 1910 and 1939. In health staff, the correlation is above 0.5, and for infrastructure it is around 0.95 for any of the three pairwise correlations. In the case of British colonies, the number of schools, students and health staff also correlate at 0.8 or above, while for infrastructure investments it is 0.57 (Figure A.2). The pattern is overall similar in both empires: those ahead in the 1910s are still ahead at the eve of World War II, even if shocks such as the Great War and the Great Depression reduced overall levels of revenue collection and therefore investment (Gardner, 2012, p. 6).

Figure A.1: Persistence of public investments in French West Africa

Note: The correlation matrices show continuity in logged levels of public investments over time. Both X and Y axis use the same logged scale.

I test more formally whether investment patterns over time converged or diverged for the case of French West Africa using autoregressive models with one lag (AR1) (equation 5). One advantage of AR1 models, as opposed to simple serial correlations, is that the constant controls for deterministic trends.\(^{28}\) I also examine whether initial levels of colonial investments \((I_{t0})\) predict

\(^{28}\)In other words, the constant would capture a constant increase across districts due to inflation (already accounted for by using real 1910FRA), a larger budget, or other factors.
Figure A.2: Persistence of public investments in British East and West Africa

Note: The correlation matrices show continuity in logged levels of public investments over time. Both X and Y axis use the same logged scale.

Inequality was already high in the early 1900s, yet all models except one indicate either increasing ($\beta > 0$) or constant ($\beta = 0$) disparities in educational, health and infrastructure investments,
consistent with a logic of increase returns. Teachers per district in 1915 predict a later increase in teachers, and the same seems to apply to health staff. The results on infrastructure investments vary depending on the specification. Public facilities such as schools and hospitals likely benefited from complementarities and economies of agglomeration more than basic infrastructure, part of which was intended to create transportation networks with more remote areas in the colony.
Table A.8: Disparities in health investments per district (1915-1939)

<table>
<thead>
<tr>
<th></th>
<th>(1) levels (eq. 5)</th>
<th>(2) FD (eq. 6)</th>
<th>(3) levels (eq. 5)</th>
<th>(4) FD (eq. 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health staff, lagged</td>
<td>0.40**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health staff in 1915</td>
<td>0.82**</td>
<td>0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.16)</td>
<td>(0.09)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health staff, logged first lag</td>
<td></td>
<td>0.61**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health staff in 1915, logged</td>
<td></td>
<td>0.35**</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.05)</td>
<td>(0.04)</td>
<td></td>
</tr>
<tr>
<td>Districts (N)</td>
<td>178</td>
<td>267</td>
<td>178</td>
<td>267</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.94</td>
<td>0.23</td>
<td>0.97</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Notes: †$p < 0.10$, *$p < 0.05$, **$p < 0.01$. Robust standard errors in parentheses for panel data models (1 and 3).
Appendix C: Figures

Figure A.3: Public expenditures by district in British colonies (1920-1938, in 1910 FRA)
Figure A.4: Public expenditures by district in French colonies (1910-1939, in 1910 FRA)
Figure A.5: Students by district in British colonies (1920-1938)

Note: British colonial records (the Blue Books) do not provide disaggregated education data for Malawi.
Figure A.6: Students in French colonies (1910-1939)

Note: Student data for Mauritania is missing in Huillery (2009)
Figure A.7: Public health staff by district in British colonies (1920-1938)
Figure A.8: Public health staff in French colonies (1910-1939)
Table 11: Population and Vital Statistics

<table>
<thead>
<tr>
<th>Sex</th>
<th>Registered Births</th>
<th>Registered Deaths</th>
<th>Marriages</th>
<th>Divorces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>123,456</td>
<td>65,432</td>
<td>12,345</td>
<td>1,234</td>
</tr>
<tr>
<td>Female</td>
<td>112,345</td>
<td>54,321</td>
<td>11,234</td>
<td>1,123</td>
</tr>
</tbody>
</table>

Figure A.9: Pages of a Blue Book page for Uganda, 1945 (left) and of a Compte Définitif for Benin, 1928 (right)
Figure A.10: Colonial map of Nigeria (1948)

Figure A.11: Natural resources in West Africa