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The Predicament of Establishing Persistence: Slavery and Human Capital in Africa

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ABSTRACT

We investigate the impact of historic slave trade on contemporary educational outcomes in Africa by replicating the empirical approach in Nunn (2008) and Nunn and Wantchekon (2011). We show that slavery's long-term legacy for literacy depends on how spatial effects are accounted for. In cross-country regressions, exposure to historic slave trade negatively predicts contemporary literacy. However, within countries, individuals whose ethnic ancestors were historically more exposed to slave exports, have higher education levels today compared to individuals from ethnicities less exposed to slave trade in the past. We argue that these somewhat puzzling findings resonate with emerging critiques of persistence studies that link historical variables with long-run development outcomes.

Keywords: Slave trade, literacy, life expectancy, persistence

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Introduction

The question as to why Africa has persistently lagged behind in development has puzzled many scholars, spawning a vast body of literature that probes the African exception in underdevelopment through a variety of prisms, including the role of such factors as geography, colonialism, and institutions (Acemoglu and Robinson, 2010; Collier and Gunning, 1999; Easterly and Levine, 1997; Gallup *et al.*, 1999). Recent literature has focused on the impact of one key extractive institution, slavery, that has profoundly influenced Africa's development. Nathan Nunn's seminal contribution, Nunn (2008), showed that the slave trade between 1400 and 1900 had a lingering impact on Africa's development. His empirical findings demonstrated that African countries that exported a larger fraction of slaves during this period had lower levels of real GDP per capita in 2000.[1] Nunn's empirical insights have inspired a rich literature on the long-run consequences of slavery. Subsequent studies have linked slavery with ethnic stratification (Whatley and Gillezeau, 2011), income inequality (Soares *et al.*, 2012), mistrust (Nunn and Wantchekon, 2011), poverty and defective provision of public goods (Acemoglu *et al.*, 2012).[2]

In this paper, we seek to contribute to this debate by empirically extending Nunn's work through an exploration of slavery's impact on education. While the literature on slavery and development has branched into several areas, a direct empirical connection between slavery and human capital has not yet been systematically established. The most relevant empirical contribution on the subject draws on a non-African context, Colombia, where municipalities with greater slavery in colonial times had lower secondary enrolment rates in the long-run (Acemoglu *et al.*, 2012). Other studies have implicitly recognized the possible impact of slavery on education. Slavery is sometimes described as a shock to the distribution of endowments in a country, which can, in turn, systematically exclude some segments of society from access to human capital accumulation (Soares *et al.*, 2012).

Why should slavery matter for contemporary human capital? Many of the factors that Nunn's original contributions (Nunn, 2008; Nunn and Wantchekon, 2011) emphasized in the context of slavery's impact on income and trust are

[1]Earlier work by Manning (1981) modelled the massive depopulation undergone by the African continent over the five centuries during which the slave trade was preponderant, thus reducing production capacities (Manning, 1981). Klein (2001) argued that the threat of enslavement through raiding and conflict, and later the enslavement of same community members and eventually family, led to the emergence of new alliances and the collapse of existing ones, exacerbating ethnic fractionalization and resulting in a high political instability.

[2]This is not an exhaustive list. Bertocchi and Dimico (2012) present evidence on the persistence of a racial gap in education in the United States. Other, such as Bhattacharyya (2009), have downplayed the adverse effect of slave trade relative to other competing explanations, such as the incidence of malaria (as probed by Gallup *et al.* (1999) and Kiszewski *et al.* (2004)), and colonial rule (as developed in Acemoglu *et al.* (2001)).

also relevant for education. Historic exposure to slave trade engendered conflict, fractionalization, and a culture of mistrust. All of these could matter for contemporary education. There is abundant evidence that ethnic fractionalization negatively affects public service provision, including access to health and education (Alesina *et al.*, 1999; Miguel and Gugerty, 2005). Another reason may have to do with the "culture of mistrust" engendered by slavery, which could conceivably impact educational provision through collective action-based explanations. By lowering trust among neighbors, family and community, slave trade is likely to have shaped the quality of local governance institutions (Nunn and Wantchekon, 2011). Local governance arrangements, in turn, could shape both the quantity and quality of educational provision. Thus, slavery could affect education through both internally transmitted cultural beliefs and norms as well as through the external environment shaped by domestic institutions and conflict.[3]

To investigate the long-run consequences of slavery for contemporary education in Africa, we re-estimate the empirical specifications in Nunn (2008) and Nunn and Wantchekon (2011) using relevant measures of education as dependent variables. Our empirical analysis proceeds in two inter-related steps. Firstly, we estimate cross-country regressions of contemporary literacy on slave exports. Secondly, we combine data on slave trade exposure at the ethnic group level with subnational data on educational attainment from the Afrobarometer survey to investigate whether, within a country, individuals whose ethnic ancestors had a greater exposure to slave trade in the past are less educated today (relative to individuals whose ethnic group was less exposed to slavery). While the unit of analysis in the former is country, the second empirical component exploits more granular variation at the level of individuals and ethnicity. This allows us to use fine-grained information on various geographic, colonial, and individual-level characteristics, such as age, gender, and occupational fixed effects.

Our empirical replications yield an intriguing set of findings. The cross-country regression analysis shows that the intensity of historic slave trade is a robust predictor of contemporary literacy rates in Africa. Specifically, we find that countries that exported more slaves in the past, relative to their size, had systematically lower literacy rates in 2000 compared to countries with less slave exports. The negative impact of slavery is a surprisingly robust feature of the data. It survives after accounting for the possible endogeneity

[3]Slavery can also shape many of the essential preconditions for human development, such as political and economic instability, urbanization, and health status. These can shape conditions for both the supply and demand of education. For instance, the perverse institutional environment associated with slavery can result in inadequate spending on education. On the demand side, individuals with shorter life expectancy are less likely to spend time in school. This is especially true if the returns to schooling are perceived to be low. These mechanisms are rarely straightforward to uncover, but they can together shape an adverse context for human capital accumulation.

of slave exports and the competing role of income, institutions, and geography in explaining variation in contemporary literacy. While Nunn's finding of slavery's impact on income is sensitive to the inclusion of a measure of malaria vulnerability (Kelly, 2019), the effect of slavery on literacy remains robust to controlling for malaria ecology and the proportion of European settlers in 1900. Notwithstanding the small sample size, we offer some preliminary evidence on mechanisms and highlight the mediating role of health and urbanization.

Contrary to the cross-country evidence, our subnational estimations that utilize data on individual survey respondents from two contemporary waves of Afrobarometer survey (2005 and 2008) posit a different empirical pattern. We find that, controlling for country fixed effects, the measure of slave exports has a positive and statistically significant effect on contemporary educational attainment. This effectively implies that, within countries, individuals whose ethnic ancestors were more intensely exposed to slave trade in the past have systematically lower levels of education today (relative to individuals whose ancestors had less exposure to slavery). Splitting the sample into subregions within Africa and re-estimating the main specification, we demonstrate that the positive impact of slavery is mainly driven by coastal countries. Recognizing the possibility that historic exposure to slave trade could determine the location of Christian missions and, thereby, education (Cagé and Rueda, 2016; Gallego and Woodberry, 2010; Okoye and Pongou, 2021), our individual-level regressions consistently include an ethnic group's exposure to Christian missions and the disease environment through malaria prevalence. Following Nunn and Wantchekon, we also include a battery of individual, ethnicity, and colonial-level controls. The result also survives after directly controlling in the model for the distance of an individual's ethnic group to the coast during slave trade, to the Saharan trade routes, and to historical reliance on fishing.

While these findings might appear as puzzling or counter-intuitive, they resonate with emerging concerns on persistence studies that the recent literature in historical political economy has highlighted (Abad and Maurer, 2021; Kelly, 2019). An important concern underlined by these critiques relates to spatial or geography-related factors. Effects of historical variables are relative to where the comparison units are located, how they are defined, and the pattern of spatial dependence (Kelly, 2020). Taking cue from this, Abad and Maurer (2021) re-estimate the main specification in some prominent persistence papers and show that the inclusion of World Bank's regional classifications as additional controls weakens the results. This helps to demonstrate that persistence papers can be sensitive to spatial dependence, manifested in this instance through "variation due to being in the same part of the world" (p. 58).

Another important concern with persistence studies is the "compression of history" that emanates from regressing a historical variable on outcomes measured several centuries later (Austin, 2008). This is especially evident in

the case of slavery which predated the colonial period. Considerable time has elapsed between the initial exposure to slave trade and modern day outcomes. It is important to determine what might have happened in the intervening periods. There are at least three major time spans that are important for assessing slavery's impact on education: the pre-colonial exposure to slave trade, colonialism, and the creation of national borders for modern African states. Our results are consistent with the suggestion that what happens after independence is important for appreciating slavery's long-run impact on education. Overall, our empirical replications of two influential works on slavery by Natthan Nunn in the context of education leave some nontrivial implications for the persistence literature, and highlight the importance of both spatial and temporal factors.

The remainder of this paper is organized as follows. The next section sets out the empirical specifications and underlying data for regression analysis. Section "Empirical Results" presents results for cross-country and individual-level regressions. The last section concludes the paper.

Empirical Specifications and Data

To investigate the impact of historic exposure to slavery on educational outcomes, we replicate the main empirical specifications in Nunn (2008) and Nunn and Wantchekon (2011). We offer below a brief description of the estimation strategy and the underlying data. For a more detailed exposition, the interested reader is referred to Nunn (2008) and Nunn and Wantchekon (2011).

Cross-country Analysis

We begin by replicating the specification in Nunn (2008) and replacing his dependent variable, the natural logarithm of real GDP per capita in 2000, with literacy rates in 2000. The estimating equation takes the following form:

$$LiteracyRate2000_i = \alpha + \beta \ln(Exports/Area)_i + \theta CD_i + \zeta X_i + \epsilon_i \qquad (1)$$

The average literacy rate of adults aged 15 years and above is a commonly used measure of education. Literacy is defined as "the ability to read and write with understanding a simple statement related to one's daily life. It involves a continuum of reading and writing skills, and often includes also basic arithmetic skills (numeracy)" (UNESCO, 2006a). We obtained literacy rates in

2000 for 51 of the 53 African countries from the UNESCO database,[4] and have tested the robustness of our findings to alternative measures of educational outcomes, such as enrolment rates or average years of schooling. Our main variable of interest is a measure of slave exports constructed by Nunn (2008), and defined as the natural logarithm of the total number of slaves exported between 1400 and 1900 normalized by land area (available for 52 countries). The measure is based on a combination of data recording the number of slaves exported from each port or region (shipping data) with data on the ethnic identity of the slaves shipped (ethnicity data). Ethnicities are then mapped to countries and aggregated at the country level in order to obtain estimates of the number of slaves shipped by each country.[5] Since bigger countries are more likely to export slaves, these estimates need to be normalized by some measure of the country size; in this case, land area.[6]

CD is a vector of colonial dummies and X denotes a vector of control variables. We retain the primary set of controls included in Nunn (2008) given their relevance for explaining cross-country differences in literacy rates. The colonial dummy variables indicate the colonizer's origin prior to independence. Their inclusion is justified on the grounds that colonial rule occurred later than slave trade and is likely to be accountable for some of the country-level differences.[7] The legal origin inherited from the colonial power can also have a powerful influence on a colony's performance and later outcomes, including literacy. To account for this, we retain dummy variables for legal origin originally compiled by La Porta *et al.* (1999).[8] The following geographical controls are also included: distance from the equator, longitude, minimum monthly rainfall, lowest average temperature, and average maximum humidity. Other variables include: regional dummies, an island indicator, and proximity to the coast measured as the natural logarithm of the ratio of coastline to total land area.

Like Nunn (2008), we include the following empirical proxies for natural resource endowments: the natural logarithms of the average for the period 1970–2000 of per capita production of gold, oil, and diamonds. These are relevant for our literacy regressions given prior evidence on the relationship between natural

[4]The dataset has been completed with the 2001 value for Angola and Sao Tome and Principe and with the 2002 value for Seychelles. The only country for which no data was available is Somalia.

[5]For more details on the construction of the measure, please see Nunn (2007, 2008).

[6]Nunn normalizes the number of slaves exported by each country using both land area and historic population. The normalization by land yields the preferred measure, although our results are robust to normalization by historic population.

[7]For example, Grier (1999) shows that owing to their more decentralized approach, British colonizers have left their colonies better educated than the French.

[8]In the sample of African countries the relevant categories are French civil law or English common law. Legal traditions are defined as: English common law, French civil law, German civil law, Scandinavian law, and socialist law.

resource abundance and education in Gylfason (2001). To account for a crude cultural explanation for educational development, the percentage of Muslims in a country's total population is also retained in the basic specification. We supplement Nunn's specification with two predetermined characteristics that could potentially shape literacy in the long-run: the percentage of European settlers in 1900 and the index of malaria ecology. Data on European settlers comes from Acemoglu *et al.* (2003). The malaria ecology index is derived from Kiszewski *et al.* (2004) and represents the stability of malaria (*Falciparum*) transmission.[9] Our empirical analysis will also include measures of GDP, health, urbanization, ethno-linguistic fractionalization, political instability, and conflict. These variables will be defined as and when introduced in the analysis.

Figure 1 provides an initial glimpse of the unconditional correlation between the natural logarithm of slave exports normalized by land area and literacy rates in 2000. As is evident from Figure 1, countries with a historically greater share of slave exports seem to have systematically lower literacy rates in 2000. Going beyond this unconditional correlation, our analysis will formally investigate the empirical connection between slavery and literacy.

Sub-regional Analysis

In the second part of empirical analysis, we replicate the empirical specification in Nunn and Wantchekon (2011) to investigate whether individuals belonging to ethnic groups who were more intensely exposed to slave trade in the past are less educated today than individuals from less exposed ethnic groups. To do so, we estimate the following equation:

$$\begin{aligned} Education_{i,e,d,c} &= \alpha_c + \beta SlaveExports_e + X'_{i,e,d,c}\Gamma + X'_{d,c}\Omega \\ &\quad + X'_e\Phi + \varepsilon_{i,e,d,c} \end{aligned} \tag{2}$$

where i denotes individuals, e ethnic groups, d districts, and c represents countries. Education is a categorical variable for education level of the individual that has the following categories, ranging from 0 to 9: (i) no formal schooling, (ii) informal schooling only, (iii) some primary schooling, (iv) primary school completed, (v) some secondary school/high school, (vi) secondary school completed/high school, (vii) postsecondary qualifications, but no university, (viii) some university, (ix) university completed, and (x) postgraduate. *Slave*

[9]Classic indices of malaria incidence are constructed as the product of the fraction of each country's land area subject to malaria and the fraction of malaria falciparum cases in the same country. However, such measures rely heavily on surveillance and reporting systems and are thereby likely to be biased. Kiszewski *et al.* (2004) have derived an arguably more exogenous index called "malaria ecology", based on the contribution of mosquito vectors to malaria transmission as well as on climatological conditions.

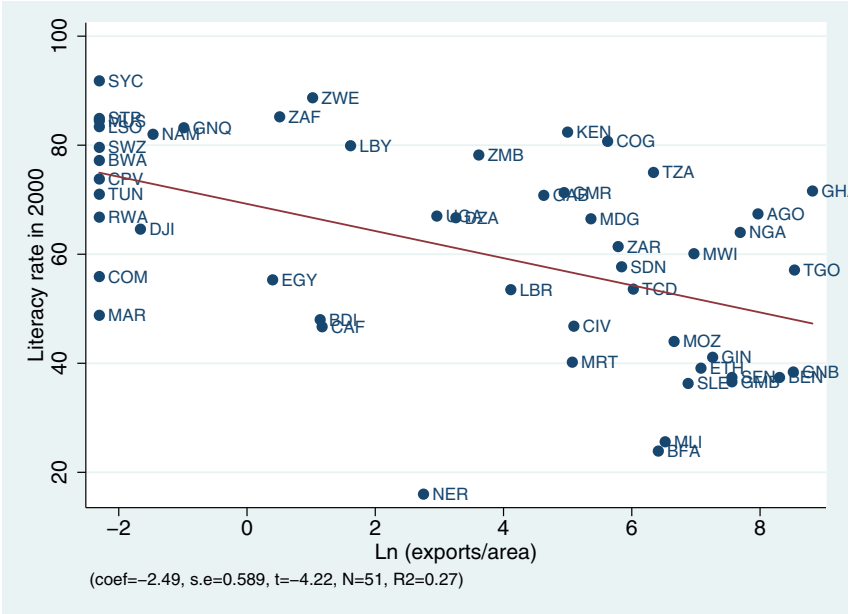


Figure 1: Literacy rates and slave exports.

$exports_e$ is the natural log of one plus slave exports normalized by land area inhabited by the ethnic group in the 19th century. β is the coefficient of interest that captures the relationship between slave exports from an individual's ethnic group and their current level of education.

$\chi'_{i,e,d,c}$ is a vector of individual-level controls that captures the respondent's age, age squared, an indicator variable for their gender identity, an indicator variable for whether they reside in an urban location, five living condition fixed effects, 18 religion fixed effects, and 25 occupation fixed effects. χ'_d is a set of district-level controls, which include the ethnic fractionalization of the respondent's district, and the share of the district's population, that is, of the same ethnicity as the respondent. χ'_e is a vector that controls for historical characteristics of ethnicities and differences in their exposure to colonial rule. As is clear from the above set-up, many controls in the estimating equating vary across ethnicities or districts, rather than at the individual-level. To control for within-group correlation of residuals, standard errors are clustered at the ethnicity and district level. Detailed justification for the inclusion of specific controls is offered in Nunn and Wantchekon (2011).

Empirical Results

Cross-country Regressions

OLS Estimates

We first present the OLS results for the basic specification set out in Equation (1). Results are documented in Table 1. All regression specifications include colonizer fixed effects. In column (1) we regress the literacy rate in 2000 ($lit00$) on the measure of slave exports ($lexp\_area$). As expected, there is a strong negative correlation between literacy and slavery, and slave exports alone explain 43% of the variation in contemporary literacy rates (also see Figure 1). In column (2), we add the cluster of geographic variables included in Nunn (2008), and described in the previous section: equatorial distance, longitude, minimum monthly rainfall, lowest average temperature, average maximum humidity, and coastal proximity. Although the addition of these variables reduces the size and significance of the coefficient on slave exports, it continues to remain statistically significant at the 5% level. Mimicking Nunn (2008), we drop small islands and North African countries in column 3.[10] The overall effect of slavery on literacy remains significant despite this exclusion. Column (4) provides an additional test for this by adding an island indicator and a North Africa dummy. The coefficient on none of these variables is individually significant and the results remain largely unchanged.

Next, following Nunn (2008), we add a cluster of control variables in column (5) that includes the percentage of Muslim in the country's total population, a dummy variable for French legal origin,[11] and per capita production of oil, gold, and diamonds. The results are instructive. Countries with a higher proportion of Muslims tend to do worse on literacy. Although consistent with a cultural explanation for illiteracy, the relatively adverse performance of Muslim majority regions could well be a regional west-African effect or an outcome of poor access to formal schooling in these regions due to the greater power of tribal intermediaries.[12] Similarly, a French legal origin might act as a

[10]North Africa followed a development path that is quite distinct from that of Sub-Saharan Africa,. For more details, please see Nunn (2008). The list of dropped countries include the following: Algeria, the Cape Verde Islands, Comoros, Egypt, Libya, Mauritius, Morocco, Tunisia, Sao Tome and Principe, and Seychelles.

[11]In our sample the legal origin is either French or British, and consequently we have to decide for one or the other variable. The results are the same in terms of significance and magnitude if we use British legal origin instead of French, only the sign changes.

[12]As mentioned in the previous section, there may be deeper contextual factors at work here. Formal literacy has historically been under-emphasized in Muslim societies with alternative modes of education like Madrassah that focus on memorizing as opposed to reading the sacred texts.

Table 1: Slave exports and literacy: Preliminary results.

	Dependent variable: literacy rate in 2000, [lit00]					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(slave exports/	−2.214***	−1.615**	−1.674*	−1.645**	−1.379**	−1.469***
land area)	[−4.24]	[−2.66]	[−2.03]	[−2.05]	[−2.17]	[−3.44]
Absolute latitude		−0.788**	−0.779	−0.927**	−0.286	−0.282
		[−2.11]	[−1.62]	[−2.57]	[−1.19]	[−1.05]
Longitude		0.234*	0.360**	0.263*	0.264**	0.167*
		[1.96]	[2.23]	[1.98]	[2.73]	[1.91]
Minimum avg		0.033	0.135	0.034	−0.209**	−0.093
rainfall		[0.23]	[0.56]	[0.24]	[−2.23]	[−0.92]
Maximum avg		0.294	0.235	0.357	0.086	−0.059
humidity		[1.35]	[0.87]	[1.36]	[0.51]	[−0.39]
Minimum avg		−1.276**	−0.861	−1.286**	−0.597	−0.703
temperature		[−2.25]	[−1.26]	[−2.20]	[−1.16]	[−1.56]
Ln(coastline/area)		1.709	1.724	1.655	1.870**	2.033**
		[1.63]	[1.42]	[1.33]	[2.29]	[2.67]
Island indicator				−2.292	12.950	
				[−0.22]	[1.53]	
North Africa				7.430	8.950	
indicator				[0.59]	[0.99]	
Percent Islamic					−0.241***	−0.239***
					[−3.21]	[−3.78]
French legal origin					−30.379***	−22.476***
					[−4.99]	[−3.53]
Ln(gold prod/pop)					−0.009	−0.122
					[−0.02]	[−0.36]
Ln(oil prod/pop)					1.606***	1.412***
					[3.15]	[3.39]
Ln(diamonds					−0.470	−0.726
prod/pop)					[−0.69]	[−1.27]
Ln(gdp after indep)						5.589*
						[1.92]
Colonizer fixed	Yes	Yes	Yes	Yes	Yes	Yes
effects						
Observations	51	51	41	51	51	51
R-squared	0.43	0.59	0.61	0.59	0.85	0.85

Robust t-statistics in brackets, $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
This table presents the results for the basic empirical specification in Equation (1) that regresses literacy rate in 2000 on the slave exports measure and other controls. The last column controls for the natural logarithm of per capita GDP averaged over the five first years of independence.

disadvantage for education, probably due to its association with other factors, such as the quality of institutions (La Porta *et al.*, 1999). Finally, both per capita oil production and coastal proximity appear as positive and statistically significant correlates of contemporary literacy in column (5). The latter finding reflects the greater propensity of coastal countries to trade, which might in turn increase the returns to schooling.

Extended Specification

An initial empirical replication of Nunn (2008) for models of literacy indicates a strong negative association between slavery and literacy. Overall, the model explains 85% of the variation in literacy. But to what extent is this association driven by per capita income that is both correlated with slave exports and literacy but excluded from our model? Countries that were richer at independence may be endowed with better public goods provision and institutions. We test this possibility in column (6) by controlling for the natural logarithm of real GDP per capita for the first five years of independence. Reassuringly, the relationship between slave exports and literacy does not appear to be an artefact of excluding per capita income from the model. The coefficient on slave exports remains negative and statistically significant even after controlling for per capita income, which has a moderately significant effect on literacy.[13]

Given the small sample size, we henceforth proceed with a more parsimonious specification by dropping all variables that are systematically unrelated to literacy and including in our models two possibly important literacy covariates: percentage of European settlers in 1900 and index of malaria ecology. Glaeser *et al.* (2004) argued that the effect of colonial settlement on institutions may have been mediated by the superior human capital of European settlers. Specifically, they note: "it seems at least plausible that what [European settlers] brought with them is themselves, and therefore their know-how and human capital." Further corroborating evidence is furnished by Rajan and Zingales (2006) who demonstrate that "the percentage of European settlers in 1900 has a very strong correlation with current educational levels even after accounting for the educational levels in 1900." For all these reasons, it is important to control for the proportion of European settlers in 1900.

Poor health status has negative externalities on education levels, as children who are sick are too weak to go to school and if they do, they lack energy to focus. For example, Miguel and Kremer (2001) find evidence consistent with this view. By reducing the life expectancy and shortening the agent's horizon, diseases may also have a negative impact on years of schooling (Acemoglu *et al.*, 2003; Weil, 2008). Health conditions in Africa are strongly affected by the underlying disease environment. For instance, malaria is one of the most widespread diseases in Africa, caused, in its most lethal version, by the *Plasmodium Falciparum*. As Gallup and Sachs (2001) argue, malaria "has life-long effects on cognitive development and education levels through the impact of chronic malaria-induced anaemia and time lost or wasted in the classroom due to illness." Malaria has been linked with high levels of mortality and fertility rate, which reduces investments in education per child (Sachs and

[13]Results also remain robust to controlling for a more recent measure of per capita GDP, averaged over the period 1988–1992.

Malaney, 2002). Besides its direct impact on human capital, malaria ecology has also been shown to attenuate the impact of slavery on income that Nunn (2008) has established (Kelly, 2019).

The inclusion of empirical proxies for European settlers and malaria ecology reduces our sample to 49 countries. Results are reported in Table 2. As the results in column (1) show, the relationship between the slave exports measure and literacy rate in 2000 is unaltered by the change in sample size and the model explains 81% of the total variation in literacy rates. In column (2), we begin by including the index of malaria ecology. Our findings confirm that countries with an ecology more prone to malaria are associated with lower literacy rates (the coefficient is negative and statistically significant at 10% level). Next, column (3) controls for the proportion of European settlers in

Table 2: Slave exports and literacy: Extended specification.

	Dependent variable: literacy rate in 2000, [lit00]			
	(1)	(2)	(3)	(4)
Ln(slave exports/land area)	-2.033^{***}	-1.602^{***}	-1.910^{***}	-1.363^{***}
	[−6.28]	[−3.93]	[−5.80]	[−3.19]
Malaria ecology		-0.399^{*}		-0.464^{**}
		[−1.88]		[−2.22]
European settlers 1900			0.110^{*}	0.152^{**}
			[1.84]	[2.45]
Longitude	0.267^{***}	0.215^{**}	0.268^{***}	0.207^{**}
	[3.14]	[2.52]	[3.11]	[2.37]
Minimum avg rainfall	-0.210^{***}	-0.177^{**}	-0.195^{***}	-0.150^{**}
	[−3.04]	[−2.69]	[−2.87]	[−2.28]
Ln(coastline/land area)	2.027^{***}	1.809^{***}	1.888^{**}	1.581^{**}
	[2.97]	[2.76]	[2.63]	[2.33]
Percent Islamic	-0.229^{***}	-0.235^{***}	-0.223^{***}	-0.228^{***}
	[−4.40]	[−4.82]	[−4.22]	[−4.64]
French legal origin	-25.639^{***}	-23.966^{***}	-24.634^{***}	-22.301^{***}
	[−5.43]	[−4.74]	[−4.96]	[−3.94]
Ln(oil prod/pop)	1.575^{***}	1.428^{***}	1.569^{***}	1.396^{***}
	[3.92]	[4.12]	[3.99]	[4.25]
Colonizer fixed effects	Yes	Yes	Yes	Yes
Observations	49	49	49	49
R-squared	0.81	0.82	0.81	0.83

Robust t-statistics in brackets, $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
This table reports results for a parsimonious specification that also includes two additional correlates of literacy: malaria ecology and the proportion of European settlers in 1900. The sample size has been reduced to 49 countries due to the inclusion of two additional variables. The three countries dropped are Equatorial Guinea, Somalia, and Seychelles.

1900 on its own, which enters the model with a coefficient that is positive and statistically significant at 10% level. Column (4) provides a tougher test for the effect of slavery by including both malaria ecology and European settlers. While both additional correlates turn up as significant predictors of literacy, the slave exports measure continues to retain its negative and statistically significant effect.

IV Estimates

Although the results in Table 2 indicate a strong negative statistical correlation between slave exports and literacy levels in 2000, the underlying relationship is not necessarily causal. As Nunn (2008) argues, four concerns could potentially lead these estimates to be biased: omitted variables, reverse causality, measurement error, and construction error. In the present context, domestic slavery could be one such omitted dimension. As evidence from the United States suggests, domestic slavery was detrimental for educational development.[14] One could also plausibly argue that groups with a lower level of education may have been more likely to select into slave trade to start with.[15]

Measurement problem is likely to be a more important source of bias. As Nunn (2008) recognizes, a legitimate question might arise around the accuracy of reported numbers of slaves shipped from the main ports and, more importantly, the reported characteristics of each slave shipped.[16] Another crucial issue associated with the numbers of slaves exported is that this measure may be inaccurately constructed and underestimate the actual number of slaves traded. This builds mainly on the fact that slaves captured from the interior (i.e., from landlocked countries) were more likely to have a high mortality rate and/or to enter domestic slavery, and therefore would not be recorded at the shipping point.[17]

[14]It is a fact that legislation in America prohibited the education of slaves and cast slave literacy as a potential threat to the slave holding colony (see for example the "Negro Act" passed in South Carolina in 1740). The example of the US shows one type of attitude toward enslaved populations, and there are reasons to think that it was similar in some ways in African societies.

[15]It is difficult to address this question in retrospect, but it seems reasonable to assume that every type of society, literate or not, had an incentive to select into slave trade. For lack of empirical evidence against this assumption, we will consider this as a minor source of bias.

[16]It is straightforward to prove that under the classical error-in-variables assumptions, such a measurement error would bias the OLS estimator towards zero, thus weakening the strength of the real relationship.

[17]In this case we are facing a measurement problem slightly more complex than the classical error-in-variables, because the error is now suspected to be negatively correlated with the distance to the coast. Nunn (2008) derives the bias from this "undersampling of slaves from the interior" and shows that it will tend to bias the OLS estimate towards zero, thereby reinforcing the classical measurement bias mentioned above.

In light of the above, both measurement and construction errors may actually hide the existing relationship. In recognition of these constraints, we replicate Nunn's empirical strategy, which consists of instrumenting slave exports with distances to the main overseas ports. The four instruments correspond to the four slave routes: trans-Saharan, Red Sea, Indian Ocean, and trans-Atlantic. For each route, the sailing or overland distance (or both when appropriate) from each African country to the closest main port of destination for the chosen route is calculated.[18] Consistent with prior literature, we treat proportion of European settlers in 1900 and malaria ecology as exogenous.[19]

Table 3 presents the IV estimates obtained with the two-stage least squares (2SLS) method. Following Nunn (2008), we progressively add control variables and examine whether the relationship between slavery and literacy still holds. Column (1) reports estimates without control variables and column (2) includes the identity of colonizer. Column (3) replicates the results for the 49 country sample for extended specification. Finally, column (4) reports the IV estimates for the extended specification with proportion of European settlers in 1900 and malaria ecology. The first stage estimates are reported in the bottom panel and show that there is a significant negative relationship between slave exports and distance to the main ports of demand. This suggests that the farther a country was from the slaves markets, the less it exported slaves. The exception to this observation is the Red Sea instrument, which is never significant. Therefore, we have run another series of instrumented regressions, dropping Red Sea as an instrument (columns (5)–(8)). As shown, this does not alter our results.

The IV estimates are reported in the top panel of Table 3. The point estimates for slave exports remain negative and statistically significant, and are much larger than the OLS estimates which is consistent with the view that the bias resulting from measurement error is probably greater than the other biases mentioned. Model diagnostics reported at the bottom of the table support the validity of instruments. Overall, these results suggest that the relationship between slavery and literacy continues to hold in both OLS and IV estimation results.

Mechanisms

If exposure to historic slave trade predicts lower literacy in the long-run, what mechanisms might underpin this? While clearly limited by the small sample size, we conduct some preliminary analysis for possible channels. We test

[18] For more details, please see Nunn (2008).

[19] Kiszewski *et al.* (2004) treat malaria ecology as a valid instrument for malaria prevalence. Malaria ecology indicator is a function of climatic factors that determine the biological properties of the vector mosquitos and their habitat.

Table 3: Slave trade and literacy: IV estimates.

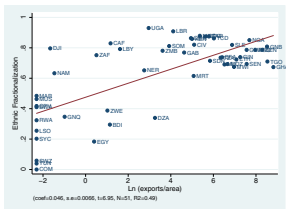
	Four instruments				Three instruments			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Second stage. Dependent variable is [*lit*00]				Second stage. Dependent variable is [*lit*00]			
Ln(exports/area)	−5.824***	−3.927***	−2.642***	−2.120**	−5.930***	−4.071***	−2.634***	−2.113**
	[−3.92]	[−3.59]	[−4.83]	[−2.35]	[−3.94]	[−3.66]	[−4.81]	[−2.35]
Colonizer fixed effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Additional controls	No	No	Yes	Yes	No	No	Yes	Yes
ME & Euro1900	No	No	No	Yes	No	No	No	Yes
F-stat	14.76	3.70	9.88	9.77	14.90	3.69	9.89	9.78
Observations	49	49	49	49	49	49	49	49
	First stage. Dependent variable is [*lexp_area*]				First stage. Dependent variable is [*lexp_area*]			
Atlantic distance	−1.315***	−1.701***	−2.126***	−1.631**	−1.295***	−1.690***	−2.084***	−1.623**
	[−3.65]	[−3.84]	[−3.49]	[−2.41]	[−3.85]	[−3.90]	[−3.80]	[−2.53]
Indian distance	−1.051***	−1.414**	−2.633***	−1.890**	−1.078***	−1.467***	−2.550***	−1.873***
	[−2.76]	[−2.61]	[−3.55]	[−2.45]	[−3.16]	[−3.24]	[−4.69]	[−2.95]
Saharan distance	−2.297***	−2.932***	−3.852*	−2.781	−2.375***	−3.049***	−3.539***	−2.712**
	[−2.78]	[−2.72]	[−1.86]	[−1.40]	[−3.50]	[−3.55]	[−3.93]	[−2.53]
Red Sea distance	−0.121	−0.156	0.294	0.068				
	[−0.17]	[−0.18]	[0.17]	[0.04]				
European settlers				−0.081**				−0.081**
				[−2.26]				[−2.32]
Malaria ecology				0.127				0.126
				[1.47]				[1.50]

(*Continued*)

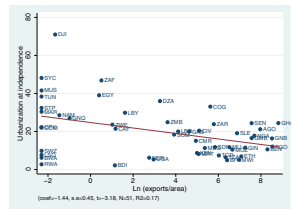
Table 3: (*Continued*)

		Four instruments				Three instruments		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	First stage.	Dependent variable is [$lexp\_area$]			First stage.	Dependent variable is [$lexp\_area$]		
Colonizer fixed effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Additional controls	No	No	Yes	Yes	No	No	Yes	Yes
ME & Euro1900	No	No	No	Yes	No	No	No	Yes
F-stat	4.25	2.13	2.29	2.83	5.78	2.43	2.51	3.09
Sargan test (p-value)	0.18	0.01	0.91	0.86	0.40	0.31	0.84	0.80

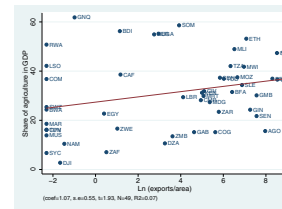
t-statistics in brackets; $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
This table reports the IV estimates for a modified specification from Nunn (2008). The dependent variable is literacy rate in 2000. Columns (1) to (4) report the IV estimates using the four instruments made available by Nunn (2008). Since distance measures to the main ports in the Red Sea routes are never significant, we have reported in columns (5) to (8) the IV estimates using only three of the four instruments.



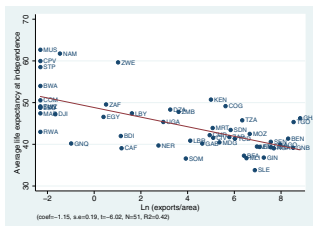
(a) Ethnic Fractionalization



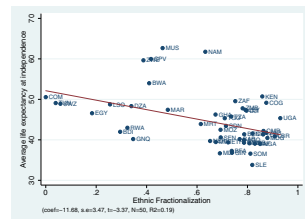
(b) Urbanization



(c) Agriculture value added



(d) Life expect. and slave exports



(e) Life expect. and ethnic fract.

Figure 2: Correlating slave exports with possible mediating factors.

for the role of several possible mechanisms, including ethnic fractionalization, urbanization, and disease. Figures 2a–2d display unconditional scatter plots of slave exports with the index of ethnic fractionalization, urbanization rate, share of agriculture in GDP, and life expectancy at birth. These plots show that the logarithm of slave exports is positively correlated with ethnic fractionalization and agriculture value added, but is negatively associated with urbanization rates, and life expectancy at birth. Additionally, Figure 2e suggests that ethnically fractionalized societies are also likely to have lower average life expectancy at birth.

We investigate these plausible channels by adding them as separate controls to our preferred specification. The results are presented in Table 4. Panel A explores the lead on ethnicity, urbanization, and share of agriculture. Panels B and C investigate the mediating impact of life expectancy. We begin in column (1) by replicating our canonical specification on the reduced sample of 46 countries. In column (2), we first consider the role of ethnic fractionalization, which has been recognized by Nunn (2008) as a plausible transmission mechanism. As historical evidence indicates, slave trade in Africa sowed the seeds for ethnic tension and endemic political instability. Ethnic division can, in turn, be a hindrance to the provision of public goods, including health and

Table 4: Exploring possible mechanisms.

	Dependent variable: [$lit00$]							Dependent variable: [$lebav$]	
	Panel A: Urbanization, agriculture and fractionalization					Panel B: Life expectancy		Panel C	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(slave exports/land area)	-1.363^{***}	-1.255^{**}	-0.528	-0.660	-0.294	-1.363^{***}	-0.441	-0.847^{***}	-0.603^{**}
	[−3.21]	[−2.05]	[−0.70]	[0.58]	[0.69]	[−3.19]	[0.51]	[0.22]	[0.23]
Malaria ecology	-0.464^{**}	-0.438^{*}	-0.559^{**}	-0.427	-0.511^{**}	-0.464^{**}	-0.310	-1.152	-0.056
	[−2.04]	[−1.85]	[−2.54]	[0.25]	[0.23]	[−2.22]	[0.20]	[0.11]	[0.11]
European settlers 1900	0.242	0.252	-0.067	-0.107	-0.208	0.152^{**}	0.078	$0.071*$	0.234
	[0.56]	[0.60]	[−0.16]	[0.35]	[0.38]	[2.45]	[0.53]	[0.04]	[0.17]
Longitude	0.205^{**}	0.211^{**}	0.190^{**}	0.217^{**}	0.199^{**}	0.207^{**}	0.306^{***}	-0.104^{**}	$-0.085*$
	[2.40]	[2.45]	[2.11]	[0.09]	[0.09]	[2.37]	[0.10]	[−0.05]	[0.04]
Minimum avg rainfall	-0.154^{**}	-0.164^{**}	-0.108	-0.042	-0.038	-0.150^{**}	-0.115	-0.024	-0.048
	[−2.32]	[−2.32]	[−1.35]	[0.10]	[0.10]	[−2.28]	[0.07]	[0.03]	[0.04]
Ln(coastline/area)	1.570^{**}	1.618^{**}	1.025	1.042	0.822	1.581^{**}	$0.978*$	0.504	0.635^{*}
	[2.30]	[2.25]	[1.46]	[0.82]	[0.75]	[2.33]	[0.57]	[0.32]	[0.32]
Percent Islamic	-0.230^{***}	-0.237^{***}	-0.261^{***}	$-.0222^{***}$	-0.244^{***}	-0.228^{***}	-0.172^{***}	-0.057^{***}	-0.069^{***}
	[−4.79]	[−4.26]	[−4.86]	[0.05]	[0.05]	[−4.64]	[0.04]	[0.02]	[0.02]
French legal origin	-21.910^{***}	-22.597^{***}	-22.618^{***}	-19.432^{***}	-21.186^{***}	-22.301^{***}	-28.623^{***}	6.727^{**}	5.005
	[−3.87]	[−3.88]	[−3.61]	[6.51]	[6.50]	[−3.94]	[5.14]	[3.23]	[3.16]
Ln(oil prod/pop)	1.331^{***}	1.318^{***}	0.989^{**}	0.960^{**}	0.823^{**}	1.396^{***}	1.060^{***}	0.306	0.248
	[3.51]	[3.42]	[2.58]	[0.42]	[0.39]	[4.25]	[0.31]	[0.20]	[0.18]
Ethnic fractionalization		−3.114	−9.290	−7.041	−9.90				$-7.266*$
		[−0.37]	[−1.02]	[8.89]	[8.95]				[3.69]
Urbanization			0.299^{**}						
			[2.09]						
Agricultural value added				-0.343^{**}					
				[0.15]					

(*Continued*)

Table 4: (*Continued*)

	Dependent variable: [*lit*00]							Dependent variable: [*lebav*]	
	Panel A: Urbanization, agriculture and fractionalization					Panel B: Life expectancy		Panel C	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Score 1					−4.714**				
					[1.76]				
Life expectancy							1.091***		
							[0.33]		
Colonizer fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	46	46	46	46	46	49	49	49	49
R-squared	0.82	0.82	0.83	0.84	0.84	0.83	0.87	0.73	0.75
Wald test (p-value)			0.13	0.09					

Robust t-statistics in brackets; $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Panels A and B focus on a specific association between potential variables of interest where the dependent variable is literacy rates in 2000. Panel C examines the explanatory power of the model for life expectancy at birth. Since some of the data do not cover the entire sample, we allow for the sample size to vary. To account for the potential effect of a sample reduction, the first column of each panel reports the point estimates of specification (2) estimated on the corresponding sample size. As shown, the significance of our relationship is not affected by this sample reduction. In the adjacent columns, we have added one or several variables of interest. When variables are added in a cluster, a Wald test for joint significance is performed. The null hypothesis states that the variables are not jointly-significant. The p-value for this test is reported in the bottom line the table. Score 1 is the first principal component of urbanization and the share of agriculture value-added.

education.[20] As the result in column (2) shows, the coefficient on the index of ethnic fractionalization is individually insignificant and is unable to knock out the effect of slavery.

Next, column (3) examines the role of urbanization. Earlier studies have shown that depopulation was an important negative externality of slave trade (Manning, 1981). This could result in lower urbanization rates in the long-run,[21] which signals lower development levels (UNESCO, 2006b). As expected, the inclusion of urbanization in column (3) eliminates the effect of slave exports. While the coefficient on slave exports is itself negative it is rendered statistically insignificant with the inclusion of urbanization, which in turn has a positive and statistically significant impact on literacy.

In column (4), we replace urbanization with the share of agriculture value-added in GDP.[22] Like urbanization, agriculture value-added eliminates the impact of slave exports and is itself a strong negative predictor of cross-country differences in literacy. In column (5) we simultaneously account for the effect of urbanization and agriculture share. Given that population density is potentially related to the marginal productivity of land and the returns to human capital, there is a strong correlation between urbanization and agriculture share. We thus include a principal components measure of both dimensions and find that this measure similarly knocks out the impact of slave exports. Taken together, the results in columns (1)–(5) provide evidence that slavery might have negatively impacted literacy through its effect on urbanization and structural change.

Next, in Panel B, we examine the role of disease as another plausible mechanism. Even though our regressions have included an index of malaria ecology, it is useful to control for a broader and more direct measure of health, especially given that health is also an important correlate of literacy (Miguel and Kremer, 2001; Weil, 2008). As before, we begin by replicating our baseline specification in column (6), and re-establish the strong negative impact of slave exports on literacy. We then include life expectancy at birth, averaged over the 1960–1999 period, in column (7). As expected, the inclusion of average life expectancy in column (7) completely wipes away the slavery effect, rendering

[20]The effect of ethnic fractionalization on public provision of health is arguably stronger than its effect on education. The correlation between ethnic fractionalization and life expectancy is −0.44, almost double than that of its correlation with literacy (−0.27). Prior literature has already established the negative impact of ethnic fractionalization on health outcomes. Ethnic fractionalization is shown to be positively correlated with infant mortality (Alesina *et al.*, 2003; La Porta *et al.*, 1999).

[21]Urbanization rate is the share of total population living in urban areas (Source: World Development Indicators, World Bank (2009)). We have averaged this measure over the first five years of independence, or over the first five years of available data depending upon availability.

[22]The value used here is the agriculture value added per worker in 2000 $US averaged from 1960 to 1990 (Source: World Development Indicators, World Bank (2009))

the coefficient on slave exports statistically insignificant. The coefficient on life expectancy is, in turn, positive and significant at 1% level. We probe this mechanism further in Panel C by replacing our main dependent variable (i.e., adult literacy in 2000) with average life expectancy at birth. As the results in columns (8)–(9) show, the slavery measure is a strong negative predictor of life expectancy, and the result holds even with the inclusion of ethnic fractionalization in the model. Together, the evidence presented in the last four columns of Table 4 provides strong evidence in favour of health as a key mediating channel. The impact of slavery on life expectancy continues to hold in IV models as well (see Appendix Table A1). In fact, a regression of life expectancy at birth on slave exports results in a coefficient of slave exports that is highly negative and statistically significant.

Competing Explanations and Robustness Tests

We carry several additional empirical tests to rule out competing explanations and to assess the robustness of these empirical patterns. Results are reported in the Online Appendix. In Table A2 we perform several tests, which include: using alternative measures of slavery, such as slave exports normalized by land area and historic population, controlling for GDP averaged over the 1988–1992 period, including a measure for educational expenditures, and omitting a possible outlier (Niger).

As suggested in Klein (2001), and further corroborated in Nunn (2008), slave trade can have long-term impacts on political instability. We investigate this possibility by including empirical proxies for conflict, political instability, and weak institutions. Individually, none of these indicators was able to dislodge the effect of slavery (see Table A3). We also examined the connection between human capital and religion by including the proportion of population characterized as Muslim, Roman Catholic, and Protestant. The results remain unchanged (see Table A4).

Finally, in Table A5 we show that the main slavery result remains unchanged to replacing the dependent variable with literacy averaged over the period 1990–2000, the natural logarithm of literacy in 2000, average years of schooling in 2000, and the percentage of population with secondary school attainment. Thus, the results hold for a number of educational outcomes. Finally, the slavery effect on literacy survives the inclusion of a full set of regional dummy variables capturing north, west, east, and southern Africa (results available upon request).

Sub-regional Analysis

Table 5 reports the OLS estimates for Equation (2) without country fixed effects. The dependent variable is the categorical variable for education as

Table 5: Slavery and education: Analysis without country fixed effects.

			Education Level (Categorical Variable)					
			2005					2008
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log slave exports/ area	-0.125^{***}	-0.115^{***}	-0.110^{***}	-0.090^{***}	-0.055^{*}	-0.058^{*}	-0.009	-0.033
	(0.043)	(0.025)	(0.027)	(0.025)	(0.031)	(0.033)	(0.034)	(0.039)
Missions/sq km				6.086^{***}	5.832^{***}	5.673^{***}	3.454^{***}	2.351^{***}
				(0.733)	(0.747)	(0.735)	(0.802)	(0.849)
Malaria ecology					-0.006^{**}	-0.007	-0.002	-0.024^{***}
					(0.003)	(0.005)	(0.005)	(0.005)
Observations	21624	21136	16922	16922	16922	16922	16922	17899
Individual controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District/ethnicity controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Colonial controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Colonial pop. density	No	No	Yes	Yes	Yes	Yes	Yes	Yes

(*Continued*)

Table 5: (*Continued*)

	Education Level (Categorical Variable)							
			2005					2008
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regional FEs	No	No	No	No	No	Yes	No	No
Subregional FE	No	No	No	No	No	No	Yes	Yes

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Notes: The table reports OLS estimates. Data is from the Afrobarometer survey waves of 2005 (Nunn and Wantchekon, 2011) and 2008 (Deconinck and Verpoorten, 2013). The unit of observation is an individual. Standard errors, reported under each coefficient, are clustered at both the ethnicity and district level. The dependent variable is a categorical variable for education level, as defined in the section "Empirical Specifications and Data". The independent variable is the natural log of one plus slave exports normalized by land area inhabited by the ethnic group in the nineteenth century. Individual controls are for age, age squared, a gender indicator variable, five living conditions fixed effects, 18 religion fixed effects, 25 occupation fixed effects, and an indicator for whether the respondent lives in an urban location. The district/ethnicity controls include ethnic fractionalization of each district and the share of the district's population that is the same ethnicity as the respondent. Colonial controls consist of ethnicity-level colonial controls such as a 1400 urbanization indicator variable, eight fixed effects for the sophistication of precolonial settlement, the number of jurisdictional political hierarchies beyond the local community in the precolonial period, an indicator for integration with the colonial rail network, and an indicator for contact with pre-colonial European explorers. Malaria ecology captures the ethnicity level prevalence of malaria during the colonial era. Colonial population density represents the natural log of an ethnicity's population density during colonial rule. Missions/sq km is the number of missions per square kilometer during the colonial period multiplied by 100. Regional fixed effects consist of dummy variables for West, East, and Southern Africa. The subregional fixed effects are fixed effects for 181 subregions within and across African countries.

defined earlier. In columns (1)–(7) we report results using data for the 2005 wave of Afrobarometer survey (Nunn and Wantchekon, 2011) and column (8) reports the corresponding results using data for the 2008 wave of Afrobarometer survey (Deconinck and Verpoorten, 2013). We start with a simple model in column (1) that includes the intensity of slave trade, our main variable of interest measured as the log of total number of slave exports taken from an ethnic group normalized by the total area. As expected, the slave exports measure is a strong negative predictor of contemporary education levels. In column (2), we add the battery of controls capturing individual, ethnicity, and district-level characteristics. The coefficient on slave exports retains its negative sign and remains statistically significant at 1% level.

In columns (3)–(5), we successively add district- and colonial-level controls. The district-level controls include ethnic fractionalization of each district and the share of the district's population that is of the same ethnicity as the respondent. The colonial controls consist of the following ethnicity-level colonial controls: a 1400-urbanization indicator variable, eight fixed effects for the sophistication of precolonial settlement, the number of jurisdictional political hierarchies beyond the local community in the precolonial period, an indicator for integration with the colonial rail network, and an indicator for contact with precolonial European explorers. All of these are likely to be important correlates of education. However, including these in column (3), along with colonial-era population density, does not substantively change the result. The coefficient on slave exports remains negative and statistically significant at 1% level.

Next, in columns (4)–(5), we add two important controls that are measured in the colonial period: number of missions per square kilometre and malaria ecology. The former is proven to be an important predictor of long-term educational outcomes in Africa (Okoye and Pongou, 2021) and the latter is an important proxy for health that could influence education. While the slavery effect remains robust to the inclusion of an indicator for Christian missions (column (4)), it is significantly attenuated with the addition of malaria ecology in column (5). Compared to column (3), the coefficient on slave exports is halved in magnitude and only significant at 10% level now. This is consistent with prior evidence on health as an important mediating channel.

So far, we have investigated the impact of differences in slave trade across Africa on contemporary education after accounting for colonial-era controls. In columns (6)–(7), we control for spatial effects by firstly including regional fixed effects through dummy variables for West, East, and Southern African countries, and subsequently replacing these with subregional fixed effects for the 181 subregions within and across Africa. While the results remain unchanged with the inclusion of regional fixed effects in column (6), the slavery effect is completely wiped off in column (7) that includes the more fine-grained subregional fixed effects. This result remains unchanged when we re-estimate

the final specification using data for the 2008 Afrobarometer wave in column (8). The results in Table 1 provide a hint of an evidence that cross-Africa differences in the intensity of slave trade predict lower educational attainment in the long-run. While the negative slavery effect is robust to colonial-era controls, it is substantially weakened with the addition of malaria ecology and wiped away with the inclusion of subregional fixed effects.

To probe the importance of spatial effects, we re-estimate the core specifications separately for the three subregions (i.e., West, East, and Southern Africa), and coastal and interior Africa. The relevant sample for each regression is defined by countries included in the associated category, which is described in the notes to Table 6. The top panel of Table 6 presents estimation results using data from the 2005 Afrobarometer wave, whereas the bottom panel reports results for the 2008 wave. Besides the usual battery of individual, district, and colonial controls, each regression includes missions per area, malaria ecology, and sea-based controls. The latter are used by Nunn and Wantchekon (2011) as possible instruments, and include the following: distance of ethnic groups from the coast at the time of slave trade, distance from Saharan trade routes and cities involved in the Saharan trade, and historical reliance on fishing. In our context, the sea-based variables could have a direct bearing on long-term educational prospects, since proximity to the coast can be correlated with a host of factors that matter for literacy. The results in Table 6 offer a useful spatial dimension. When we separately estimate the regression model for the three subregions, the negative effect of slave exports survives for the 2005 wave. However, re-estimation using data for the 2008 wave only flags a negative and statistically significant coefficient for slave exports for the East Africa sample. Turning to the coastal versus interior divide, Table 6 offers a consistent pattern across the two data waves in that the negative effect of slavery on education seems to be primarily driven by Africa's coastal countries.

Results with Country Fixed Effects

Next, in Table 7, we add another important spatial dimension by including country fixed effects. The creation of national borders has left an enduring legacy for African political economy. In our context, country fixed effects allow us to account for country-specific factors, such as the impact of nation building programmes and education policies, among other dimensions. Effectively, the regressions in Table 7 allow us to investigate whether, within countries, individuals from an ethnicity that had a greater historic exposure to slave trade were likely to have different educational attainment today relative to individuals whose ethnic ancestors were less exposed to slave trade. As the results show, the inclusion of country fixed effects totally changes the nature of relationship between historic slave exports and education. The estimated coefficient on slave exports is now positive and statistically significant across

Table 6: Estimations by sub-regions: Without country fixed effects.

	Education level (categorical variable)				
	2005 Wave				
	Regions			Costal vs Interior	
	(1)	(2)	(3)	(4)	(5)
	West	East	South	Coastal	Interior
Log slave exports/area	−0.257***	−0.426***	−4.269***	−0.160***	−0.111
	(0.057)	(0.095)	(1.034)	(0.040)	(0.095)
Observations	6020	7469	3433	10322	6600
Individual controls	Yes	Yes	Yes	Yes	Yes
District/ethnicity controls	Yes	Yes	Yes	Yes	Yes
Colonial controls	Yes	Yes	Yes	Yes	Yes
Colonial pop. density	Yes	Yes	Yes	Yes	Yes
Sea/trade controls	Yes	Yes	Yes	Yes	Yes
	2008 Wave				
	Regions			Costal vs Interior	
	(1)	(2)	(3)	(4)	(5)
	West	East	South	Coastal	Interior
Log slave exports/area	−0.067	−0.230***	−1.094	−0.129***	0.131
	(0.050)	(0.084)	(0.838)	(0.042)	(0.106)
Observations	7570	7854	2475	11191	6708
Individual controls	Yes	Yes	Yes	Yes	Yes
District/ethnicity controls	Yes	Yes	Yes	Yes	Yes
Colonial controls	Yes	Yes	Yes	Yes	Yes
Colonial pop. density	Yes	Yes	Yes	Yes	Yes
Sea/trade controls	Yes	Yes	Yes	Yes	Yes

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Notes: The top and bottom panels report OLS estimates using the 2005 and 2008 Afrobarmeter survey data, respectively. The dependent variable is a categorical variable for the education level of an individual. The individual controls, district controls, ethnicity-level colonial controls, and colonial population density measures are described in Table 1. The colonial controls now additionally include malaria ecology and missions/sq km. The sea/trade controls include the distance of ethnic groups from the coast at the time of the slave trade, distance from Saharan routes and cities involved in the Saharan trade, and historical reliance on fishing. West Africa subsample consists Ghana, Senegal, Benin, Mali, and Nigeria. East Africa subsample consists of Kenya, Uganda, Tanzania, Mozambique, Madagascar, Zambia, Zimbabwe, and Malawi. Southern Africa sub-sample consists of Botswana, Namibia, South Africa, and Lesotho. The 2008 Afrobarometer sample for West Africa additionally includes Liberia and Burkina Faso. The Coastal VS Interior categorization divides countries into coastal versus land-locked countries to disaggregate the impact of the sea.

all columns. Comparing the result in column (2) in Table 7 with that of column (2) in Table 5 shows that the slavery coefficient is almost equal in magnitude but opposite in sign. The coefficient on slave exports remains positive and statistically significant when we include colonial controls (column

Table 7: Slavery and education: Analysis with country fixed effects.

	Education Level (Categorical Variable)						
	2005 Wave						2008 Wave
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log slave exports/area	0.221***	0.118***	0.159***	0.154***	0.137***	0.137***	0.095***
	(0.048)	(0.026)	(0.031)	(0.032)	(0.032)	(0.035)	(0.035)
Missions/sq km				2.024***	2.277***	1.843**	0.848
				(0.700)	(0.717)	(0.725)	(0.622)
Malaria ecology					0.012**	0.009*	0.008
					(0.005)	(0.005)	(0.005)
Dist from Sea						−0.000*	0.000
						(0.000)	(0.000)
Reliance on Fishing						0.005*	0.078***
						(0.003)	(0.026)
Distance from Saharan Line						0.002*	−0.002**
						(0.001)	(0.001)
Distance from Saharan Node						−0.002**	0.002***
						(0.001)	(0.001)

(*Continued*)

Table 7: (*Continued*)

	Education Level (Categorical Variable)						
		2005 Wave					2008 Wave
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Observations	21624	21,136	16,922	16,922	16,922	16,922	17,899
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	No	Yes	Yes	Yes	Yes	Yes	Yes
District/ethnicity controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Colonial controls	No	No	Yes	Yes	Yes	Yes	Yes
Colonial pop. density	No	No	Yes	Yes	Yes	Yes	Yes

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Notes: The table reports OLS estimates. The data is from the Afrobarometer survey waves of 2005 (Nunn and Wantchekon, 2011) and 2008 (Deconinck and Verpoorten, 2013). The unit of observation is an individual. Standard errors, reported under each coefficient, are clustered at both the ethnicity and district level. The dependent variable is a categorical variable for education level, as defined in the section "Empirical Specifications and Data". The independent variable is the natural log of one plus slave exports normalized by land area inhabited by the ethnic group in the nineteenth century. Individual, district, and ethnicity level controls are defined as in Table 5. Malaria ecology captures the ethnicity level prevalence of malaria during the colonial era. Colonial population density represents the natural log of an ethnicity's population density during colonial rule. Missions/sq km is the number of missions per square kilometer during the colonial period multiplied by 100.

(3)), Christian missions (column (4)), and malaria ecology (column (5)). To the extent that the positive slavery effect might be driven by distance to the coast and historic trading routes, we include the battery of sea-based controls in column (6). While some of these controls individually enter the model with statistically significant coefficients, their inclusion does not dislodge the positive impact of slave exports on education.

Re-estimating the final specification using data from the 2008 Afrobarometer wave maintains the positive and statistically significant impact of slavery on education. Finally, in Table 8 we separately re-estimate the specification for the three subregions (i.e., West, East, and Southern Africa) and along the coastal-interior divide. The results are instructive. We only get a positive coefficient for slave exports for estimations using data from the west African sample. The coefficient is negative for both East and Southern African samples, although it loses statistical significance for the 2008 wave. A more consistent result across the two waves is obtained for the subsample slit for coastal Africa. The slave exports measure is now a positive and statistically significant predictor of contemporary education for both the 2005 and 2008 Afrobarometer waves. There is a clear suggestion here that the positive impact of slave trade on education is mainly driven by coastal countries of Africa.

Robustness

To further reinforce these findings, we conduct some related tests and report these in the Online Appendix. In Table A6 we report the main results using different measures of slavery, which include slave exports expressed in thousands of persons (column (1)) and normalized by total area of land inhabited by the ethnic group during the 19th century (column (2)). Taking a cue from Nunn and Wantchekon (2011), we also re-estimate the main regression for four alternative slave measures: slave exports normalized by colonial population (column (3)), the natural log of one plus slave exports (column (4)), and the log measure normalized by land area (column (5)) and historic population (column (6)). As expected, we get negative coefficient estimates for most slavery measures in models without country fixed effects (see top panel). However, controlling for country fixed effects, the coefficients on slave exports are all consistently positive and statistically significant (see bottom panel).

Next, we explore possible heterogeneity by levels of education. For this purpose, we disaggregate the main education variable in four ethnicity-level variables, defined as the proportion of individuals by ethnicity that have: (a) no formal education; at least completed, (b) primary education, (c) secondary school, (d) university education. Each of these variables are then separately regressed on the slave exports measure, while controlling for individual, district, ethnicity, and colonial controls. The results, presented in Appendix Table A7, confirm the basic patterns furnished above. Across Africa, ethnic groups that

Table 8: Estimations by sub-regions: With country fixed effects.

	Education level (Categorical variable)				
	2005 Wave				
	Regions			Costal vs Interior	
	(1)	(2)	(3)	(4)	(5)
	West	East	South	Coastal	Interior
Log slave exports/area	0.044	−0.185*	−5.795***	0.146***	−0.127
	(0.054)	(0.096)	(1.091)	(0.041)	(0.092)
Observations	6020	7469	3433	10,322	6600
Individual controls	Yes	Yes	Yes	Yes	Yes
District/ethnicity controls	Yes	Yes	Yes	Yes	Yes
Colonial controls	Yes	Yes	Yes	Yes	Yes
Colonial pop. density	Yes	Yes	Yes	Yes	Yes
Sea/trade controls	Yes	Yes	Yes	Yes	Yes
	2008 Wave				
	Regions			Costal VS Interior	
	(1)	(2)	(3)	(4)	(5)
	West	East	South	Coastal	Interior
Log slave exports/area	0.062	−0.116	−1.111	0.098**	0.205**
	(0.047)	(0.085)	(0.897)	(0.043)	(0.100)
Observations	7570	7854	2475	11191	6708
Individual controls	Yes	Yes	Yes	Yes	Yes
District/ethnicity controls	Yes	Yes	Yes	Yes	Yes
Colonial controls	Yes	Yes	Yes	Yes	Yes
Colonial pop. density	Yes	Yes	Yes	Yes	Yes
Sea/trade controls	Yes	Yes	Yes	Yes	Yes

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.
Notes: The top and bottom panels report OLS estimates with country fixed effects using the 2005 and 2008 Afrobarmeter survey data, respectively. The dependent variable is a categorical variable for the education level of an individual. The individual controls, district controls, ethnicity-level colonial controls, and colonial population density measures are described in Table 1. The colonial controls now additionally include malaria ecology and missions/sq km. The sea/trade controls include the distance of ethnic groups from the coast at the time of the slave trade, distance from Saharan routes and cities involved in the Saharan trade, and historical reliance on fishing. West Africa subsample consists Ghana, Senegal, Benin, Mali, and Nigeria. East Africa subsample consists of Kenya, Uganda, Tanzania, Mozambique, Madagascar, Zambia, Zimbabwe, and Malawi. Southern Africa subsample consists of Botswana, Namibia, South Africa, and Lesotho. The 2008 Afrobarometer sample for West Africa additionally includes Liberia and Burkina Faso. The Coastal vs Interior categorization divides countries into coastal versus land-locked countries to disaggregate the impact of the sea.

were historically exposed to more intense slave trade have significantly higher proportion of individuals without any formal education and a lower proportion of individuals who have completed at least secondary education. This pattern is overturned with the inclusion of country fixed effects. The slave exports

measure is now a positive and statistically significant predictor of primary, secondary, and University education and, within countries, ethnicities with greater historic exposure to slave trade have a significantly lower proportion of individuals without any formal education. Finally, in Table A8 we show the robustness of our basic pattern of results to the inclusion of five different measures of trust (trust of relatives, neighbours, local council, and inter- and intragroup trust). This helps allay the concern that slavery's impact on contemporary education might be driven by an omitted dimension (i.e., trust) which is correlated with both the intensity of historic slave trade and contemporary education.

Internal Versus External Channels

Reassured that the empirical patterns we have documented are robust, we turn to the final empirical test in Nunn and Wantchekon (2011) that seeks to distinguish between two possible explanations behind slavery's long-run impact. The first explanation centres around internalized behavioural norms that tend to persist through descendants, and the second explanation relates to an individual's 'external environment' represented in the persistence of the larger institutional environment. To empirically distinguish these explanations by including both the ethnicity-based measure of slavery and a location-based measure, which "measures the number of slaves taken from the geographic area in which the individual is currently living" (Nunn and Wantchekon, 2011, p. 3247). While the former measure helps to probe the impact of slave trade on the individual's ancestors, the latter measure captures its impact on an individual's location.

As the results in Table 9 reveal, this is a particularly useful exercise in our context as the two effects seem to move in opposite directions. We start in column (1) by simultaneously including the two slavery measures in a specification without subregional or country fixed effects. The estimate for the baseline ethnicity-based slave trade measure is positive but statistically insignificant while the coefficient estimate for the localized slave measure is negative and statistically significant. However, with the addition of subregional fixed effects (column (2)) and country fixed effects (column (3)), the negative effect of localized measure of slavery is wiped away and our baseline measure capturing the internalized ancestry-related effects of slavery enters with a positive and statistically significant coefficient. This pattern is maintained when we re-estimate these models using data from the 2008 wave. Interestingly, in the first specification without subregional or country fixed effects, the coefficients on two slave trade measures are both statistically significant, equal in magnitude, but opposite in sign (see column (4)). Slavery seems to have a positive effect on education through the internal channel and a negative effect through the external channel. However, it is only the positive effect of

Table 9: Slavery and education: Internal vs external channels.

	Education level (categorical variable)					
	2005 Wave			2008 Wave		
	(1)	(2)	(3)	(4)	(5)	(6)
Log slave exports/area	0.002	−0.008	0.104***	0.119***	−0.028	0.100**
	(0.038)	(0.036)	(0.035)	(0.042)	(0.041)	(0.041)
Localized slave exports	−0.079**	−0.014	0.049*	−0.119***	−0.026	−0.009
	(0.034)	(0.036)	(0.028)	(0.043)	(0.051)	(0.036)
Observations	16210	16210	16210	17899	17899	17899
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
District/ethnicity controls	Yes	Yes	Yes	Yes	Yes	Yes
Colonial controls	Yes	Yes	Yes	Yes	Yes	Yes
Subregional FEs	No	Yes	No	No	Yes	No
Country FEs	No	No	Yes	No	No	Yes

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.
Notes: The table attempts to disaggregate the persistence of slavery's impact through behavioural (internal norms) and localized (institutional) channels. The data is from the Afrobarometer survey waves of 2005 (Nunn and Wantchekon, 2011) and 2008 (Deconinck and Verpoorten, 2013). The unit of observation is an individual. The standard errors are reported under each coefficient and are clustered at both the ethnicity and district level. The baseline measure of slave exports used throughout the paper is an ethnicity-based slave export measure which is the log of the number of slaves taken from an individual's ethnic group normalized by land area. The localized slave export is a location-based slave export measure which is the log of the number of slaves taken from the location where an individual is currently living normalized by land area. Refer to Table 3 for the description of individual controls, district/ethnicity controls, colonial controls, malaria ecology, missions/sq km, and colonial population density. The colonial controls include malaria ecology, missions/sq km, and colonial population density. The regional fixed effects are three fixed effects for West, East, and South African regions.

our slavery measure that is robust to the inclusion of country fixed effects in column (6) while the coefficient on localized slave measure retains its negative sign but is now rendered statistically insignificant.

Conclusion

In this paper, we replicated the empirical approach in Nunn (2008) and Nunn and Wantchekon (2011) to investigate the long-run impact of slavery on human capital. Our findings offer a puzzling pattern. The cross-country regressions indicate a strong negative relationship between historical slaves exports and contemporary literacy rates, which is surprisingly robust to a variety of empirical perturbations. However, our individual-level regressions using survey data from two contemporary waves of Afrobarometer flag a positive effect of the historic exposure of an individual's ethnic ancestors to slave trade on educational attainment. Specifically, we show that, after the inclusion of country fixed effects, individuals whose ethnic groups were more

intensely exposed to slave trade in the past have higher educational attainment today. Furthermore, our subsample analysis indicates that these patterns are primarily driven by coastal countries and through the internal channel measured by an ethnicity-based indicator of slave exports.

These are intriguing stylized facts that require more careful examination by future research. It is important to emphasize that these findings do not discount the immensely valuable and pioneering work conducted by Nathan Nunn and colleagues on the long-run impact of slavery. However, the empirical patterns offered in this paper do resonate with recent critiques of persistence studies that relate a historical variable with long-run development outcomes. While these studies have provided a rich empirical understanding of how the past connects with the present, they face several challenges including "the compression of history, and failure to account for the effects of geography" (Abad and Maurer, 2021, p. 31). Our analysis shows that the slavery's long-term legacy for educational development depends on how spatial effects are accounted for and what happens after independence of modern African states.

As is the case with slavery, there is often a considerable time lag between the historical treatment and contemporary outcomes. As Cantoni (2021) argues, accounting for what happens in intervening periods can be crucial, especially in the presence of time-varying shocks that make the effect of history contingent on other factors. This raises a substantive question: If there are many critical junctures, which juncture matters more? In other words, which part of history has greater salience in shaping slavery's impact on development. And, what is the role of time-varying shocks and historical contingency? It is possible that slavery's impact on contemporary development remains latent for some time and assumes saliency later. As has been recognized by Nunn (2008) and Abad and Maurer (2021), slavery's impact on income grows stronger after independence.

Our empirical patterns raise an even more puzzling possibility, which is that even the very nature of slavery's impact on education could be different depending on whether or not we account for modern borders. Our results suggest that what happens *after* independence is crucial for understanding the long-run impact of slavery on human capital. We do not have a good answer for why, within countries, individuals whose ethnic ancestors were more intensely exposed to slave trade have systematically higher educational attainment today than individuals from less exposed ethnic ancestry. While this lies beyond the remit of this paper, several explanations are possible, including the nature of nation-building policies, the type of educational reforms pursued after independence, nature of collective action and interest representation, power sharing among ethnicities, the spatial concentration of resource extraction, and patterns of occupational selection of different ethnicities, among others. What we can rule out, thanks to the battery of useful controls available in Nunn and Wantchekon (2011), is that neither the presence of Christian missions nor

distance from sea or historic trade routes can explain away the positive impact of historic slave exposure on an individual's educational attainment today.

Even the very straightforward empirical replications presented in this paper highlight that establishing the long-run impact of slavery is a complicated exercise where timing, spatiality, and context matter far more than previously recognized. In a milieu where, in the words of Dennison (2021), "context is everything" and the devil is in the detail, deep historical comparisons of a few cases can be helpful to understand the nature of country-specific fixed factors whose inclusion makes slavery's impact positive within countries. Ultimately, future work would need to conduct more in-depth microstudies and draw on a more eclectic use of historical sources to trace the processes through which slavery's impact is transmitted over time.

References

Abad, L. A. and N. Maurer. 2021. "History Never Really Says Goodbye: A Critical Review of the Persistence Literature". *Journal of Historical Political Economy* 1: 31–68.

Acemoglu, D., C. García-Jimeno, and J. A. Robinson. 2012. "Finding Eldorado: Slavery and Long-run Development in Colombia". *Journal of Comparative Economics* 40: 534–64.

Acemoglu, D., S. Johnson, and J. Robinson. 2003. "Disease and Development in Historical Perspective". *Journal of the European Economic Association* 1: 397–405.

Acemoglu, D., S. Johnson, and J. A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation". *American Economic Review* 91: 1369–401.

Acemoglu, D. and J. A. Robinson. 2010. "Why is Africa Poor?" *Economic History of Developing Regions* 25: 21–50.

Alesina, A., R. Baqir, and W. Easterly. 1999. "Public Goods And Ethnic Divisions". *The Quarterly Journal of Economics* 114: 1243–84.

Alesina, A., A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziargl. 2003. "Fractionalization". *Journal of Economic Growth* 8: 155–94.

Austin, G. 2008. "The 'Reversal of Fortune' Thesis and the Compression of History: Perspectives from African and Comparative Economic History". *Journal of International Development: The Journal of the Development Studies Association* 20: 996–1027.

Bertocchi, G. and A. Dimico. 2012. "The Racial Gap in Education and the Legacy of Slavery". *Journal of Comparative Economics* 40: 581–95.

Bhattacharyya, S. 2009. "Root Causes of African Underdevelopment". *Journal of African Economies* 18: 745–80.

Cagé, J. and V. Rueda. 2016. "The Long-term Effects of the Printing Press in Sub-Saharan Africa". *American Economic Journal: Applied Economics* 8(3): 69–99.

Cantoni, D. 2021. "Embracing Historical Contingency in Historical Political Economy". *Broadstreet blog.*

Collier, P. and J. W. Gunning. 1999. "Explaining African Economic Performance". *Journal of Economic Literature* 37: 64–111.

Deconinck, K. and M. Verpoorten. 2013. "Narrow and Scientific Replication of 'The Slave Trade and the Origins of Mistrust in Africa'". *Journal of Applied Econometrics* 28: 166–69.

Dennison, T. 2021. "Context is Everything: The Problem of History in Quantitative Social Science". *Journal of Historical Political Economy* 1: 105–26.

Easterly, W. and R. Levine. 1997. "Africa's Growth Tragedy: Policies and Ethnic Divisions". *The Quarterly Journal of Economics* 112: 1203–50.

Gallego, F. A. and R. Woodberry. 2010. "Christian Missionaries and Education in Former African Colonies: How Competition Mattered". *Journal of African Economies* 18: 294–329.

Gallup, J. L. and J. D. Sachs. 2001. "The Economic Burden of Malaria". *American Journal of Tropical Medecine and Hygiene* 64: 85–96.

Gallup, J. L., J. D. Sachs, and A. Mellinger. 1999. "Geography and Economic Development". *CID Working Papers* No. 1. Center for International Development at Harvard University.

Glaeser, E. L., R. L. Porta, F. Lopez-de-Silanes, and A. Shleifer. 2004. "Do Institutions Cause Growth?" *Journal of Economic Growth* 9: 271–303.

Grier, R. M. 1999. "Colonial Legacies and Economic Growth". *Public Choice* 98: 317–35.

Gylfason, T. 2001. "Natural Resources, Education, and Economic Development". *European Economic Review* 45: 847–59.

Kelly, M. 2019. "The Standard Errors of Persistence". *CEPR Discussion Paper* No. 13783. Centre for Economic Policy Research.

Kiszewski, A., A. Mellinger, A. Spielman, P. Malaney, S. E. Sachs, and J. Sachs. 2004. "A Global Index Representing the Stability of Malaria Transmission". *American Journal of Tropical Medecine and Hygiene* 70: 486–98.

Klein, M. A. 2001. "The Slave Trade and Decentralized Societies". *The Journal of African History* 42: 49–65.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny. 1999. "The Quality of Government". *Journal of Law, Economics and Organization* 15: 222–79.

Manning, P. 1981. "The Enslavement of Africans: A Demographic Model". *Canadian Journal of African Studies / Revue Canadienne des Études Africaines* 15: 499–526.

Miguel, E. and M. K. Gugerty. 2005. "Ethnic Diversity, Social Sanctions, and Public Goods in Kenya". *Journal of Public Economics* 89: 2325–68.

Miguel, E. and M. Kremer. 2001. "Worms: Education and Health Externalities in Kenya". *NBER Working Paper* No. 8481. National Bureau of Economic Research.

Nunn, N. 2007. *Data Appendix for: The Long-Term Effects of Africa's Slave Trades*. Mimeo, University of British Columbia.

Nunn, N. 2008. "The Long-Term Effects of Africa's Slave Trades". *The Quarterly Journal of Economics* 123: 139–76.

Nunn, N. and L. Wantchekon. 2011. "The Slave Trade and the Origins of Mistrust in Africa". *American Economic Review* 101: 3221–52.

Okoye, D. and R. Pongou. 2021. "Missions and Social Change: Average and Heterogeneous Effects from Border Discontinuities in the Emirates of Northern Nigeria". *Unpublished Manuscript*.

Rajan, R. G. and L. Zingales. 2006. "The Persistence of Underdevelopment: Institutions, Human Capital or Constituencies". *CEPR Discussion Paper* No. 5867. Centre for Economic Policy Research.

Sachs, J. and P. Malaney. 2002. "The Economic and Social Burden of Malaria". *Nature* 415: 680–85.

Soares, R. R., J. J. Assunção, and T. F. Goulart. 2012. "A Note on Slavery and the Roots of Inequality". *Journal of Comparative Economics* 40: 565–80.

UNESCO. 2006a. Database [online]. UNESCO Institute for Statistics, Montreal, Canada.

UNESCO. 2006b. *EFA Global Monitoring Report 2006: Education for All — Literacy for Life*. Paris: UNESCO.

Weil, D. N. 2008. "Endemic Diseases and African Economic Growth: Challenges and Policy Responses". Prepared for the African Economic Research Consortium meeting in Nairobi.

Whatley, W. and R. Gillezeau. 2011. "The Impact of the Transatlantic Slave Trade on Ethnic Stratification in Africa". *The American Economic Review* 101: 571–76.

World Bank. 2009. *World Development Indicators 2000*. Washington, DC: The World Bank.