Online Appendix for Malik and Bouaroudj (2021)

*Slavery and Human Capital in Africa*

## Appendix Table A1: Summary Statistics

| Variable | General Statistics | | | | | By exports size | | |
| | Mean | Std. Dev. | Min | Max | Obs. | Mean (low) | Mean (high) | T-stat |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ln(exports/area) | 3.26 | 3.89 | -2.30 | 8.82 | 52 | -0.11 | 6.63 | -12.7 |
| Ln(pop in 1400/area) | 7.02 | 1.33 | 4.61 | 9.94 | 52 | 6.59 | 7.45 | -2.44 |
| Ln(pop at independence/area) | 9.54 | 1.35 | 6.73 | 12.9 | 51 | 9.72 | 9.37 | 0.91 |
| Literacy rate in 2000 (%) | 61.2 | 18.9 | 16 | 91.8 | 51 | 69.3 | 53.3 | 3.30 |
| Years of schooling in 2000 | 3.58 | 1.55 | 0.8 | 6.5 | 51 | 4.41 | 2.79 | 4.34 |
| Malaria Ecology | 10.3 | 8.26 | 0 | 31.5 | 51 | 5.90 | 14.5 | -4.36 |
| European settlers in 1900 (%) | 3.71 | 14.5 | 0 | 100 | 50 | 6.84 | 0.82 | 1.50 |
| Muslim population (%) | 35.3 | 39.1 | 0 | 100 | 52 | 35.3 | 35.3 | 0.00 |
| Ln(GDP at independence) | 7.49 | 0.81 | 6.36 | 10.5 | 52 | 7.80 | 7.18 | 2.99 |
| Ln(oil/pop) | -6.71 | 4.03 | -9.21 | 3.24 | 52 | -7.10 | -6.32 | -0.69 |
| Life expectancy at birth | 44.9 | 6.80 | 33.8 | 62.7 | 51 | 48.6 | 41.43 | 4.39 |
| Ethnic fractionalization | 0.63 | 0.25 | 0 | 0.93 | 51 | 0.48 | 0.77 | -4.94 |
| Urbanization (%) | 20.0 | 13.7 | 2.2 | 71 | 52 | 25.5 | 14.6 | 3.09 |
| Agricultural value added (%) | 30.9 | 15.3 | 2.74 | 61.83 | 49 | 27.1 | 32.6 | -1.31 |

Slave exports and population density are expressed in people per thousand square kilometres. The first panel of Table ?? describes selected variables from the dataset. In the second panel, we have divided our sample in two sub-samples according to the number of slaves exported. For illustrative purpose, the last column reports the t-statistic associated to the means of the sub-sample. Assuming a normal distribution of the variables, this t-statistic should be compared to the tabulated value of 1.96.

## 0.1 Description of robustness tests

Table A2 modifies our core explanatory variables and presents the point estimates on the slavery measure (our variable of interest). The first row reports the point estimates obtained from our preferred specification (column (4) in Table 2). In the second row, we deploy a measure of slave exports normalized by average population between 1400 and 1900. Normalizing the slave measure by land area or historic population does not alter our main result. The third row controls for a more recent measure of income, the average GDP between 1988 and 1992. These point estimates can be compared to those obtained with our preferred measure of GDP, the average GDP for the first five years of independence (see column (6) of Table 1). In row (4), we control for the average expenditure on education since 1965. Again, the strength and significance of slavery effect remains intact. In row (5), we drop Niger (code: NER), which appears to be an outlier in Figure 1[1]. The coefficient on $[lexp\_area]$ increases in magnitude and remains statistically significant. When the non-exporting countries are dropped in the last row, the slave exports measure loses statistical significance. The sample size is too small to give any meaningful interpretation to this result, however.

Next, in Table A3, we explore other competing channels of transmission. To

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[1]We have not investigated on that matter, but it seems that other structural factors are at stake in Niger. Interestingly enough, it performs very badly for each of the dimensions that we have identified as detrimental for literacy: it is highly affected by malaria and life expectancy drops under 50 years, the dominant religion is Islam, the schooling system has been inherited from the French and urbanization rate is low. Controlling for all these factors, the effect of slavery is less than for other countries.

this end, we investigate the role of institutions and conflict. To proxy for the role of institutional quality, we use two standard measures: the aggregate governance index compiled by Kaufmann et al. (2009) and a measure of constraints on the executive from the PolityIV database (Marshall and Jaggers (2009)). We also include a conflict index as defined in Banks and Wilson (2015). None of the institutional measures enter with a statistically significant effect (columns 2, 3 and 5). However, the coefficient on conflict index is negative and statistically significant at 5 percent level in column (4). While the inclusion of conflict index slightly weakens the impact of slave exports on literacy, the slavery effect remains statistically significant at 10 percent level. Simultaneously including measures of institutions and conflict maintains this result (columns 6-8).

Subsequently, in Table A4, we investigate the connection between human capital and religion using alternative measures of religious presence. Specifically, we use the percentage of the population that "belonged to the three most widely spread religions in the world in 1980", namely Muslim, Roman Catholic and Protestant, as defined in La Porta et al. (1999). A higher share of Muslims in the population still has a negative and statistically significant effect on literacy rates (column 2). When entered individually, both Roman Catholic and Protestant prevalence are associated with a positive and statistically significant effect on literacy (column 3-4). However, when included together, the three measures become insignificant[2] (column 5).

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[2]Such results could be investigated further, especially using the data from Gallego and Woodberry (2010) on missionary presence, another proxy for religious presence. Unfortunately, only 27 African countries only are covered by this dataset, a sample size too small to yield meaningful results

Finally, changing the dependent variable to alternative measures of educational outcomes does not change our findings either (see Table A5). In each row we report the point estimates for [$lexp\_area$], starting by using different measures of literacy. In row (1), we use a 10 years averaged literacy rate, in order to account for the potential errors in the measure of literacy rates. As expected, the estimates are largely unaffected. In row (2), we use the natural logarithm of literacy rates in 2000. The third row replaces literacy levels in 2000 with average years of schooling in 2000[3]. Row (4) uses a narrower measure of education: the share of population with secondary education attainment. Reassuringly, the adverse effect of having selected into slave trades holds for a number of educational outcomes.

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[3]Average years of schooling and enrolment rates are from Barro and Lee (2010). The data on average years of schooling have been completed for some countries by Wood and Mayer (2009).

**Table A2:** *Robustness to changes in explanatory variables*

| Dependent variable: literacy rate in 2000 | Coeff. | t-stat | N | $R^2$ |
|---|---|---|---|---|
| Slave exports normalized by land area | -1.363*** | (0.43) | 49 | 0.83 |
| Slave exports normalized by historic population | -1.212** | (0.44) | 49 | 0.82 |
| Controlling for average 1988-1992 GDP | -1.100* | (0.57) | 49 | 0.83 |
| Controlling for expenditure on education | -1.501*** | (0.45) | 46 | 0.83 |
| | | | | |
| Omitting NER (main outlier) | -1.503*** | (0.42) | 48 | 0.83 |
| Omitting zero slave exports countries | -0.464 | (0.94) | 39 | 0.82 |

Robust standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table A3: *Competing role of institutions and conflict*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Dependent variable is [*lit*00] | | | | | | | |
| Ln(slave exports/land area) | -1.132** | -1.230** | -1.142** | -1.060* | -1.218* | -1.163* | -1.079* | -1.157* |
| | [-2.11] | [-2.07] | [-2.10] | [-2.03] | [-2.04] | [-1.98] | [-2.04] | [-1.96] |
| Malaria Ecology | -0.479** | -0.510** | -0.483** | -0.406* | -0.504** | -0.439** | -0.415* | -0.436* |
| | [-2.06] | [-2.16] | [-2.05] | [-1.95] | [-2.08] | [-2.06] | [-1.97] | [-1.98] |
| European settlers 1900 | 0.214 | 0.264 | 0.209 | 0.906** | 0.275 | 0.972*** | 0.901** | 0.976*** |
| | [0.56] | [0.78] | [0.53] | [2.43] | [0.77] | [3.02] | [2.33] | [2.95] |
| Longitude | 0.249** | 0.223* | 0.248** | 0.261** | 0.223* | 0.235* | 0.261** | 0.234* |
| | [2.48] | [1.72] | [2.41] | [2.62] | [1.71] | [1.81] | [2.55] | [1.79] |
| Minimum avg rainfall | -0.137* | -0.146* | -0.138* | -0.103 | -0.144* | -0.112 | -0.106 | -0.111 |
| | [-2.02] | [-1.88] | [-1.88] | [-1.42] | [-1.79] | [-1.33] | [-1.34] | [-1.27] |
| Ln(coastline/land area) | 1.360* | 1.472 | 1.372 | 1.553** | 1.457 | 1.675* | 1.578* | 1.668* |
| | [1.79] | [1.66] | [1.68] | [2.10] | [1.57] | [1.92] | [2.01] | [1.82] |
| Percent Islamic | -0.213*** | -0.227*** | -0.213*** | -0.216*** | -0.228*** | -0.232*** | -0.216*** | -0.232*** |
| | [-3.98] | [-3.68] | [-3.91] | [-4.23] | [-3.69] | [-3.88] | [-4.16] | [-3.88] |
| French legal origin | -22.404*** | -19.207** | -22.336*** | -22.902*** | -19.153** | -19.513*** | -22.771*** | -19.485*** |
| | [-3.56] | [-2.41] | [-3.46] | [-5.12] | [-2.36] | [-3.08] | [-4.90] | [-3.03] |
| Ln(oil prod/pop) | 1.436*** | 1.252** | 1.424*** | 1.469*** | 1.262** | 1.274** | 1.447*** | 1.279** |
| | [4.05] | [2.24] | [3.45] | [4.22] | [2.17] | [2.28] | [3.47] | [2.19] |
| KKZ Index | | -3.600 | | | -3.794 | -3.827 | | -3.922 |
| | | [-0.58] | | | [-0.61] | [-0.62] | | [-0.63] |
| Institutional constraints | | | -0.033 | | 0.057 | | -0.064 | 0.028 |
| | | | [-0.09] | | [0.16] | | [-0.17] | [0.07] |
| Conflict Index | | | | -0.002** | | -0.002** | -0.002** | -0.002** |
| | | | | [-2.31] | | [-2.57] | [-2.33] | [-2.52] |
| Colonizer fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| R-squared | 0.82 | 0.82 | 0.82 | 0.83 | 0.82 | 0.84 | 0.83 | 0.84 |
| Wald test (*p*-value) | | | | | 0.83 | 0.01 | 0.08 | 0.03 |

Robust t-statistics in brackets; *** p<0.01, ** p<0.05, * p<0.1

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.

**Table A4:** *Religion and human capital*

| | Dependent variable is [*lit*00] | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Ln(slave exports/land area) | -1.363*** | -1.367*** | -1.055** | -1.161* | -1.250*** |
| | [-3.19] | [-3.14] | [-2.17] | [-1.98] | [-2.99] |
| Malaria Ecology | -0.464** | -0.473** | -0.439* | -0.373 | -0.462* |
| | [-2.22] | [-2.25] | [-1.80] | [-1.54] | [-2.01] |
| European settlers 1900 | 0.152** | 0.150** | 0.113* | 0.199** | 0.129* |
| | [2.45] | [2.40] | [1.77] | [2.12] | [1.99] |
| Longitude | 0.207** | 0.206** | 0.276*** | 0.246** | 0.204** |
| | [2.37] | [2.36] | [3.52] | [2.32] | [2.52] |
| Minimum avg rainfall | -0.150** | -0.138** | -0.106 | -0.057 | -0.122* |
| | [-2.28] | [-2.13] | [-1.06] | [-0.44] | [-1.71] |
| Ln(coastline/land area) | 1.581** | 1.600** | 1.020 | 1.504* | 1.550** |
| | [2.33] | [2.32] | [1.44] | [1.78] | [2.19] |
| Percent Islamic | -0.228*** | | | | |
| | [-4.64] | | | | |
| French legal origin | -22.301*** | -22.738*** | -25.035*** | -18.363* | -21.355*** |
| | [-3.94] | [-3.74] | [-3.31] | [-1.73] | [-2.87] |
| Ln(oil prod/pop) | 1.396*** | 1.411*** | 1.295*** | 1.303*** | 1.288*** |
| | [4.25] | [4.20] | [3.32] | [3.08] | [3.22] |
| Muslim80 | | -0.233*** | | | -0.165 |
| | | [-4.57] | | | [-1.45] |
| Catho80 | | | 0.316*** | | 0.116 |
| | | | [3.81] | | [0.98] |
| Protmg80 | | | | 0.441** | 0.080 |
| | | | | [2.08] | [0.31] |
| | | | | | |
| Colonizer fixed effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 49 | 49 | 49 | 49 | 49 |
| R-squared | 0.83 | 0.83 | 0.79 | 0.76 | 0.83 |
| Wald test (*p*-value) | | | | | 0.00 |

Robust t-statistics in brackets; *** p<0.01, ** p<0.05, * p<0.1

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.

**Table A5:** *Robustness to changes in dependent variables*

| Changes in dependent variables | Coeff. | t-stat | N | $R^2$ |
|---|---|---|---|---|
| Average literacy (1990-2000) | -1.290*** | (0.41) | 49 | 0.84 |
| Ln (literacy in 2000) | -0.019* | (0.01) | 49 | 0.78 |
| Average years of schooling in 2000 | -0.130*** | (0.04) | 49 | 0.81 |
| Secondary schooling attained (% pop in 2000) | -2.370** | (1.11) | 36 | 0.70 |

Robust standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1

## 0.2 Further tests for sub-national analysis

We conduct several additional tests for subnational regressions. In Table A6 we report OLS estimates for five different slave export measures used by Nunn and Wantchekon (2011). The data is from the Afrobarometer survey wave of 2005. Slave exports (thousands) is the total number of slaves taken from an ethnic group expressed in thousands of people. Exports/area normalizes the number of slaves taken by the area of land inhabited by the ethnic group in the nineteenth century. Exports/historical pop normalizes slave exports using colonial population figures from Murdock (1959). Columns 4-6 report results for the natural log of one plus the first three measures of slave export. Refer to main tables for the description of dependent variable, individual controls, district/ethnic controls, colonial controls, malaria ecology, missions/sq km, and colonial population density. The colonial controls here additionally include malaria ecology and missions/sq km.

Table A7 reports disaggregate results by levels of education. For each column, the dependent variable is constructed as the proportion of individuals by ethnicity that have the relevant education level. In Table A8 we control for various measures of trust used by Nunn and Wantchekon (2011) and show the robustness of our main result on education to their inclusion.

**Table A6:** *All Measures of Slavery from Nunn and Wantchekon (2011)*

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | *W/O Country Fixed Effects* | | | | | |
| | *Education Level (Categorical Variable)* | | | | | |
| Slave exports (thousands) | -0.000**<br>(0.000) | | | | | |
| Exports/area | | -0.017***<br>(0.003) | | | | |
| Exports/historical pop | | | -0.629***<br>(0.110) | | | |
| ln(1+exports) | | | | -0.015<br>(0.012) | | |
| ln(1+exports/area) | | | | | -0.055*<br>(0.031) | |
| ln(1+export/historical pop) | | | | | | -0.839***<br>(0.147) |
| Observations | 16922 | 16922 | 16922 | 16922 | 16922 | 16922 |
| 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 |
| Colonial Pop. Density | Yes | Yes | Yes | Yes | Yes | Yes |
| | *With Country Fixed Effects* | | | | | |
| | *Education Level (Categorical Variable)* | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Slave exports (thousands) | 0.001***<br>(0.000) | | | | | |
| Exports/area | | 0.014***<br>(0.004) | | | | |
| Exports/historical pop | | | 0.297**<br>(0.120) | | | |
| ln(1+exports) | | | | 0.024*<br>(0.013) | | |
| ln(1+exports/area) | | | | | 0.137***<br>(0.032) | |
| ln(1+export/historical pop) | | | | | | 0.468***<br>(0.166) |
| Observations | 16922 | 16922 | 16922 | 16922 | 16922 | 16922 |
| 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 |
| Colonial Pop. Density | Yes | Yes | Yes | Yes | Yes | Yes |

*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

**Table A7:** *Heterogeneity by Education Level: Proportions at Ethnicity-level*

| | W/O Country Fixed Effects | | | |
|---|---|---|---|---|
| | *Education Level Categorized* | | | |
| | (1) No | (2) Primary | (3) Secondary | (4) University |
| ln(1+exports/area) | 0.016*** | -0.000 | -0.020*** | 0.002 |
| | (0.006) | (0.008) | (0.006) | (0.002) |
| Observations | 16960 | 16960 | 16960 | 16960 |
| Individual Controls | Yes | Yes | Yes | Yes |
| District/Ethnicity Controls | Yes | Yes | Yes | Yes |
| Colonial Controls | Yes | Yes | Yes | Yes |
| Colonial Pop. Density | Yes | Yes | Yes | Yes |
| | With Country Fixed Effects | | | |
| | *Education Level Categorized* | | | |
| | (1) No | (2) Primary | (3) Secondary | (4) University |
| ln(1+exports/area) | -0.011*** | 0.023*** | 0.012*** | 0.011*** |
| | (0.004) | (0.006) | (0.004) | (0.002) |
| Observations | 16960 | 16960 | 16960 | 16960 |
| Individual Controls | Yes | Yes | Yes | Yes |
| District/Ethnicity Controls | Yes | Yes | Yes | Yes |
| Colonial Controls | Yes | Yes | Yes | Yes |
| Colonial Pop. Density | Yes | Yes | Yes | Yes |

*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

*Notes*: The table above disaggregates the main education variable in four different ethnicity-level variables. *No* captures the proportion of individuals by ethnicity that have no formal education. *Primary* captures the proportion of individuals by ethnicity that have at least completed primary school. *Secondary* records the proportion of individuals by ethnicity that have at least completed secondary school. *University* reports the proportion of individuals by ethnicity who have at least some university education. Each of these categorizations is used as the independent variable. 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. Top panel reports the OLS estimates without country fixed effects. The bottom panel reports estimates with country fixed effects. Refer to main tables for the detailed description of individual controls, district/ethnicity controls, colonial controls, and colonial population density measures. Colonial controls include malaria ecology and missions/sq km

**Table A8:** *Controlling for Nunn and Wantchekon (2011) Measures of Trust*

| | *W/O Country Fixed Effects* | | | | | |
|---|---|---|---|---|---|---|
| | *Education Level (Categorical Variable)* | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(1+exports/area) | -0.053* | -0.061* | -0.070** | -0.054* | -0.066** | -0.083*** |
| | (0.031) | (0.031) | (0.031) | (0.031) | (0.030) | (0.030) |
| Trust of relatives | -0.060*** | | | | | 0.036** |
| | (0.015) | | | | | (0.018) |
| Trust of neighbors | | -0.111*** | | | | -0.030 |
| | | (0.014) | | | | (0.020) |
| Trust of local council | | | -0.163*** | | | -0.145*** |
| | | | (0.013) | | | (0.013) |
| Inter-group trust | | | | -0.101*** | | 0.016 |
| | | | | (0.014) | | (0.017) |
| Intra-group trust | | | | | -0.152*** | -0.130*** |
| | | | | | (0.015) | (0.021) |
| Observations | 16709 | 16679 | 15905 | 16473 | 16636 | 15469 |
| 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 |
| Colonial Pop. Density | Yes | Yes | Yes | Yes | Yes | Yes |
| | *With Country Fixed Effects* | | | | | |
| | *Education Level (Categorical Variable)* | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(1+exports/area) | 0.133*** | 0.122*** | 0.116*** | 0.128*** | 0.115*** | 0.098*** |
| | (0.032) | (0.032) | (0.032) | (0.032) | (0.031) | (0.032) |
| Trust of relatives | -0.038** | | | | | 0.035* |
| | (0.015) | | | | | (0.018) |
| Trust of neighbors | | -0.083*** | | | | -0.042** |
| | | (0.014) | | | | (0.019) |
| Trust of local council | | | -0.080*** | | | -0.068*** |
| | | | (0.013) | | | (0.013) |
| Inter-group trust | | | | -0.059*** | | 0.029* |
| | | | | (0.013) | | (0.017) |
| Intra-group trust | | | | | -0.109*** | -0.104*** |
| | | | | | (0.014) | (0.019) |
| Observations | 16709 | 16679 | 15905 | 16473 | 16636 | 15469 |
| 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 |
| Colonial Pop. Density | Yes | Yes | Yes | Yes | Yes | Yes |

*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

*Notes*: The table above systematically controls for all measures of trust used by Nunn and Wantchekon (2011). The top panel reports the OLS estimates without country fixed effects. The bottom panel reports estimates with country fixed effects. Please refer to the detailed notes in Table A7.

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