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This one is 400 Libyan dinars, this one is 500: Insights from Cognitive Human Capital and Slave Trade[1]

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This one is 400 Libyan dinars, this one is 500: Insights from Cognitive Human Capital and Slave Trade

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Abstract

One of the most disturbing contemporary episodes in human history that has been decried globally is the recent Libyan experience of slave trade, where migrants captured end-up being sold as slaves. We contribute to the understanding of this phenomenon by investigating the role of cognitive human capital in slave trade. To this end, we use the historic intelligence and slave trade variables respectively, as the independent and outcome variables of interest. Our findings show a negative relationship between slave trade and cognitive human capital. Hence, slave trade is more apparent when cognitive human capital is low. The Ordinary Least Squares findings are robust to the control for outliers, uncertainty about the model and Tobit regressions. We substantiate why from the perspective of massive sensitisation and education, the non-contemporary relationship between cognitive ability and slave trade established in this study has contemporary practical policy relevance in efforts to stem the tide of clandestine travel to Europe through countries in which clandestine migrants are captured and sold as slaves.

JEL Classification: I20; I29; N30

Keywords: Intelligence; Human Capital; Slavery

1. Introduction

"*This man would come and say 'I need one person,' and they say, 'This one is 400 Libyan dinar.' 'This one is 500.' 'This one is for 300' and 'this one is for 200.' They sell you and buy you like that, (In U.S. dollars, that's a range of about $150 to $350)*" (Sherlock, 2018). Two main tendencies in policy and academic circles motivate the positioning of this study, namely: the growing policy concern of slave trade (especially in Africa) and gaps in the literature. The two points are substantiated in chronological order.

First, according to the International Organization for Migration (IOM), migrants who go through Libya to Europe are ignorant of the trade circumstances prevailing on the ground. The IOM chief spokesman Leonard Doyle in Geneva maintains that "*There they become commodities to be bought, sold and discarded when they have no more value*" (IOM, 2017). According the narrative, the fact that migrants caught in Libya are sold as slaves has been unanimously and widely condemned by governments of the world as well as international development agencies.

Second, though some dimensions on the concern of immigration and corresponding negative externalities have been covered in recent literature (Sigona, 2017; Zarocostas, 2018) scholarly focus on the crisis is sparse from the perspective of slave trade, probably because of the very recent occurrence of the crisis which was first revealed towards the end of the 2017. In this study, we bridge the gap in the literature by building on this contemporary renewal of interest in slave trade to provide insights into the historic connection between cognitive human capital and slave trade. Beyond the motivation of the recent Libyan experience, such a positioning is also relevant on the grounds of the sparse literature on slave trade. This is probably because data on the phenomenon, for the most part, was not comprehensively available before the study of Nunn (2008a) on the connection between slave trade and economic development[2]. Following Nunn (2008a), there has been a growing stream of the literature on the contemporary development consequences of slave trade (Nunn, 2008b, 2010; Philippe, 2010; Dell, 2010; Whatley & Gillezeau, 2010, 2011; Nunn & Wantchekon, 2011; Nunn & Diego, 2012; Bezemer *et al.*, 2014). Unfortunately, in spite of the growing relevance of education and knowledge economy in development outcomes (Tchamyou, 2017, 2018; Asongu & Tchamyou, 2018; Asongu & Nwachukwu, 2018a, 2018b), the extant literature has not robustly investigated the nexus between human capital and slave trade because it has

[2] For an introduction into the works of Nunn, the interested reader may refer to Kodila-Tedika (2011).

failed to account for censured nature of the data as well as the uncertain nature of the relationship under investigation (Asongu & Kodila-Tedika, 2018).

By addressing the highlighted issues using Historic intelligence quotient (IQ) as the measurement of human capital, this study also contributes to the debates on the relevance of IQ in development outcomes. While Historic IQ is consistent with the problem statement being investigated because data on slave trade from Nunn (2008a, 2008b) is also historic, there have some criticisms in scholarly circles on the relevance of the IQ or cognitive ability as a measurement of human capital.

It is important to note that there is yet no consensus in empirical literature on the measurement of human capital (Weede & Kampf, 2002; Asongu & Tchamyou, 2017). In essence, the impact of specific indicators of human capital on development outcomes is yet to be widely accepted (Cohen & Soto, 2007; De la Fuente & Domenech, 2006). In attempts to address the underlying concerns, a strand of authors has used international academic evaluation tests such as the Program of International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) (Hanushek & Kimko, 2000; Hanushek & Woessmann, 2008, 2009). Another stand of authors involving psychologists such as Lynn and Vanhanen (2012a, 2012b) has compiled data on IQ from many countries. This latter strand is more relevant for our study because the Historic IQ developed by Lynn (2012) has not been widely used in the literature, with the exception of a few studies (e.g. Danielle, 2013).

In this study, we employ the Historic IQ from Lynn (2012) on two main grounds. On the one hand, it is consistent with the non-contemporary phenomenon of slave trade. On the other hand, the IQ from the same author has been widely used scholarly in scholarly circles to explain contemporary development phenomena, in spite of criticisms such as the under estimation of IQ in African countries (see Wicherts *et al.*, 2010a, 2010b, Kodila-Tedika & Asongu, 2016). Some examples on the wide usage of the IQ, include, its employment to connect and explain other macroeconomic and institutional variables such as: statistical capacity (Kodila-Tedika *et al.*, 2017); environmental quality (Salahodjaev, 2016a, 2016b); governance (Kodila-Tedika, 2014; Rindermann *et al.*, 2015), poverty (Kodila-Tedika & Bolito-Losembe, 2014), entrepreneurship (Salahodjaev, 2016c; Hafer & Jones, 2015), economic growth (Jones & Schneider, 2006), financial development (Salahodjaev, 2015a; Kodila-Tedika & Asongu, 2015; Hafer, 2016), taxation (Kodila-Tedika & Mutascu, 2014), alcohol consumption (Belasen & Hafer, 2013), economic diversification (Kodila-Tedika &

Asongu, 2018), well being (Nikolaev & Salahodjaev, 2016, Hafer, 2016), gender inequality (Salahodjaev & Azam, 2015) and the informal economy (Salahodjaev, 2015b).

In the light of the above, the present study contributes to the extant literature by investigating the relevance of cognitive human capital (proxied with Historic IQ) on trade slave (proxied with slave exports). The intuition for the investigation is that countries that were comparatively more endowed with better human capital levels were equally more predisposed to experience lower levels of exports in slaves. This is essentially because intelligence associated with the underlying higher human capital levels is also linked with dynamics of organization and corporation that enabled them to escape from capture by slave traders (Jones, 2008; Kodila-Tedika, 2014). Such corporation and organization were relevant for confronting and monitoring slave traders. These avenues of corporation and organization would also have enabled potential slaves to make better use of landscapes and forests as mechanisms of escape and hideout. This narrative is broadly consistent with Nunn and Puga (2012) who have established that ruggedness of landscape eased escape from slavery by potential victims of slave trade. Building on the established positive association between intelligence and the ability of individuals to find solutions and engage in compromise (Kodila-Tedika, 2014), it is also reasonable to postulate that intelligence was linked with lower levels of exports in slaves.

The rest of the study is organized as follows. The data and empirical strategy are described in Section 2. The empirical results and robustness checks are covered in Section 3 and Section 4 respectively. We conclude in Section 5.

2. Data description and empirical strategy

2.1 Data description

The outcome indicator is "slave exports" which entails the estimated number of slaves that were exported from Africa between 1400 and 1900: a periodicity capturing the four episodes of slave trade. The data is sourced from Nunn (2008a, 2008b) and it is constituted by linking shipping observations from a multitude of historical sources which disclose the ethnicities of slaves that were shipped from Africa during the underlying periodicity. Upon consolidation, the author estimated country-specific slave numbers that were shipped from Africa between 1400 and 1900. In the light of the insights above, we normalize figures on exports in terms of land surface area per country. Given that some countries are not associated with slave exports, in order to address issues related to positively skewed data, the data is transformed by taking the natural logarithm of one plus the number of exported slaves per 1000 sq km (square kilometre). More insights into how the data is computed are available in Nunn (2008a, 2008b).

As highlighted in the introduction, cognitive human capital is measured with the Historic Intelligence Quotient (IQ). The indicator which has been used in recent intelligence literature (Lynn, 2012; Danielle, 2013) is measured as the "*national average intelligence quotients of populations, including estimates of indigenous populations for the colonized countries*" (Danielle, 2013, p. 31). IQ within the framework of the study represents the reasonability of a person (computed using problem-solving related tests) as compared to the statistical norm or average age of the person. While Danielle has employed two measures of intelligence (i.e. the IQ and Historic IQ), only Historic IQ is used this study because it is in line with the non-contemporary nature of slave exports used as the outcome variable. It is also worthwhile to note that, while different types of intelligence exists (e.g. musical, naturalist, existential, mathematical, logical, linguistic, interpersonal, spatial and bodily-kinesthetic), it is assumed in this paper that the multitude of intelligence dimensions are captured by the IQ. The reasoning-inclination and "problem solving"-orientation of the study builds on the perspective that IQ can be used to avoid captivity during slave trade.

Adopted control variables which are consistent with the literature on slave trade (e.g. Nunn & Puga, 2012) discussed in the introduction, include: "year since the Neolithic Transition", biogeographic conditions, mean ruggedness, the adoption of military, agricultural and communications technologies, *inter alia* (Tech1500), landlockedness and the European descent.

"Year since Neolithic Transition" denotes the time elapsed in terms of thousands of years (as of the year 2000) since the earliest recorded date on the transition from primary dependence on hunting to primary reliance on cultivated crops and livestock. This indictor which is compiled by Putterman (2008) constitutes a multitude of both region- and country-specific studies on archaeology, coupled with studies of more general framework pertaining to the Neolithic transition from hunting and gathering to agriculture. More insights into the data are available from the website of the Agricultural Transition Data Set. These include insights into assumptions on the methodology and data sources employed for the construction of the indicator.

"Biogeographic conditions" encompasses the number of pre-historic plant and animal species that were domesticable. Its computation is guided by the methodology proposed by

Olsson and Hibbs (2005). It is worthwhile to articulate that the literature has emphasised that biogeography and technology are exogenous to the slavery (Angeles, 2013).

"Mean ruggedness" refers the average value of an index on the landscape ruggedness of a country, relative to hundreds of metres above the sea level. The value is computed on the basis of geospatial surface undulation measurements, contingent on a degree of resolution from the Economic data (G-Econ) project that is geographically-based (Nordhaus, 2006). This computation builds on enhanced spatially disaggregated elevated indicators on a ten minutes resolution from New *et al.* (2002). The grid cell level indicator of ruggedness is further computed at the country level through averages across grid cells that are located within countries' borders. More information on the computation of this indicator is also available on the G-Econ project's website.

"Tech1500" is a measurement adopted from Easterly *et al.* (2010) which indicates the adoption of communication, agriculture and military technologies while the landlocked dummy from the Central Intelligence Agency (CIA) World Fact book represents nations that are landlocked on the basis countries' coastline length. Consistent with Asongu (2012, 2015, 2018), this measurement is employed to account for the unobserved heterogeneity in comparative development literature.

"Statehist" from Putterman (2004, revised 2012), is an indicator which appreciates the importance of supra-tribal governments (that existed between 1 CE and 1500 CE) in territories which reflect countries of today while the European descent indicator measures people of European origin. It is important to note that Acemoglu *et al.* (2001) have established the relevance of geography in the development of Africa.

Appendix 1 discloses the summary statistics whereas the correlation matrix is provided in Appendix 2. The sampled countries are: "Afghanistan; Angola; Albania; United Arab Emirates; Argentina; Australia; Austria; Benin; Belgium; Burkina Faso; Bangladesh; Bulgaria; Bosnia and Herzegovina; Belarus; Belize; Bolivia; Brazil; Bhutan; Botswana; Central African Republic; Canada; Chad; Chile; China; Cote d'Ivoire; Cameroon; Congo; Colombia; Costa Rica; Cuba; Czech Republic; Denmark; Algeria; Ecuador; Egypt; Spain; Estonia; Ethiopia; Finland; Fiji; France; Gabon; United Kingdom; Germany; Ghana; Guinea; Guinea-Bissau; Equatorial Guinea; Greece; Guatemala; Guyana; Hong Kong; Honduras; Croatia; Hungary; Indonesia; India; Ireland; Iran; Iraq; Israel; Italy; Jordan; Japan; Kazakhstan; Kenya; Cambodia; Republic of Korea; Laos; Lebanon; Liberia; Libya; Lesotho; Lithuania; Latvia; Morocco; Republic of Moldova; Madagascar; Mexico; Macedonia; Mali;

Malta; Myanmar; Mongolia; Mozambique; Oman; Mauritania; Malawi; Malaysia; Namibia; Niger; Nigeria; Nicaragua; Netherlands; Norway; Nepal; New Zealand; Pakistan; Panama; Peru; Philippines; Papua New Guinea; Poland; Portugal; Paraguay; Romania; Russian Federation; Saudi Arabia; Sudan; Senegal ; Singapore; Sierra Leone; El Salvador; Somalia; Singapore; Serbia; Suriname; Slovakia; Sweden; Swaziland; Switzerland; Syria; Thailand; Tajikistan; Turkmenistan; Tonga; Tunisia; Turkey; United Republic of Tanzania; Uganda; Ukraine; Uruguay; United States; Uzbekistan; Venezuela; Vietnam; Yemen; South Africa; Congo Democratic Republic; Zambia and Zimbabwe.

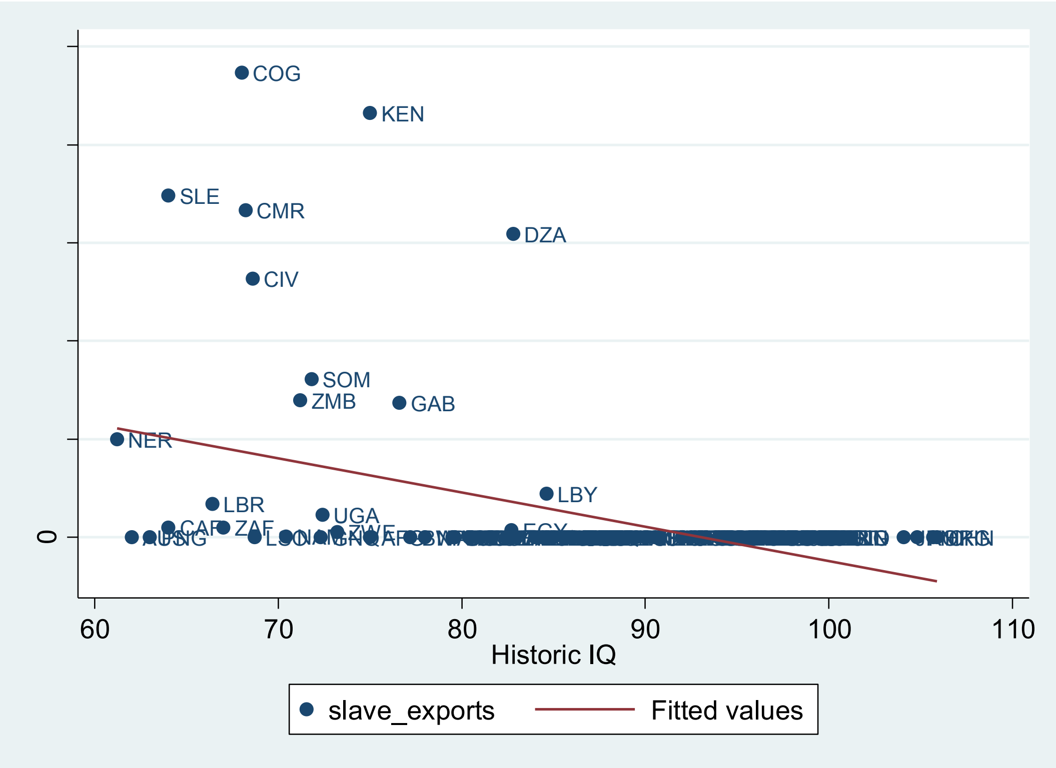

Figure 1: Relationship between Slave Exports and Historic IQ

From Figure 1, a negative linkage between slave exports (the proxy for slave trade) and Historic IQ (the proxy for cognitive human capital) is apparent. While the graph confirms the intuition on the negative nexus between the two variables of interest, it is important to substantiate the exploratory relationship with more robust empirical validity.

2.2 Empirical strategy

In accordance with recent intelligence (Kodila-Tedika & Asongu, 2015a, 2015b) and development (Asongu, 2013) literature, Eq. (1) investigates the nexus between slave trade and Historic IQ.

$$ST_i = \alpha_1 + \alpha_2 HI_i + \alpha_3 C_i + \varepsilon_i \ , \qquad (1)$$

where, ST_i (HI_i) represents the slave trade (Historic IQ) indicator for country i , α_1 is a constant, C is the vector of control variables, and ε_i the error term. *C* which reflects variables in the conditioning information set includes: Years to Neolithic transition; Biogeographic conditions, Ruggedness, Tech 1500; Landlocked and European descent. The purpose of Eq. (1) which is estimated by Ordinary Least Squares (OLS) is to assess if Historic IQ is connected to slave trade. The estimation is with standard errors that are corrected for heteroscedasticity

For robustness purposes, we account for the censured nature of the data by employing the Tobit model. It is important to note that the observations are left-censored because we are studying a phenomenon that has already occurred and do not know précised specific episodes of major trade during the sampled periodicity. Hence, in order to account for the left-censored nature of the outcome variable, a Tobit model is adopted because estimating by Ordinary Least Squares (OLS) may not be appropriate (Kumbhakar & Lovell, 2000; Koetter *et al.*, 2008; McDonald, 2009; Ariss, 2010; Coccorese & Pellecchia, 2010; Asongu & Nwachukwu, 2016).

The standard Tobit model (Tobin, 1958; Asongu & Le Roux, 2017; Boateng *et al.*, 2018) is as follows in Eq. (2):

$$y^*_{i,t} = \alpha_0 + \beta X_{i,t} + \varepsilon_{i,t} , \qquad (2)$$

where, $y^*_{i,t}$ is a latent response variable, α_0 is a constant, $X_{i,t}$ is an observed $(1 \times k)$ vector of explanatory variables and $\varepsilon_{i,t} \approx$ i.i.d. N(0, σ^2) and is independent variables in $X_{i,t}$.

Instead of observing $y^*_{i,t}$, we observe $y_{i,t}$ in Eq. (3):

$$y_{i,t} = \begin{cases} y^*_{i,t,} \ if \ y^*_{i,t} > \gamma \\ 0, \ if \ y^*_{i,t} \leq \gamma, \end{cases} \qquad (3)$$

where, γ is a non-stochastic constant. In other words, the value of $y^*_{i,t}$ is missing when it is less than or equal to γ.

3. Empirical results

The empirical findings are disclosed in this section. The baseline OLS results are provided in Table 1. Consistent with the intuition of the study, there is a negative relationship between Historic IQ and the outcome variable. This negative relationship withstands empirical scrutiny when alternative specifications are taken into account. These involve varying constituents in the conditioning information set or control variables. Such variation in constituents in the conditioning information set is reflected by geographic, historic and cultural variables.

Most of the estimated control variables have the anticipated signs, even when they are not significant. With regard to the significant control variables: (i) the Tech1500 index logically has a positive relationship with slave trade because it reflects the adoption of some technologies (military, agricultural and communication) that are by intuition positively related to trade and openness activities (Easterly & Gong, 2010); (ii) in accordance with Angeles (2013), biogeographic conditions in Africa considerably hamper the development of the continent, including trade.

As concerns the insignificant control variables, (iii) slave trade is negatively connected to with “year since the Neolithic transition”. This negative relationship is most likely because as time unfolds, owing to increasing civilisation, people growingly become aware of the imperative to treat human beings as equal, regardless of the their skin colour. (iv) Landlocked nations are logically negatively connected to slave trade because getting into landlocked countries to capture slaves required more resources as well as entailed more risks. (v) In accordance with Nunn and Wantchekon (2011), “terrain ruggedness” facilitated local resistance to and escapes from slave trade. Hence, a negative relationship is expected. (vi) The relationship between the European descent and slave trade is positive because Europeans considerably participated in slave trade (Acemoglu *et al.*, 2005).

Table 1: Ordinary Least Squares Estimations

	I	II	III	IV	V	VI	VII
Historic IQ	-697.437***	-691.712***	-843.751***	-769.994***	-907.913***	-984.695***	-1097.752***
	(133.929)	(155.775)	(253.396)	(254.331)	(282,563)	(285.502)	(388.545)
Years since Neolithic		-536.613	-99.592	279.592	-264,730	-600.232	-449.581
		(661.788)	(1 310.914)	(1 315.492)	(1 646.153)	(1 649,937)	(976.523)
Biocondition			29.623	-590.554	-3 281.519	-3 122.004	-4 234.193*
			(2 554.825)	(2 551.867)	(3 414.774)	(3 388.619)	(2 277.645)
Ruggedness				-3 126.097	-3 105.367	-2 363.315	-2 240.832
				(1 917.806)	(2 010.847)	(2 062.826)	(1 515.130)
Tech 1500					19 710.659	20 626.364	24 366.895**
					(15 656.923)	(15 541.929)	(10 920.159)
Landlocked						-7 897.451	-8 057.981
						(5 610.507)	(5 178.518)
European_descent							44.386
							(39.827)
Constant	64 932.714***	67 493.359***	79 332.746***	75 446.883***	81 040.665***	89 589.106***	95 073.503***
	(11 656.070)	(12 651.597)	(22 234.160)	(22 089.212)	(23 144.316)	(23 743.974)	(33 193.765)
Number of observations	122	111	70	70	65	65	64
R^2	0.184	0.198	0.234	0.264	0.284	0.308	0.310

Notes: .01 - ***; .05 - **; .1 - * represent significant levels of 1%, 5% and 10%. Historic IQ: Historic Intelligence Quotient. "Year since Neolithic": Year since the Neolithic transition. Biocondition: Biogeographic conditions. Ruggedness: Mean ruggedness. Tech 1500: the adoption of technologies in military, agriculture and communication. Landlocked: landlocked countries. European_descent: European descent.

4. Robustness checks

Three main types of robustness checks are performed, notably, by: (i) controlling for outliers, (ii) accounting for uncertainty about the model and (iii) taking into account the left censored nature of the data using Tobit regressions.

First, we verify the consistency of the findings by controlling for the presence of outliers. In accordance with Kodila-Tedika and Asongu (2015c), two methods for the control of outliers are used for this purpose, namely: Hadi (1992) and Huber (1973). The latter strategy from Huber entails the use of Iteratively Reweighted Least Squares (IRWLS) with M-Regression. As maintained by Midi and Talib (2008), compared to the OLS, this approach is robust because it accounts for outliers. Accordingly, it simultaneously addresses concerns arising from the non-constant nature of variance (i.e. heteroscedasticity) and the presence of outliers.

The IRWLS findings are presented in the second column of Table 2. In the third column, findings on the Hadi approach to the detection of outliers are presented. The following outliers are detected and excluded, namely: Turkey, Egypt, Uganda, Botswana, Sierra Leone, Pakistan, Cameroon, Congo, Japan, Tunisia, Syria, Zambia, Nepal, Zimbabwe, South Africa, Lesotho, Papua New Guinea, Central African Republic, Niger, Morocco and China. In the fourth column, the dependent variable is transformed by taking its natural logarithm. All the approaches confirm the robust negative relationship between Historic IQ and slave trade.

The control variables have the expected signs for the most part. In addition to the discussed variables in the conditioning information set in Table 1, the variable "Statehist" which reflects evidence of supra-tribal government is positive and the positive nexus can be explained by the fact that kings and chiefs did not play an insignificant role in the slave trade, since they facilitated the capture of slaves (Smith, 2009) in exchange for some Western commodities.

Table 2: Controlling for outliers

	M-Regression	Hadi	Ln
Historic IQ	-89.594**	-3 088.587***	-101 048.525***
	(36.837)	(957.984)	(33 943.261)
Years since Neolithic	-102.400*	-4 453.346*	-798.360
	(54.770)	(2 360.959)	(1 740.259)
Biocondition	-236.407	16 828.265**	-4 041.561
	(187.638)	(6 983.989)	(4 126.932)
Ruggedness	-155.566*	-312.034	-2 211.895
	(89.544)	(1 843.493)	(2 150.616)
Statehist	465.805	-14 436.131	5 588.497
	(627.523)	(15 616.385)	(17 603.167)
Tech 1500	2 052.230***	-1 349.259	21 846.936
	(780.635)	(22 975.101)	(16 626.824)
Landlocked	196.871	6 399.042	-9 629.098*
	(160.274)	(5 517.946)	(5 738.650)
European_descent	4.879	-36.646	58.064
	(4.449)	(122.925)	(90.901)
Constant	7 407.470***	306 830.564***	450 131.293***
	(2 820.682)	(84 261.691)	(142 393.495)
Number of observations	63	40	63
R^2		0.453	0.346

Notes: .01 - ***; .05 - **; .1 - * represent significant levels of 1%, 5% and 10%. Historic IQ: Historic Intelligence Quotient. "Year since Neolithic": Years since the Neolithic transition. Biocondition: Biogeographic conditions. Ruggedness: Mean ruggedness. Statehist: importance of supra-tribal governments. Tech 1500: the adoption of technologies in military, agriculture and communication. Landlocked: landlocked countries. European_descent: European descent.

In Table 3, the models account for uncertainty. Consistent with recent literature (Young, 2009; Young & Kroeger, 2017), econometric models are always associated with some degree of uncertainty. In order to further assess the robustness of the findings from this uncertain dimension, we use the *mrobust* command in Stata developed by Young *et al.* (2013). The authors have maintained that "*This program facilitates robustness tests that are more rigorous, transparent, and informative. It takes a regression model and tests the robustness of a coefficient of interest with respect to the choice of controls. The program estimates all possible combinations of control variables, and reports key statistics on the resulting distribution of estimates*" (Young *et al.*, 2013, p.2). The sensitivity framework enables the study to address one of the most relevant concerns in empirical social science, notably: the sensitivity of empirical findings to credible variations in model specification (see Young, 2009). This position is substantiated by Young and Kroeger (2017): "*framework for model robustness of that can demonstrate robustness across sets of possible controls, variable* *definitions, standard errors, and functional forms. We estimate all possible combinations of specified model ingredients, report key statistics on the modeling distribution of estimates, and identify the model details that are empirically most influential*" (p. 4). Our findings using this framework are disclosed in Table 3.

Table 3: The Effect of IQ on Slave Export: Model Uncertainty and Robustness

Variable of interest	Historic IQ		
Outcome variable	Slave export	Number of observations	63
Possible control terms	7	Mean R-squared	0.29
Number of models	128	Multicollinearity	0.78
Model Robustness Statistics:		Conventional Significance Testing:	
Mean(b)	-975.14	Sign Stability	100%
Sampling SE	327.81	Significance rate	100%
Modeling SE	102.16	Positive	0%
Total SE	343.36	Positive and Sig	0%
Robustness Ratio	-2.84	Negative	100%
		Negative and Sig	100%
Model Influence			
	Marginal Effect of Variable Inclusion	Percent Change From Mean(b)	
Tech 1500	-143.4224	14.7%	
Landlock	-99.9181	10.2%	
Ruggedness	53.4373	-5.5%	
European_descent	-34.4223	3.5%	
Statehist	16.6206	-1.7%	
Biocondition	-14.9756	1.5%	
Years since Neolithic	-8.2893	0.9%	
Constant	-859.6574		
R-squared	0.8489		

Historic IQ: Historic Intelligence Quotient. "Year since Neolithic": Years since the Neolithic transition. Biocondition: Biogeographic conditions. Ruggedness: Mean ruggedness. Statehist: importance of supra-tribal governments. Tech 1500: the adoption of technologies in military, agriculture and communication. Landlocked: landlocked countries. European_descent: European descent.

As shown Table 3, 128 unique combinations of control variables were generated by the program. Moreover, the program ran each of those models using OLS and storing the estimates from each model. It is established that the estimated coefficient of IQ is negative and significant (sign stability: 100%, significance rate: 100%, positive and sign: 100%). From the controls with the OLS approach, it is not possible to establish an opposite-signed, or even non-significant, estimate. The average estimate across all of these models is -975.1424. Given the total standard error of 343.3599, the robustness student test statistic is -2.840.

In the light of the second part of the table, notably on "model influence", we establish that the following variables exert a positive influence, namely, ruggedness, Statehist (or the importance of supra-tribal governments) and "Years since the Neolithic transition", with third variable having the lowest possible influence. Furthermore, when the Tech 1500 variable is included in the model, the estimated effect of IQ on slave trade is on average 14.7% low.

Results of Tobit regressions are disclosed in Table 4. Given that not all countries experienced slave trade, some observations of the outcome variable may be null. This tendency can substantially bias the estimated coefficients established using previous estimation approaches. Another related concern is the censored nature of the data. Accordingly, observations are left-censored because while we are investigating a phenomenon that has already occurred; we are not precisely knowledgeable of specific periods during which such phenomenon occurred in the light of the sampled periodicity. Hence, we correct for the left-censored nature of the data as well as the presence of null observations by employing the Tobit model. The findings from the Tobit model are broadly consistent with those established earlier.

Table 4: Tobit regressions

	Marginal effects after Tobit	
Historic IQ	-701.454***	-1 110.008***
	(211.755)	(376.988)
Years since Neolithic		-461.338
		(932.440)
Biocondition		-4 281.149*
		(2 193.125)
Ruggedness		-2 265.530
		(1 453.014)
Tech 1500		24 692.532**
		(10 610.726)
Landlocked		-8 185.536
		(4 990.408)
European_descent		45.006
		(38.075)
Constant	65 302.132***	96 132.594***
	(19 507.734)	(32 219.128)
Number of observations	122	64
Pseudo R^2	0.0092	0.0165
Uncensored observations	19	13
Left-censored observations	103	51

Historic IQ: Historic Intelligence Quotient. "Year since Neolithic": Years since Neolithic transition. Biocondition: Biogeographic conditions. Ruggedness: Mean ruggedness. Tech 1500: the adoption of technologies in military, agriculture and communication. Landlocked: landlocked countries. European_descent: European descent.

5. Concluding implications and future research directions

One of the most disturbing contemporary episodes in human history that has been decried globally is the recent Libyan experience of slave trade, where migrants captured end-up being sold as slaves. We contribute to the understanding of this phenomenon by investigating the role of cognitive human capital in slave trade. To this end, we use the historic intelligence and slave trade variables respectively, from Lynn (2012) and Nunn (2008) as the independent and outcome variables of interest. Our findings show a negative relationship between slave trade and cognitive human capital. Hence, slave trade is more apparent when cognitive human capital is low. The Ordinary Least Squares findings are robust to the control for outliers, uncertainty about the model and Tobit regressions.

The findings are broadly in line with Kodila-Tedika (2014) and Jones (2008) who have postulated that nations which were associated with higher levels of human capital were also more likely to corporate effectively as well as put in place organisations that prevented the inhuman treatment of human beings in society. While the findings cannot be directly exported to the recent Libyan experience owing the political stalemate in the country, it is nonetheless important to emphasize that Africans that are south of the Saharan need to be educated on the perils of moving to Europe clandestinely through the Sahara Desert and Libya. The youth in Africa need to be increasingly sensitised on the risks to slavery involved in such perilous journeys. In so doing, the unemployed youth will be endowed with higher levels of understanding (and by extension intelligence) on the risks associated with clandestine travel to Europe through routes that are likely to lead them to captivity and eventually sold as modern slaves. It follows that seen from the perspective of massive sensitisation and education, the non-contemporary relationship between Historic IQ and slave trade established in this study has contemporary practical policy relevance. This recommendation of massive sensitisation accords with the International Organization for Migration (IOM) which maintains that migrants who go through Libya to Europe are ignorant of the trade circumstances prevailing on the ground (IOM, 2017).

On a societal front, push factors such as unemployment, poverty and political stability can be addressed with more education of leaders on the importance of effective political, institutional and economic governance in sub-Saharan African countries. Such push factors can be taken on board if leaders are intelligent enough to put society's interest above theirs once they hold leadership, government and operational positions.

Future studies can improve the established findings and extant literature by exploring and suggesting other policy measures by which modern slavery can be mitigated and avoided. Libya is a good country-specific candidate to start with. This is essentially because not exclusively blanket policies are required, given that the phenomenon is contemporarily more pronounced in some countries than in others.

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Appendix 1: Descriptive Statistics

	Obs	Mean	Std. Dev
Historic IQ	142	84.59648	11.03489
European_descent	162	31.30754	41.37928
Biogeographic conditions	101	.0772379	1.392351
Mean ruggedness	114	1.263002	1.105888
Tech 1500	118	.4868644	.3141906
Landlock	195	.1897436	.3931074
Neolithic Transition	165	4814.242	2453.842
Statehist	153	.4510381	.2434273
Slave export	189	82911.63	356199.9

Obs: Observations. Std. Dev: Standard Deviation. IQ: Intelligence Quotient. European_descent: Variable on European Descent. Biogeographic conditions refer to the first principal component of the number of prehistoric: (i) domesticable animal species and (ii) plant species. Seventh, 'mean ruggedness' is the mean value of an index on landscape ruggedness (relative to hundreds of meters above the sea level) for a nation. Tech1500 is an index denoting the adoption of military, agricultural and communications technologies, inter alia. Sixth, 'Statehist' is an index denoting the presence of supra-tribal government on territory representing the present-day country, entailing years 1CE to 1500 CE.

Appendix 2 : Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Statehist (1)	1								
Slave export (2)	0.01	1							
Historic IQ (3)	0.64	-0.39	1						
Biogeographic Conditions (4)	0.65	-0.30	0.70	1					
Meanruggedness (5)	0.32	-0.24	0.33	0.22	1				
Neolithic Transition (6)	0.66	-0.19	0.55	0.75	0.27	1			
Landlocked (7)	-0.15	-0.02	-0.21	-0.15	0.11	-0.20	1		
Tech 1500 (8)	0.73	-0.11	0.68	0.85	0.19	0.74	-0.14	1	
European_descent (9)	0.24	-0.28	0.68	0.62	0.16	0.32	-0.10	0.43	1

European_descent: Variable on European Descent. Pop: Population. Biogeographic conditions refer to the first principal component of the number of prehistoric: (i) domesticable animal species and (ii) plant species. Seventh, 'mean ruggedness' is the mean value of an index on landscape ruggedness (relative to hundreds of meters above the sea level) for a nation. Tech1500 is an index denoting the adoption of military, agricultural and communications technologies, inter alia. Sixth, 'Statehist' is an index denoting the presence of supra-tribal government on territory representing the present-day country, entailing years 1CE to 1500 CE.