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Is There a Long-Term Effect of Africa's Slave Trades?

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Abstract

Nunn (2008) found a negative relationship between past slave exports and economic performance within Africa. Here we investigate these findings and the suggested causal pathway in further detail. Extending the sample period back in time we reveal that the coefficient on slave exports did not become significantly negative until 1970, and that it was close to zero in 1960. While one potential explanation for this temporal pattern could be decolonization, we analyse other episodes of slave raiding outside Africa, and find evidence that questions the validity of such suggestion. In addition, our reading of the historical and anthropological literature differs from that of Nunn. For instance, taking a global rather than African perspective we find that the African slave trades cannot without difficulties explain the patterns of ethnic fractionalization that we observe today.

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Contents

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1. Introduction[1]

A great number of hypotheses have been put forth in order to explain Africa's anomalously poor economic performance (Rodney 1972; Easterly and Levine 1997; Sachs and Warner 1997; Collier and Gunning 1999; Acemoglu, Johnson and Robinson 2001; Hernández-Catá, Schwab and Lopez-Claros 2004). One popular theory claims to have traced its roots back to past slave trades, and in particular, the trans-Atlantic slave trade. A recent proponent of this theory is Nathan Nunn (2008) who has uncovered evidence in favor of a substantial negative relationship between past slave exports and current economic performance within Africa. Nunn argues that his evidence taken together with the historical literature suggests that slave trade had an adverse effect on economic development and that the most likely causal pathway goes via impeded state formation and increased ethnic fractionalization.

However, despite its intuitive appeal and supporting data, we argue that the long run effects of slave trade are not necessarily as clear-cut as Nunn's reasoning would suggest. In particular we show that a too narrow focus on a single year, 2000, as the outcome variable and a single continent, Africa, as the sample space may be driving his conclusions.

By extending the sample period in Nunn (2008) back to 1960 we demonstrate that the coefficient for past slave exports is declining over time and that it is not significantly below zero before the 1970s. While this finding is in line with Nunn's suggestion that the economic effects of past slave exports did not necessarily manifest themselves until after the decolonization of Africa, we also uncover a number of empirical irregularities in the data. Most notably, the coefficient for past slave exports is often positive instead of negative for those countries that produced oil at any point in time during the sample period. Further, our reading of the historical and anthropological literature is quite different from that of Nunn. In Africa, there is an obvious latitudinal gradient in ethnic fractionalization which is associated with GDP as well as past slave exports (Easterly and Levine 1997; Alesina *et al.* 2003; Nunn 2008). Nunn suggests, presumably in light of this, that the causal mechanism from slave exports to current economic performance goes via ethnic fractionalization. It is argued that the exogenous demand for slaves led to a decrease in trust and an increase in conflict, which in turn impeded state formation and contributed to modern day ethnic fractionalization. That ethnic fractionalization is associated with poor economic performance is well known, although the actual causes remain disputed (Easterly and Levine 1997; Alesina *et al.* 2003). What is undisputed, however, is that lower latitudes are strongly associated with higher ethnic and linguistic diversity, not only in Africa, but also globally (Cashdan 2001; Collard and Foley 2002). This empirical relationship is perhaps little known outside the rather narrow field of human biogeography, but it mirrors an extensive and earlier literature that documents a latitudinal gradient in present, and past, species diversity, within, as well as across, regions and taxa (Pianka 1966; MacArthur 1972; Rosenzweig 1992; 1995).

While these facts do not disprove, or particularly undermine, the negative association between past slave trade and current economic performance for Africa as a whole, they do

[1] We would like to thank Robert A. Foley for kind permission to reprint Figure 1 as well as Tore Ellingsen, Magnus Johannesson, Juanna Joensen, Erik Lindqvist, Mats Lundahl, Sheilagh Ogilvie, Ola Olsson, Tino Sanandaji, Yoichi Sugita, an anonymous referee at the Bank of Italy, and seminar participants at the Stockholm School of Economics Lunch seminar Series and the RES 2012 Annual conference for their helpful comments and suggestions.

suggest that if there is a causal relationship, then it is likely to be more complex, and less straightforward, than what is commonly believed. In fact, to complicate matters further collecting and analysing historical data on contemporaneous pirate raiding activities we demonstrate that there is also a negative relationship between past slave raids and current economic performance within Italy.[2] On the surface this evidence is supportive of a negative relationship between past slave trades and GDP per capita. However, such a relationship has admittedly rarely, if ever, been suggested by historians for Italy. Together with the fact that, like for Africa, going back to 1960, the trend of the coefficient on slave raids is downward sloping, the Italian evidence arguably casts doubt on, rather than support, the reliability of the methodology employed to support the hypothesis that past slave exports negatively affected economic development in post-independence Africa. Rather, this additional empirical evidence is suggestive of possible methodological limitations, such as omitted variables or spurious correlation.

The remainder of the paper is organized as follows. Section 2 investigates the long run economic consequences of slave trade in more detail. Section 3 reviews the anthropological and historical literature, while Section 4 describes the data and the empirical strategy. The empirical results are presented in Section 5 and we conclude with a discussion of our findings in Section 6.

2. The economic consequences of slave trade

The first and most immediate effect of Africans selling other Africans to non-Africans in return for various commodities and precious metals is obviously an increase of capital and a decrease of labor in Africa. Further, in the presence of decreasing marginal products of capital, land and labor, the marginal and average product of labor for the remaining African population that was not exported as slaves should have increased, *ceteris paribus*. That a large scale catastrophe, like the slave trades were for large parts of Africa, can cause an increase in average and marginal productivity may perhaps seem counter-intuitive, or even perverse, to some, but such outcomes are well documented (Lee 1973; Findlay and Lundahl 2002; 2006; Clark 2005; Pamuk 2007). In this respect, the economic consequences of the slave trades are clearly analogous to those of the Black Death in medieval Europe[3], but with the added twist of an influx of capital. However, in contrast to the Black Death the slave trades did not target individuals in an approximately random fashion. Rather, the demand for slaves was concentrated to young and healthy males, in the trans-Atlantic slave trade, or females, in the trans-Saharan slave trade (Phillips 1985).[4] Thus, since young adult males were arguably the most productive group in pre-industrial societies (Kaplan *et al.* 2000), selection may potentially have offset other immediate effects of slave exports on GDP per capita, leaving the overall effect unresolved in the absence of more detailed data.

The exact nature and mechanisms behind medium and long run effects of slavery on economic performance are in many ways even less clear than those for short run effects. This

[2] As measured by regional per capita GDP in 2000.

[3] Similar outcomes have been observed also for the Justinian plague in 6th century Egypt and to a lesser extent for the Antonine plague in 2nd century Egypt (see for instance Findalay and Lundahl 2006; Scheidel 2010a).

[4] Interestingly this suggests that short, and long, term effects of the slave trades may have been heterogeneous across Africa. Nunn (2008) implicitly assumes homogenous effects.

pertains in particular to the type of effects that we study here, that is, effects that are observed several decades, or centuries, after the actual trades themselves stopped. Not only does the testing of long run effects involve a Kierkegaardian leap of faith in terms of a large set of untestable exogeneity, homogeneity and ceteris paribus assumptions, it also relies on the existence of causal and permanent effects on factors that determine not only aggregate, but also per capita production. These are stringent requirements, in particular the latter one, which asks that any such effects holds also after accounting for population dynamics. Importantly, the method employed by Nunn (2008), regressing current GDP on past slave exports, imply that hundreds of years of history is treated as a black box, an approach that Austin (2008) has critically dubbed "compression of history", and that is particularly sensitive to a number of key assumptions. For instance, in his regressions Nunn (2008) control for colonizer fixed effects, but these are only partially complete and do not cover neither the prolonged Bantu colonization of Eastern and Southern Africa that continued well into the 19th century nor any of its contemporary Arabic incursions into sub-Saharan politics (Gray 1975; Flint 1977). Nonetheless, it is not difficult to construct an argument for why an observed association between past slave trade and current economic performance could be causal. As we have seen, the exogenous demand for slaves was targeted to the two groups, young and healthy men and women, who were key to both production and reproduction in pre-industrial societies. The exogenous demand for slaves may also have channelled effort and resources away from productive to destructive and rent-seeking activities such as arms races and slave raiding.

According to Nunn (2008) this is approximately what happened. The African slave trades led to a demographic collapse, the corruption of existing legal systems, increased conflict, an environment of mistrust and smaller and less well functioning states. Slaves were often acquired through raiding, or alternatively sometimes via the legal system. The latter method arguably undermined the rule of law, while slave raiding contributed to create an environment of mistrust and violence. These developments were further fuelled by the influx of European weapons which helped to create an arms race accompanied by a vicious circle of violence that is often referred to as the guns for slave cycle.[5] Compared to other, earlier, episodes of slave trading the African slave trades were unique both in their scale and in how they turned individuals of the same, or similar, ethnicities against each other. The foreign demand for slaves spurred neighboring individuals, groups and villages to raid each other. This in turn led to the breakdown of existing states and impeded the formation of larger and more well functioning states. Nunn's suggested causal mechanism thus goes from past slave trades to current economic performance via these phenomena, ethnic fractionalization, weak government, corruption and low levels of trust, which have all been found to associate negatively with per capita GDP and growth.

To test if past slave trades did in fact have a negative effect on current GDP Nunn runs the following regression,

$$\ln y_i = \beta_0 + \beta_1 \ln(\text{exports}_i/\text{area}_i) + C_i'\delta + X'\gamma + \varepsilon_i$$

[5] There were arguably precursors. In the trans-Saharan slave trade there was a substantial horses for slaves trade predating the guns for slave trade that is typically associated with the trans-Atlantic slave trade. These horses were often used for military purposes as well as for slave raids and this trade is in many respects analogous to the guns for slave trade. See for instance Phillips (1985) and Fisher (2001).

where lny_i is the natural logarithm of real per capita GDP in country *i* in year 2000. $ln(exports_i/area_i)$ is the natural logarithm of the total number of slaves exported from country *i* between 1400 and 1900, normalized by land area. C and X are vectors that control respectively for colonizers prior to independence and a set of geographic and climatic variables. The base line sample consists of all African countries, but a number of these are dropped in robustness checks which also normalize exports by historical population rather than area, along with varying the exact number and composition of the controls. In addition to the standard OLS the author also runs an IV regression where approximate distances from a country to the location of demand for slaves are used as instruments in order to demonstrate causality and overcome measurement error.

The evidence that emerges from this exercise is very much supportive of there being a negative effect of past slave trades on current GDP per capita as the coefficient on exports is typically negative and significant for both the OLS and IV regressions. If correct, the negative effect is not only statistically significant, but also economically so. In Table 1 we report the average GDP per capita across continents in 2000 along with the counterfactual for Africa in the absence of slave exports. Of course, such an exercise is sensitive to a number of assumptions, but as long as it is taken with a pinch of salt it may nonetheless be instructive. As can be seen, according to the OLS estimate for the specification (5) that was used as an example by Nunn (2008) average African GDP per capita would be approximately 50% higher in the absence of slave trade. While this is indeed economically significant it still does not go very far in explaining Africa's comparative economic underdevelopment. In this example, if there were no slave trades Africa's GDP per capita would increase from 38% to 56% of that of the second poorest continent (Asia) and from 5% to 8% of the richest (North America). The calculations thus support the findings from the sub-Saharan countries that were reported in Birchenall (2009a). That is, the OLS estimates reported in Nunn (2008) indicate that past slave exports can explain different economic outcomes within Africa, but only very little of the difference between Africa and the other continents. The IV estimates do however tell a somewhat different story. Using the counterfactual for the corresponding IV specification we find that in the absence of slave trade African GDP would have been 3.75 times higher than what it is now.[6] Thus, average African GDP per capita would have been 43% higher than the Asian and almost at par with the Latin American.

If we choose to accept the evidence that Nunn (2008) presents, it still raises a number of questions. Slavery is an ancient institution that until recently was widespread across the globe (Phillips 1985). Today, Africa is by far the poorest continent. Why then, did slavery cause poverty in Africa, but not elsewhere? Though perhaps not central to detecting a negative association between past slave trades within Africa and current economic performance, it is an important motivating question. Many countries that historically faced extensive slave taking, raiding and trading are today much richer than any African country. Thus, there does not seem to exist a deterministic relationship between slave trade and

[6] When interpreting these estimates it is important to keep in mind that in addition to the standard caveats the coefficient on slave exports for the IV regression used in calculating the counterfactual is significant at the 10%, but not at the 5%, level. In addition, of the four instruments the three for the Islamic slave trades are insignificant while that for the trans-Atlantic is significant at the 10% level. The IV estimate that the calculations are based on is the only one in the paper, (3), which uses both the (almost) full set of controls and the whole sample.

economic performance. By claiming that the African slave trades were unique Nunn (2008) at least partially circumvents this critique.

3. The historical and anthropological evidence

The conclusion that past slave trades had a negative effect on modern-day per capita GDP hinges critically on a number of factors. Crucially, Nunn (2008) argues that the African slave trades were unique for three reasons i) their volume ii) how they turned individuals of same of similar ethnicities against each other and iii) how they corrupted existing legal structures. These features of the African slave trades were also those that supposedly led to ethnic fractionalization, and in turn lower GDP per capita. Hence, given this mechanism, the uniqueness of the African slave trades and their causal link to ethnic fractionalization becomes central to assessing the validity of the claim that the African slave trades led to depressed economic performance. In what follows we will scrutinize these three aspects of the slave trades in detail, collapsing the latter two into one, and thereafter we proceed to take a closer look at how ethnicity was imputed and the validity of the instruments. Doing this, we find that the African slave trades were neither unique in scale nor scope. In addition, we raise a number of concerns as regards the causal relationship between slave trades and ethnic fractionalization.

But, before proceeding we would like to comment on a couple of important issues, which relate both to selection, but are also of a more general interest for evaluating the long run effects of slave trade. The first concerns slavery as an institution, while the second concerns the definition of Africa. In particular, if there were some African societies that had slavery prior to the slave trades, and if there were those that did not, then this could be a potential source of selection into the slave trades. Reviewing the literature Nunn (2008) finds, although not explicitly stating so, that at the onset of the trans-Atlantic slave trade there was no indigenous slavery in sub-Saharan Africa and that slavery only existed in those African societies that were part of the older Islamic slave trades. However, this conclusion stands in stark contrast to the opinions of a number of authorities such as Phillips (1985), Thornton (1998), Lovejoy (2000), Fage and Tordoff (2002) and Austin (2008). Most notably, Austin (2008) addresses Nunn's reading of the literature directly: “Finally (and contrary to Nunn, 2008, p. 139), there is no dispute in the specialist Africanist literature today that ‘domestic’ slavery, while not universal, pre-dated the Atlantic slave trade, and not only in areas involved in the Islamic slave trades” (p. 1006).

Another, and perhaps more important, concern is the definition of the sample as well as of Africa. First, it is important to remember that Africa is a culturally, economically and genetically diverse continent, and hence not necessarily a natural unit for studying the effects of slave trades (Gray 1975; Flint 1977; Oliver 1978; Cavalli-Sforza, Menozzi and Piazza 1994; UNEP 2008). Thus, the sample used in the main analysis contains not only exporters and non-exporters of slaves, but also importers (primarily Northern Africa) as well as countries that were uninhabited (four islands). Although these problems are partially overcome in sensitivity analyses, the issue whether the modern geographic definition of Africa is a natural unit of analysis for studying the economic consequences of slave trades remains. As we shall see these concerns will also be important for evaluating the effect of slavery on ethnic fractionalization as well as for the relationship between selection into slavery and development.

3.1. Volume

Like all slave trades, the African slave trades were unique. While it is possible that the absolute volume of these trades were greater than those of other slave trades, this is not necessarily true. More importantly, the African slave trades were most likely not unmatched in scale. Rather, what makes the African slave trades unique in terms of volume is the comparatively detailed source material. Although there are many gaps, and some debate, we can with reasonable confidence estimate the extent of the trans-Atlantic slave trade. The *Voyages: The Trans-Atlantic Slave Trade Database* which maps the vast majority of the trans-Atlantic slave voyages estimates that this trade alone shipped some 12.5 million slaves from Africa. This is no doubt a lot of people, and it has been suggested that the probability of being captured as a slave during a lifetime in coastal West and Middle Africa could at times have been as high as 9.3% (Whatley and Gillezeau 2009). But, does millions and millions of people make it unique? While there is little actual data for other episodes of slave trading the evidence suggests that this is not the case. Staying in Africa, the trans-Saharan slave trade was also substantial. In his paper Nunn (2008) uses estimates from Austen (1979) who calculated that approximately 7.5 million slaves were exported across the Sahara.[7] While these numbers are both much smaller and less precise than those for the trans-Atlantic trade they illustrate that although the latter is the most studied and well known slave trade, there are many other trades of note.

Perhaps most importantly, late republican and early imperial Rome is often considered to have been the foremost so called slave society in history, arguably surpassing even the New World in the colonial era (Phillips 1985; Bradley 1994; Scheidel 2010b). While there is plenty of evidence as to the nature, and approximate extent, of slavery in Rome, little is known about actual trades and the true number of slaves that were involved. Nonetheless, off the cuffs estimates suggest that in total some 100-200 million people would have been held in slavery by the ancient Romans, and that at its height several millions of slaves lived within the boundaries of the Roman empire (Scheidel 2010b). Even if we allow for organic growth, and the fact that there were a number of slave reservoirs, it is likely that some areas must have supplied Rome with slaves at the same rate as Africa did for the New World, at least if we adjust for population. For example, Gaul remained an important source of Roman slaves for centuries (Bradley 1994; Nash Briggs 2003). Estimates on the extent of this trade are hard to come by, but an often quoted number based on written and archaeological sources puts it at 15,000 per year in peacetime (see discussions in Tchernia 1983; Bradley 1994; Scheidel 2007; 2010b). Importantly, if we adjust for population a different picture emerges. Table 2 reports the estimated number of slaves taken during the Atlantic, Saharan and Gallic slave trades along with the yearly fraction of the estimated population for the Atlantic and Gallic slave trades as well as their ratios.

Of course, all estimates except those for the number of slaves shipped across the Atlantic are highly uncertain. Interestingly, using the population data from Maddison (2010) the estimated yearly exports as a fraction of the population for the trans-Atlantic slave trade is 0.27-0.37 of that from Gaul. Thus, while we have little actual data, the evidence that is available strongly suggests that the African slave trades were not unique in scale.

[7] This estimate is highly uncertain (Austen 1979; Austin 2008).

Likewise, the discussion on the demographic impacts of the slave trades is somewhat lopsided and builds exclusively on Manning's (1990) work which relies crucially on rather obscure assumptions. Unlike Manning many authors, including Malthus (1817) and Fage and Tordoff (2002), do not believe that the long run demographic impact of the Atlantic slave trades was substantial. Thus, that the slave trade led to a demographic collapse is neither a fact nor the default hypothesis. Rather, it is a position held by some scholars.

3.2. The slave trades and ethnic fractionalization

Today, Africa arguably has a higher ethnic diversity than any other continent (Easterly and Levine 1997; Fearon 2003). While diversity is often seen as a blessing, there is also a well established negative association between ethnic fractionalization and economic performance. One explanation for Africa's, and sub-Saharan in particular, ethnic fractionalization could be the slave trades. According to Nunn (2008) the African slave trades were not only unique in their scale, but also "because, unlike previous slave trades, individuals of the same or similar ethnicities enslaved each other" (p. 142) a fact which in turn led to "particularly detrimental consequences, including social and ethnic fragmentation, political instability and a weakening of states, and the corruption of judicial institutions" and in the extension impaired economic performance.

Indeed, the exogenous demand for slaves has been often argued to have led to conflicts, destabilized existing states, impeded state building and territorial expansion (Rodney 1972; Lovejoy 2000; Whatley 2008; Whatley and Gillezeau 2009; Nunn and Wantchekon 2010). However, the introduction of economic incentives to military might and increased fire power does not necessarily lead to smaller states and ethnic groups in the long run (Thornton 1982; 1998; Phillips 1985; Meillassoux 1991; Lovejoy 2000; Fisher 2001; McIntosh 2001; McCaskie 2002). In fact, there are even those who in contrast to Nunn (2008) favor an interpretation where the slave trades may have contributed, although not necessarily uniformly, to the centralization and strengthening of states (for instance, Fage 1969; Klein 1992).

Ultimately, the question of whether slavery caused ethnic fractionalization is an empirical question. Here we do not try to prove or disprove causality, but rather we ask i) if the African slave trades really were the only slave trades that turned individuals of same and similar ethnicities against each other and ii) whether if looking at the anthropological and biogeographical evidence from a global perspective there are alternative, and more likely, explanations for the pattern of ethnic fractionalization that we observe in Africa today.

Returning to Europe and the ancient Roman empire there is strong evidence in favor of the African slave trades not being unique in how they enslaved individuals of same and similar ethnicities. Given the scale of the Gallic slave trade and raiding it is hardly surprising to find that not only Romans, but also those of Gallic ethnicity were involved.[8] Of course, we do not know where the slaves came from, but they were most likely of Gallic or German origin, a hypothesis that receives strong support both from geography and the prevalence of slaves from these areas in Rome. In fact, it has been suggested that some Gallic tribes and

[8] A well know anecdote from Diodorus describes how "many of the Italian traders [...] believe that the love of wine of these Gauls is their own godsend [...] for in exchange for a jar of wine they receive a slave, getting a servant in return for the drink" (1939, p. 167).

elites were involved in raiding slaves from their neighbors already during the early Iron Age, slaves that were subsequently sold to the Etruscans (Nash Briggs 2003). Like Gaul, Germania was a Roman slave reservoir (Phillips 1985; Bradley 1994; Scheidel 2007), and German slave taking and trading can be expected to have unfolded in a similar way to that in Gaul.[9] Thus warring Gallic and German tribes were probably involved in both the capture and trading of their enemies as slaves, enemies that most likely were of neighboring and similar ethnicities (Rives 1999; Nash Briggs 2003; Scheidel 2007; Smith 2009).[10]

Europe faced several additional and more recent episodes of slave raiding and trading. Perhaps most notably, from the Muslim invasion of the Iberian peninsula and onwards Spain suffered a great number of wars, skirmishes and slave raids (Phillips 1985). Christians enslaved neighboring Muslims, and vice versa. Pirating activities and coastal raids in the Mediterranean using North Africa as base continued well into the 19th century and plagued in particular Spain and Italy. Although these raids are relatively unknown, it has been estimated that as many as 1,250,000 Europeans were captured as slaves by Saracen pirates between 1530 and 1780 (Davis 2003). Importantly, while the Saracen captains were Muslim, many were Christian renegades who occasionally even returned to haunt their own home regions. Thus, the experiences of Roman Europe, and early modern Mediterranean stand in sharp contrast to Nunn's (2008) claim that the African slave trades were unique "because, unlike previous slave trades, individuals of the same or similar ethnicities enslaved each other" (p. 142).

Despite its importance in Nunn's argument, little effort is made to disentangle the empirical relationship between past slave trades and ethnic fractionalization. Although we agree with Nunn that a correlation exists between these two variables, we believe that it is to a large extent spurious. The reason for this is that it is easy to demonstrate that there is not only a significant correlation between past slave exports and ethnic fractionalization, but also one between past slave exports and latitude, as well as one between latitude and ethnic fractionalization. Based on biogeographical and anthropological evidence we believe that the latter association is of first order and that it temporally precedes the one between slave trades and ethnic fractionalization.

If we zoom out of Africa and instead study the world as a whole, we quickly discover that the pattern between ethnic fractionalization and latitude that Nunn observes for Africa holds also globally, despite there being no other continents that were substantial early modern net exporters of slaves. This relationship is illustrated in Figure 1 and has been demonstrated by Nettle (1999), Cashdan (2001) and Collard and Foley (2002) who show that absolute latitude explains a large fraction of diversity for a number of ethnic and linguistic measures both within and between continents. Interestingly, the pattern is very similar for

[9] In fact, there are even suggestions that slaves were acquired for export via intra-ethnic debt slavery. Tactitus, describing the gambling habits of Germans, notes the following: "The loser goes into slavery without complaint; younger or stronger he may be, but he suffers himself to be bound. Such is their perverse persistence, or, to use their own word, their honour. Slaves of this sort are sold and passed on, so that the winner may be clear of the shame that even he feels in his victory" (Mattingly 1948, p. 121).

[10] Interestingly, and in contrast to what we would expect in the presence of negative long term effects of slave exports, only a few hundred years after these slave trades had subsided somewhat Rome itself was overrun by people from Gaul and Germania, and today, the region that was formerly known as Gaul is one of the very richest in the world.

present and past species diversity, for which the latitudinal gradient has been well know since at least the turn of the last century (Pianka 1966; MacArthur 1972; Rosenzweig 1992; 1995).

Two potentially important explanations for why human ethnic and linguistic diversity is correlated with latitude, without having to resort to more fundamental explanations of species diversity itself, are carrying capacity and species diversity (Cashdan 2001; Collard and Foley 2002; Moore *et al.* 2002).

While it is true that the latitudinal gradient in ethnic fractionalization is global, there are also indications that the relationship is stronger in Africa than elsewhere (Collard and Foley 2002). Again, the exact reason for this is unclear, and it is indeed possible that there is a second order effect that goes from slave trades to ethnic fractionalization. However, this is not necessarily the most parsimonious explanation.[11] Independently of whether one agrees with us or not, it is safe to say that there are many competing explanations for why there is a correlation between slave exports and latitude. We also note that the causality could in fact not only be spurious, but also reversed. If ethnic fractionalization was higher in tropical Western and Middle Africa, then it is not unlikely that these areas selected into the slave trades, at least in theory.

The idea that the pattern of ethnic fractionalization and comparatively low economic development that we see in Africa today can be explained by events and environmental factors that pre-date the slave trades has received support in a number of recent papers that are methodologically related to Nunn (2008), but that go further back in time (Acemoglu, Johnson and Robinson 2001; Cashdan 2001; Olsson and Hibbs 2005; Garner 2006; Ahlerup and Olsson 2007; Bhattacharyya 2008; Nunn 2008; Ashraf and Galor 2009; Birchenall 2009a; 2009b; Michalopoulos 2009; Motamed *et al.* 2009; Spolaore and Wacziarg. 2009; Beck and Sieber 2010; Fenske 2010). Taken together, these papers suggest that the patterns of ethnic diversity and economic performance observed by Nunn (2008) need not be driven by the slave trades, rather they could with ease be attributed to other, more fundamental, factors that pre-date the slave trades.

3.3. Did really the most advanced African societies select into the slave trades?

According to Nunn (2008) demographic and ethnographic evidence shows that it was the most developed areas of Africa that tended to select into the slave trades, a finding that the author himself refers to as a "seemingly paradoxical relationship." We find three problems with Nunn's (2008) reasoning. The first refers to selection. The ethnographic accounts that he uses to demonstrate the political and technological sophistication of Middle African societies are missing for large parts of Africa, including most parts of Middle Africa (Gray 1975; Flint 1977; Oliver 1978; Thornton 1998; Austin 2008). The actual available historical evidence outside a few kingdoms that were in comparatively frequent contact with

[11] There are reasons to believe that ethnic differentiation amongst hunter-gatherers may have been higher in Africa than in more recently colonized continents (Ahlerup and Olsson 2007). Also genetic diversity is substantially higher in Africa than elsewhere and most scholars agree that this is primarily due to the deeper evolutionary history of our species on this continent (Cavalli-Sforza, Menozzi and Piazza 1994). In addition, the Neolithic revolution begun later in sub-Saharan Africa than elsewhere, and the spread of agriculture is likely to have contributed to decreased ethnic fractionalization (Ammerman and Cavalli-Sforza 1971; Smith 1995; Zohary and Hopf 2000; Diamond 2002; Ahlerup and Olsson 2007).

Europeans and Arabs is typically scant. Hence, what is at most demonstrated is that some societies were at least as, or more, developed that the reader would have expected, not that they were more developed than other contemporary African societies.

Secondly, since net primary productivity has a latitudinal gradient, a high population density does not imply a high level of development in and of itself (Cramer *et al.* 1999; Galor and Weil 2000; Austin 2008; Birchenall 2009b). Rather, it typically reflects extrapolations based on the carrying capacity of the land and 20th century population densities (see for instance Austin 2008; Hopkins 2009). That being said, Middle Africa was probably substantially more developed than most parts of Southern Africa (Gray 1975; Flint 1977; Oliver 1978; Lee 1979). There are many strong indications that such was the case. It is however not necessarily true that Middle Africa was more developed than Eastern Africa. For instance, the Arabic influence was comparatively strong in the east, and there were complex city structures such as the famed great Zimbabwe.

Thirdly, and perhaps most importantly, the definition of Africa is not clearly laid out in the paper. The statement that tropical Africa was the most developed part of sub-Saharan Africa is rather uncontroversial and it may be possible to stretch it as far as to claim that the west was more developed than the east, but that is far from given. However, claiming that the most advanced African societies selected into the slave trades signifies to indirectly claim that sub-Saharan Africa was more developed than North Africa. In contrast, it was North Africa to be substantially more developed than sub-Saharan Africa at the onset of the slave trades (Gray 1975; Flint 1977; Oliver 1978). Thus, in the paper, sometimes the whole of Africa is treated as Africa, as in the empirical strategy, but elsewhere in the paper "Africa" seemingly refers only to sub-Saharan Africa. This is somewhat problematic, and once again highlights the issue of whether Africa as a geographical entity is the appropriate sample/unit of analysis.

3.4. The imputation of ethnicity

The key variable in Nunn's (2008) analysis is total slave exports per country. While the number of slaves shipped from each coastal country during the trans-Atlantic slave trade can quite easily be calculated with reasonable confidence the actually number of slaves exported from any given African country is much more difficult to approximate since trade with the Europeans primarily took place at trading posts along the west coast of Africa. Similarly, both the actual number of slaves exported in the Islamic slave trades and their origins are highly uncertain. This makes the novel and unusually careful estimates of slave exports that Nunn provides an important contribution of his paper. To impute the number of slaves exported from each country Nunn extracted the ethnicities of tens of thousands of slaves from administrative records. These ethnicities were then mapped and aggregated onto the modern day countries of Africa so that they could be used to calculate the ratios of slaves exported from each coastal country relative to the land locked countries further inland. While we are sympathetic towards the methodology, we still believe that there are some problems that may seriously bias the analysis. First, ethnicities are not always stable and there were substantial migrations in early modern African history. In fact, as pointed out by Austin (2008), the idea that you can easily map past ethnicities to modern day countries in Africa goes counter too much of the work that has been done in ethnography. But, even if mapping is in theory possible at least one problem remains. The sample of administrative records that

Nunn (2008) uses is not likely to be representative of past slave trades as it is presumably based on what records are readily available today rather than a random sample of all slaves that were exported in the African slave trades.

Indeed, a quick look at Table 3 and how ethnicities were imputed reveals that there is cause for concern.

For the trans-Atlantic slave trade 54 different samples were used, however, two single points in time and space, Trinidad 1813 and Sierra Leone 1848, represent almost a third (30.9%) of the total sample. In fact, the 50 year period 1801-1850 is overrepresented by a factor of almost two in Nunn's sample, while the 50 year period 1701-1750 is barely represented at all despite its share of aggregate exports being approximately 20%. Further, if we would instead look at single years within each time period the bias would become even more apparent. Some of this temporal bias is however mitigated by the fact that many of the slaves were presumably shipped to the New World years prior to them being recorded in the censuses, notarial and other administrative records that were used for imputation. Unfortunately, it is not possible to disentangle when the slaves in Nunn's sample arrived to the New World. Equally, and perhaps more, damaging is the spatial bias of the sample. For instance, more than 15% of Nunn sample is made up by slaves registered in Trinidad in 1813. It has been estimated that some 44,000 slaves disembarked in Trinidad and Tobago between 1600 and 1826, representing 4 per mill of the aggregate estimated trans-Atlantic slave trade. That is, slaves that were shipped to Trinidad are arguably more than 37 times overrepresented in the sample that was used to impute ethnicity. Similarly, observations in Sierra Leone in 1848 make up more than 15% of the sample although slaves disembarked in Africa only made up less than 1.5% of total exports, and likewise, early colonial Peru[12] is overrepresented by a factor of about seven and Haiti by a factor greater than two. In contrast, Brazil who was by far the leading slave importer with more than 45% of total disembarkations is underrepresented by a factor greater than three and Jamaica with about 9.5% is not represented at all. Thus, Trinidad, Sierra Leone, early colonial Peru and Haiti that make up almost 60% of Nunn's sample only represent approximately 10.5% of the aggregate trade while Jamaica and Brazil who imported well over half of the total number of exported slaves only make up some 13% of Nunn's sample. For the Islamic slave trade, the bias is likely to be worse. The ethnicities of slaves shipped across the Indian ocean is imputed by using six samples and for those shipped across the Sahara and the Red sea there are two samples. While for two of these trades the samples at least contain several thousand individuals, for the latter they only contain 67 slaves of 32 ethnicities.

3.5. The instruments

To deal with measurement error and to establish causality Nunn (2008) develops four instruments, one for each slave trade. The method of instrumental variables provides a general solution to the problem of an endogenous explanatory variable and measurement error. However, the resulting estimates will be identified only if two conditions are satisfied. First, the instrument must be uncorrelated with the error term, and secondly the instrument has to be partially correlated with the instrumented variable once the other controls have been netted out. While the second condition is testable, the first has to be maintained. In this

[12] Although Nunn's sample(s) for Peru start in 1548 and end in 1702 the careful reader may nonetheless want to disregard this estimate with reference to the previous footnote.

section we put forward reasons to believe that both requirements are only weakly satisfied, and in particular that (i) the instrument may be correlated with the error term, and (ii) the instrument may be too weakly correlated with the instrumented variable. These concerns, if founded, would mean that the IV estimates could be biased and inconsistent (Stock and Yogo 2002; Wooldridge 2002).

The chosen instruments are more or less identical in construction, and they are all derived from proxies for the distance needed to transport slaves from their country of origin to the location of demand. While geographic instruments are popular, they are also often problematic. Here, we in particular worry that the location of demand and supply for slaves could have common and unobserved determinants that are correlated with underlying geographic variables, which in turn are correlated with the instruments. An indication that this could indeed be a concern is given by the fact that once the climatic and geographic controls are included in the first stage regression for the full sample none of the instruments are significant at the 5% level and the F-statistic drops below 2.[13] As the trans-Atlantic slave trade was the most important African slave trade, and given that it was the only one for which the instrument was significant at the 10% level for all specifications, we will focus our attention on this instrument.

First of all, the location of demand for slaves in the New World was non-random and primarily driven by the suitability of land for cash crops, and in particular sugar (Fogel 1989; Engerman and Sokoloff 2002). Sugar is a crop that requires high temperatures, sunshine, moisture, limited draught and that is most commonly grown in the tropics (Bakker 1999), a fact which introduces a geographic component into the location of demand for slaves. Given the taxing nature of manual labor in sugar production it would hardly be surprising if plantation owners demanded slaves that were suitable and well adopted for hard physical labor in high temperatures and humidity as well as for life in tropical disease environments. Elsewhere in his paper, Nunn (2008) argues that the ethnicity of a slave was an important and reliable label that had real economic meaning, and this is a reasoning that is in part borne out by the legal preoccupation with slave ethnicities in Rome (Bradley 1994). While these labels may not always have been accurate, we tend to agree with Nunn (2008), but we suspect that one of the reasons for their importance was that slaves from different areas of Africa may have been differently suited for work in sugar plantations.

Presumably, slaves that were suitable for working the cane fields were to be found in areas with similar climates to those where sugar was grown. If true, this introduces a common geographic component into the location of demand and supply for slaves that could potentially be correlated with the instrument. In fact, two out of Nunn's three measures of climate are negatively correlated with the instrument and positively correlated with slave exports. Moreover, when these are introduced into the first stage of the IV regression along with the other controls the instrument becomes, as mentioned above, insignificant at the 5% level. Likewise, although malaria was most likely introduced to the New World either by Europeans or their African slaves, it soon became indigenous and a major source of sickness (Packard 2007). Thus, it is hardly surprising to find that a measure of the fraction of the

[13] More specifically, the F-statistic is 1.73 and the p-values for the instruments range from 0.093 (trans-Atlantic slave trade) to 0.507 (Red Sea). In contrast, without controls all instruments but the one for the Red Sea slave trade ($p = 0.998$) are individually significant at the 1% level, and the F-statistic is 15.4. For further details, see page 162 in Nunn (2008).

population in African countries that live in areas of high intensity malaria transmission (Rowe *et al.* 2006) is highly negatively correlated with the instrument, and positively correlated with slave exports. Indeed, if we add a sugar production dummy based on production data from *FAOSTAT* to the first stage regression the instrument becomes insignificant also at the 10% level for the full sample with geographic controls. Further, adding the malaria index results in none of the coefficients being close to significance.[14] In fact, like for Nunn's (2008) reduced sample, the instrument for the Red-Sea trade, becomes positive. While this last result is particularly intriguing, it must be said that it comes at the cost of reducing the sample from 52 to 44 countries.

4. The data and the empirical methodology

Before proceeding with the analysis we present the data we use in greater detail. Throughout, while we share some of the misgivings about the demographic and ethnic variables that Austin (2008) voiced, we will take Nunn's (2008) data as given.

4.1. Data

4.1.1. Africa

In this paper we extend the analysis of Nunn (2008) back in time. In order to do so we take the data made available by the author on his webpage as given and augment it with the variables that change over time, using the same sources as Nunn.[15] Data on per capita GDP for the years 1960 to 2006 was obtained from the most recent update by Maddison (2010). Similarly, like Nunn, we use data on oil, diamond and gold production from the British Geological Survey's *World Mineral Statistics/Production*.[16] In contrast to Nunn who uses 31 year averages we use annual production in our analysis. Since the production figures overlap between editions we always use the most recent available estimate. In a few instances when there were obvious typos with too many, or too few, zeros these were cross-checked with other editions of the said publication, or with data from the *U.S. Energy Information Administration*, and corrected. Unfortunately there is no separate data on gold production in Burundi and Rwanda for the years 1960-1962, only information on joint production. To overcome this problem we impute the production for these years using country specific aggregate gold production 1963-2006 as weights.[17]

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[14] If we add the sugar dummy to the fist-stage the p-values range from 0.146 (Atlantic) to 0.818 (Saharan), while they range from 0.349 (Atlantic) to 0.645 (Red Sea) if we add the malaria measure. Finally, if we add both the sugar dummy and the malaria measure the p-values range from 0.318 (Saharan) to 0.729 (Red Sea), with that for the trans-Atlantic distance instrument being 0.491.

[15] Nunn's webpage can be found at http://www.economics.harvard.edu/faculty/nunn. Note that we follow Nunn (2005; 2008) in treating Ethiopia and Eritrea as one country.

[16] The name "World Mineral Statistics" was used in publications printed between 1978 and 2004. From 2005 and onwards the publication is named "World Mineral Production". Prior to 1978 the publication was known as "Statistical Summary of the Mineral Industry – World Production, Exports and Imports." All of these publications are available on the web from the British Geological Survey's World mineral statistics archive. The data on oil and gold from the 1960s were converted from long tons to tonnes, and ounces to kilos, respectively.

[17] The results are not sensitive to this choice, since joint production was negligible 1960-1962.

4.1.2. Italy

Our analysis for Italy tries to mimic that for Africa. Data on slave raiding for the years 1530-1780 was collected from Davis (2003).[18] Data on regional per capita GDP in 2000 were obtained from Istat (*Istat Statistics*). Coastal length was obtained from Angela Barbano, APAT (Barbano 2005-2006), and climatic data from the *CRU CL 2.0* dataset (New *et al.* 2002).[19] Note that this data provides average humidity rather than average maximum afternoon humidity. Historical regional GDP was taken from the *CRENoS* database and is expressed in euro at 1995 constant price. Historical regional GDP for the period 1970-2004 was taken from the *CRENoS* database and is expressed in euro at 1995 constant price. To compare regression results for the year 1960 between Italy and Africa, we used data from Paci and Saba (1997), converted to 1990 International Geary-Khamis dollars using Maddison (2010). Finally, centroids for the regions were obtained from the *NGA GEOnet Names Server*.

4.2. Empirical methodology

In our empirical analysis we have gone to great lengths to be as faithful as possible to the spirit of Nunn (2008). For Africa, we simply extend his econometric analysis from the single year 2000 to every year in the period 1960 to 2006. This is a natural extension, and our motivation for doing so is that we want to be able to assess the stability over time for the relationship between slave trades and economic performance. Following Nunn, we study six different specifications of Equation (1). Of these, specifications (3) and (6) are evaluated for a reduced sample of 42, rather than 52, countries. The countries dropped in these two specifications are the North African countries Morocco, Algeria, Tunisia, Libya, Egypt and the island nations Seychelles, Mauritius, Comoros, São Tomé and Príncipe, and Cape Verde. Table 4 summarizes the differences between the six specifications. Note that in contrast to Nunn we focus exclusively on the OLS regressions, leaving the more contentious IV regressions aside.

To study the effects on past slave raids on economic performance within Italy, we replicate the above analysis for Italian regions. Whenever possible, we use the same controls as for Africa, and if unavailable, we use the closest possible substitute. While the economic, geographic and climatic data do not present any additional problems to those described in 4.1.2, the colonizer fixed effects pose a more difficult challenge. Africa has experienced extensive colonization, and accordingly, Nunn includes colonizer fixed effects to "control for the other significant event in Africa's past, colonial rule" (p. 154), which suggest that such effects are ultimately meant to capture the unobservable heterogeneity that characterizes different part of Africa. Accordingly, to broadly control of the heterogeneity across Italian regions, we opt for including a dummy that indicates if a particular region was under the dominion of the House of Savoy prior to unification. Such choice is to some extent arbitrary, and dictated by data constraints, as the relatively small sample of no more than 20 regions that we are dealing with precludes us the possibility of having a large set of fixed

[18] We only include observations for which an actual number or estimate was given. If an observation included locations in more than one region, the aggregate number was divided equally among the locations before mapping these into their respective regions.

[19] The dataset provides estimates 10 minute latitudes and longitudes. Our measures are calculated as the weighted, by distance, value using the values for the nearest coordinates to the center of each region.

effects dummies.[20] Nonetheless, we believe it is sufficient for the purpose at hand, which is not to gauge the effects of slaving activities in Italy, by rather to highlight the possible methodological failures of the methodology in question.

Besides the colonizer dummies, the indicators for North Africa, French legal origin and Islam do not have direct counterparts for Italy. Nunn justifies the use of these three variables with them being of interest as "additional control variables to account for potential differences between islands or North African countries and the rest of Africa. Two core differences between North Africa and the rest of Africa is that North African countries are predominantly Islamic and that they all have legal systems based on French civil law" (p. 156). In other words, the three dummies primarily serve the purpose of capturing what unobservables make North Africa different, and in the extension, more prosperous than the rest of the continent. For Italy, we opt for splitting the country in two macro areas typically juxtaposed in terms of economic performance, namely the North and South of Italy, and accordingly we add a dummy variable for the South of Italy in our regressions. Finally, we should mention that we do not include the mineral controls in the Italian analysis. Mineral production is a very small part of most modern western economies, and in Italy the quantities produced are negligible. With these changes in mind, we run specification (1), (2) and (4), with controls as summarized in Table 5.

In what follows, we focus on specifications (1) and (5). Note that for Italy specification (5) does not account for mineral production, which would render it equivalent to specification (4). To avoid unnecessary confusion, when talking about Italy we will refer to specification (4) as specification (5). The primary reason for doing so is comparability, as specification (5) seems to be the one preferred by Nunn.

5. Empirical results

Tables 6 and 7 present the results for specifications (1) and (5). Each of the two tables contains four columns. The first two present the estimates for Africa, using GDP per capita in 1960 and 2000 as dependent variables.[21] The remaining two columns present the estimates from the same regressions for Italy.

Several interesting results can be gleaned from the tables. First, using yearly data on mineral production, rather than 31 year averages, our estimates are very close to those in Nunn (2008). Second, for 2000 there is not only a negative relationship between slave exports and per capita GDP for Africa, but also one for Italy. However, this relationship is insignificant in specification (5), that is, after introducing climatic and geographic controls.[22]

[20] We are aware that the Bourbon domination in the South, the presence of the Vatican State in the Centre and the Austro-Hungarian domination in the North-East have been important determinants of Italy's current economic situation. Unfortunately, however, because of the size of our dataset, including all these relevant dummies in the regression would wash away any additional effect brought about by the slave trades. Accordingly, we opted for including only one.

[21] The tables in the empirical section present the exact estimates only for 1960 and 2000. We run yearly (1960-2006) regression for all six specifications for Africa. Likewise, for Italy we run specification (1), (2) and (4) for 1960, 1975 and 2000. All betas are reported graphically in the paper, but exact estimates outside 1960 and 2000 are omitted. These are however available from the authors upon request.

[22] The p-value for the coefficient on slave raids is 0.105. Note however that for Italy there are only 20 regions. Interestingly, all coefficients in specification (5) have the same sign as for Africa.

Finally, the relationship between slave exports and per capita GDP is not stable over time. For specification (1) the coefficient on slave exports is insignificant for both Africa and Italy in 1960. In fact, for Africa, the coefficient is not significant in any of the six specifications, and for Italy it is positive in specification (5).

To a certain extent our findings are not surprising. The declining coefficient on slave exports for Africa was pre-viewed by the ad-hoc analysis in Nunn who split the African sample into countries 'high' and 'low' slave exporters and found a negative relationship between economic growth and past slave exports.

What is perhaps more surprising is that there is also a negative relationship between slave raiding and economic performance for Italy, and that time trend on the coefficient for Italy is similar to that of Africa. To our knowledge the literature does not offer any obvious explanation to why this should be so. In order to investigate the time trends in further detail we plotted the yearly African slave export betas for the years 1960-2006 (Figures 2, 3, 4 and 5) along with those for Italy and the years 1960, 1975 and 2000 (Figures 6 and 7). The declining coefficients on slave exports for both Africa and Italy can be seen clearly in Figures 2, 4 and 6, which confirm the conclusions drawn on the basis of Tables 6 and 7.

In addition, Figures 2 and 4 report the time trend for the African slave export coefficients when the sample is split into those countries who produced oil at any point during the sample period, and those who did not. While these patterns are fairly regular for specification (1) they look highly irregular for specification (5).

For those countries that produced oil, the coefficient makes several jumps of substantial magnitudes, and contrary to the hypothesis, it is positive for approximately half of the years. While the interpretation of this result is not straightforward, it may be indicative of there being some kind of interaction between oil production, GDP per capita and slave trades that we cannot disentangle, and that could potentially affect the analysis. This intuition receives support from the additional specifications that are reported in the Appendix. For specification (2) and (4) the beta for the oil producing countries is always significant, while for specification (3) the beta for the oil producing countries is instead always negative, and sometimes substantially so.

Finally, in Figures 3, 5 and 7 we report the confidence intervals for each yearly beta. As can be seen, neither in specification (1), nor (5), is the beta significantly negative before the 1970s.

6. Discussion and conclusions

The African slave trades have come to epitomize human tragedy on a grand scale. Millions and millions of people were uprooted, kidnapped, and sold off as slaves to far distant countries. Millions more died in the process. But, did the horrors of the slave trades also contribute to the relative poverty of modern day Africa? In a recent paper Nunn (2008) argues that they did. Here we have argued that although this is an appealing theory, the slave trades may not have been that influential. Taking Nunn's methodology at face value a researcher studying Africa in the early 2000s would have had to conclude that past slave trades did have a negative effect on GDP per capita. In fact, as we show, there is even some indicative evidence that this could be true not only for Africa, but also elsewhere, as we document thanks to a historical dataset on slave raiding and pirating activities in Italy

between 1530 and 1780. The Italian evidence does, however, not necessarily support Nunn's conclusions, rather it highlights a possible concern with his paper. Slavery was until recently widespread across the globe, and today many formerly slave exporting regions are comparatively rich. Thus, there does not seem to exist a deterministic long run relationship between slave exports and economic performance. We believe that any paper which argues that slave trade had negative long run effects on economic performance needs to address these facts, and look beyond Africa. In his paper, Nunn circumvents the problem by claiming that the African slave trades were unique in scale and scope. In contrast, we study other slave trades, and find that adjusting for population, the uniqueness of the African slave trades is questioned.

Further, and in contrast to Nunn, we do not believe that the African slave trades were particularly prominent in causing the latitudinal pattern of ethnic fractionalization that we observe today. Rather, the positive correlation between absolute latitude and ethnic fractionalization in Africa belongs to a global relationship between ethnic, as well as species, diversity and latitude. Since this pattern arguably predates the slave trades, and since ethnic fractionalization is highly, and significantly, correlated with both past slave exports and current GDP per capita this is a potential source of spurious correlation between the two. Following a similar line of reasoning, we also argue that correlations with climate, disease environments and suitability of land for sugar cane production are potential threats to the validity of the instruments. There is some suggestive evidence to this extent, and when proxies for these variables are included as controls, the instruments become insignificant. In addition, we raise a number of issues concerning potential biases in the imputation of ethnicities, the definition of the sample and selection into the slave trades.

Finally, going back both in time, and to Nunn's methodology, we demonstrate that a researcher studying the African slave trades in the early 1960s would, in contrast to Nunn, have had a difficult time to conclude that past slave trades had a negative impact on GDP per capita. More specifically, we find that the coefficient on slave exports is both small and insignificant in 1960, and that it remains so throughout the 1960s. The trend is however declining and by 1970 the coefficient is typically significant at the 5% level. To a certain extent this result was anticipated by Nunn, who suggested that the negative effects of the slave trades may have become more pronounced in post-independence Africa. Thus, although our findings raise some doubts concerning the nature and stability of the negative relationship between slave exports and economic performance, they do in part support the hypothesis that they had a negative impact on state development and economic growth after decolonization. However, returning to Italy, we find a weak relationship between slave exports and regional GDP per capita in 1960.

In other words, despite the fact that no decolonization occurred in Italy the coefficient on slave exports shows a similar downward sloping trend, over time, to that for Africa. With this, and the other concerns that we have raised, in mind we conclude that the evidence in favor of the hypothesis that the African slave trades had an adverse effect on modern day economic development is weak.

References

Acemoglu, D., Johnson, S. and Robinson, J.A. (2001), "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 91, pp. 1369-1401.

Ahlerup, P. and Olsson, O. (2007), *The Roots of Ethnic Diversity*, Göteborg University, School of Business, Economics and Law – Working Papers in Economics, no. 281.

Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S. and Wacziarg, R. (2003), "Fractionalization", *Journal of Economic Growth*, 8, pp. 155-194.

Ammerman, A.J. and Cavalli-Sforza, L.L. (1971), "Measuring the Rate of Spread of Early Farming in Europe," *Man*, n.s., 6, pp. 674-688.

Ashraf, Q. and Galor O. (2009), *The "Out of Africa" Hypothesis, Human Genetic Diversity, and Comparative Economic Development*, mimeo.

Austen, R.A. (1979), "The Trans-Saharan Slave Trade: A Tentative Census," in Gemery, H.A. and Hogendorn, J.S. (eds.), *The Uncommon Market: Essays in the Economic History of the Atlantic Slave Trade*, New York, NY: Academic Press.

Austin, G. (2008), "The 'Reversal of Fortune' Thesis and the Compression o History: Perspectives from African and Comparative Economic History", *Journal of International Development*, 20, pp. 996-1027.

Bakker, H. (1999), *Sugar Cane Cultivation and Management*, Amsterdam, NL: Springer.

Barbano, A. (2005-2006), *Il Sistema Informativo Geografico Costiero dell'APAT – Studi per la caratterizzazione della costa*, lavoro presentato al Workshop "Progetto Archimede", Roma, 29-30 novembre 2005 e alla 10ª Conferenza Nazionale delle Agenzie Ambientali, Pescara, 5-9 marzo 2006.

Beck, J. and Sieber, A. (2010), *Is the Spatial Distribution of Mankind's Most Basic Economic Traits Determined by Climate and Soil Alone?*, PlosOne, 5 [available at: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0010416].

Bezemer, D., Bolt, J. and Lensink, R. (2009), *Indigenous Slavery in Africa's History: Conditions and Consequences*, mimeo.

Bhattacharyya, S. (2008), *Root Causes of African Underdevelopment*, Australian National University – Working Papers in Trade and Development, no. 16.

Birchenall, J.A. (2009a), *Quantitative Aspects of Africa's Past Economic Development*, mimeo.

——————— (2009b), *Population and Long-Term Economic Development: A Re-examination and Some New Evidence*, mimeo.

Bradley, K. (1994), *Slavery and Society at Rome*, Cambridge, UK: Cambridge University Press.

Cashdan, E. (2001), "Ethnic Diversity and its Environmental Determinants: Effects of Climate, Pathogens, and Habitat Diversity," *American Anthropologist*, 103, pp. 968-991.

Cavalli-Sforza, L.L., Menozzi, P. and Piazza, A. (1994), *The History and Geography of Human Genes*, Princeton, NJ: Princeton University Press.

Clark, G. (2005), "The Condition of the Working Class in England, 1209-2004," *Journal of Political Economy*, 113, pp. 1307-1340.

Collard, I.F. and Foley, R.A. (2002), "Latitudinal Patterns and Environmental Determinants of Recent Human Cultural Diversity: Do Humans Follow Biogeographical Rules?," *Evolutionary Ecology Research*, 4, pp. 371-383.

Collier, P. and Gunning, J.W. (1999), "Why Has Africa Grown Slowly?," *Journal of Economic Perspectives*, 13, pp. 3-22.

Cramer, W., Kicklighter, D.W., Bondeau, A., Moore III, B. , Churkina, G., Nemry, B., Ruimy, A., Schloss, A.L. and the participants of the Potsdam NPP model intercomparison (1999), "Comparing Global Models of Terrestial Net Primary Productivity (Npp): Overview and Key Results", *Global Change Biology*, 5, pp. 1-15.

CRENoS Database on Regional Accounts, Italian Regions [available at http://crenos.unica.it/crenos/?q=en/Regio-IT_1970-2004].

Davis, R.C. (2003), *Christian Slaves, Muslim Masters – White Slavery in the Mediterranean, the Barbary Coast, and Italy, 1500-1800*, New York, NY: Palgrave Macmillan.

Diamond, J. (2002), "Evolution, Consequences and Future of Plant and Animal Domestication," *Nature*, 418, pp. 700-707.

Diodorus Siculus, *Bibliotheca historica*, vol. III, ed. Loeb Classical Library (1939), Cambridge, MA: Harvard University Press.

Easterly, W. and Levine, R. (1997), "Africa's Growth Tragedy: Policies and Ethnic Divisions," *Quarterly Journal of Economics*, 112, pp. 1203-1250.

Engerman, S.L. and Sokoloff, K.L. (2002), *Factor Endowments, Inequality, and Paths of Development among New World Economies*, NBER Working Paper, no. 9259.

Elbl, I. (1997), "The Volume of the Early Atlantic Slave Trade, 1450-1521," *Journal of African History*, 38, pp. 31-75.

Fage, J.D. (1969), "Slavery and the Slave Trade in the Context of West African History," *Journal of African History*, 3, pp. 393-404.

Fage, J.D. and Tordoff, W. (2002), *A History of Africa*, 4th ed., Abingdon, UK: Routledge.

FAOSTAT [available at http://faostat.fao.org/].

Fearon, J.D. (2003), "Ethnic and Cultural Diversity by Country", *Journal of Economic Growth*, 8, pp. 195-222.

Fenske, J. (2010), *Does Land Abundance Explain African Institutions*, mimeo.

Ferdière, A. (1998), *Les campagnes en Gaule romaine : 52 av. J. C. - 486 ap. J. C*, 2 voll., Paris, FR: Errance.

Findlay, R. and Lundahl, M. (2002), "Towards a Factor Proportions Approach to Economic History: Population, Precious Metals and Prices from the Black Death to the Price Revolution," in Findlay, R., Jonung, L. and Lundahl, M. (eds.), *Bertil Ohlin: A Centennial Celebration 1899-1999*, Cambridge, MA: MIT Press.

———— (2006), "Demographic Shocks and the Factor Proportions Model: From the Plague of Justinian to the Black Death," in Findlay, R., Henriksson, R.G.H., Lindgren, H. and Lundahl, M. (eds.), *Eli Heckscher, International Trade and Economic History*, Cambridge, MA: MIT Press.

Fisher, H.J. (2001), *Slavery in the History of Muslim Black Africa*, New York, NY: New York University Press.

Flint, J.E. (ed.) (1977), *The Cambridge History of Africa. Vol. 5, From c. 1790 to c. 1870*, Cambridge, UK: Cambridge University Press.

Fogel, R.W. (1989*), Without Consent or Contract – The Rise and Fall of American Slavery*, New York, NY: W.W. Norton & Company.

Galor, O. and Weil, D.N. (2000), "Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond," *American Economic Review*, 90, pp. 806-828.

Garner, P. (2006), *Reversal in Africa*, mimeo.

Gray, R. (ed.) (1975), *The Cambridge History of Africa, Vol. 4, From c. 1600 to c. 1790*, Cambridge, UK: Cambridge University Press.

Hernández-Catá, E., Scwab, K. and Lopez-Claros, A. (2004) (eds.), *The Africa Competitiveness Report 2004*, Geneva: World Economic Forum.

Hopkins, A.G. (2009), "The New Economic History of Africa," *Journal of African History*, 50, pp. 155-177.

Istat Statistics [available at http://dati.istat.it/?lang=en].

Kaplan, H., Hill, K., Lancaster, J. and Hurtado, A.M. (2000), "A Theory of Human Life History Evolution: Diet, Intelligence, and Longevity," *Evolutionary Anthropology*, 9 , pp. 156-185.

Klein, M.A. (1992) "The Impact of the Atlantic Slave Trade on the Societies of the Western Sudan," in Inikori, J.E. and Engerman S.L. (eds.), *The Atlantic Slave Trade – Effects on Economies, Societies, and Peoples in Africa, the Americas, and Europe*, Durham, NC: Duke University Press.

Klein, R.G. (2009), *The Human Career – Human Biological and Cultural Origins*, 3rd ed., Chicago, IL: The University of Chicago Press.

Lee, R.B. (1979), *The !Kung San: Men, Women and Work in a Foraging Society*, Cambridge, UK: Cambridge University Press.

———— (1973), "Population in Preindustrial England: An Econometric Analysis", *Quarterly Journal of Economics*, 87, pp. 581-607.

Lovejoy, P.E. (2000), *Transformation in Slavery – A History of Slavery in Africa,* 2nd ed., Cambridge, UK: Cambridge University Press.

MacArthur, R.H. (1972), *Geographical Ecology: Patterns in the Distribution of Species*, New York, NY: Harper & Row.

Maddison, A. (2010), *Historical Statistics of the World Economy: 1-2008 AD* [available at http:// www. ggdc.net/ MADDISON/Historical_Statistics/horizontal-file_02-2010.xls].

Malthus, T.R. (1817), *An Essay on the Principle of Population*, 5th ed., London, UK: John Murray.

Manning, P. (1990), *Slavery and African Life – Occidental, Oriental, and African Slave Trades*, Cambridge,UK: Cambridge University Press.

Mattingly, H. (1948), *Tacitus on Britain and Germany : A New Translation of the Agricola and the Germania*, West Drayton, UK: Penguin Books.

McCaskie, T.C. (2002), *State and Society in Pre-Colonial Asante*, Cambridge, UK: Cambridge University Press.

McIntosh, S.K. (2001), "Tools for Understanding Transformation and Continuity in Senegambian Society: 1500-1900," in DeCorse, C.R. (ed.), *West Africa during the Atlantic Slave Trade – Archaeological Perspectives,* London, UK: Leicester University Press.

Meillassoux, C. (1991), *The Anthropology of Slavery – The Womb of Iron and Gold*, Chicago, Il: The University of Chicago Press.

Michalopoulos, S. (2009), *The Origins of Ethnolinguistic Diversity*, Collegio Carlo Alberto – Carlo Alberto Notebooks, no. 110.

Moore, J.L., Manne, L., Brooks, T., Burgess, N.D., Davies, R., Rahbeck, C., Williams P. and Balmford, A. (2002), "The Distribution of Cultural and Biological Diversity in Africa," *Proceedings of Royal Society B*, 269 , pp. 1645-1653.

Motamed, M.J., Raymond, J.G., Florax, M. and Masters, W.A. (2009*), Geography and Economic Transition: Global Spatial Analysis at the Grid Level*, mimeo.

Nash Briggs, D. (2003), "Metals, Salt, and Slaves: Economic Links Between Gaul and Italy From the Eigth to the Late Sixth Century," *Oxford Journal of Archaeology*, 22, pp. 243-259.

Nationalencyklopedin [available at http://www.ne.se].

Nettle, D. (1999), *Linguistic Diversity*, Oxford, UK: Oxford University Press.

New, M., Lister, D., Hulme, M. and Makin, I. (2002), "A High-Resolution Data Set of Surface Climate over Global Land Areas," *Climate Research*, 21, pp. 1-25.

NGA GEOnet Names Server [available at http://earth-info.nga.mil/gns/html/].

Nunn, N. (2005), *Slavery, Institutional Development, and Long-Run Growth in Africa, 1400-2000,* mimeo.

———— (2008), "The Long-Term Effects of Africa's Slave Trades," *Quarterly Journal of Economics*, 123, pp. 139-176.

Nunn, N. and Wantchekon, L. (2010), *The Slave Trade and the Origins of Mistrust in Africa*, mimeo.

Olsson, O. and Hibbs, D.A. (2005), "Biogeography and Long-Run Economic Development," *European Economic Review*, 49, pp. 909-938.

Oliver, R.A. (ed.) (1978), *The Cambridge History of Africa, Vol. 2, c. 500 B.C. to A.D. 1050*, Cambridge, UK: Cambridge University Press.

Packard, R. (2007), *The Making of a Tropical Disease – A Short History of Malaria*, Baltimore, MD: Johns Hopkins University Press.

Paci, R. and Saba, A. (1997), *The Empirics of Regional Economic Growth in Italy. 1951-1993,* University of Cagliari and Sassari, Sardinia – Working Paper CRENoS, no. 199701.

Pamuk, S. (2007) "The Black Death and the origins of the 'Great Divergence' across Europe, 1300-1600," *European Review of Economic History*, 11, pp. 289-317.

Phillips, W.D.Jr. (1985), *Slavery from Roman Times to the Early Transatlantic Trade*, Manchester, UK: Manchester University Press.

Pianka, E.R. (1966), "Latitudinal Gradients in Species Diversity: A Review of Concepts," *American Naturalist*, 100, pp. 33-46.

Putterman, L. (2008), "Agriculture, Diffusion and Development: Ripple Effects of the Neolithic Revolution," *Economica*, 75, pp. 729-748.

Rives, J.B. (1999), "Introduction," in Id., *Tacitus: Germania*, Oxford, UK: Clarendon Press.

Rodney, W. (1972), *How Europe Underdeveloped Africa*, London, UK: Bogle-L'Ouverture.

Rosenzweig, M.L. (1992), "Species Diversity Gradients: We Know More and Less Than We Thought," *Journal of Mammology*, 73, pp. 715-730.

———— (1995), *Species Diversity in Space and Time*, Cambridge, UK: Cambridge University Press.

Rowe, A.K., Rowe, S.Y., Snow, R.W., Korenromp, E.L., Armstrong Schellenberg, J.R. M., Stein, C., Nahlen, B.L., Bryce, J., Black, R.E. and Steketee, R.W. (2006), "Estimates of the Burden of Mortality Directly Attributable to Malaria for Children Under 5 Years of Age in Africa for the Year 2000", *CHERG Final Report*, 10.

Sachs, J.D. and Warner, A.M. (1997), "Sources of Slow Growth in African Economies, *Journal of African Economies*, 6, pp. 335-376.

Scheidel, W. (2007), "The Roman Slave Supply", in Bradley, K. and Cartledge. P. (eds.), *The Cambridge World History of Slavery, 1: The Ancient Mediterranean World*, Cambridge, UK: Cambridge University Press.

Scheidel, W. (2010a), *Roman Wellbeing and the Economic Consequences of the 'Antonine Plague,'* Princeton/Stanford Working Papers in Classics, January.

———— (2010b), *Slavery in the Roman Economy*, Princeton/Stanford Working Papers in Classics, September.

Smith, B.D. (1995), *The Emergence of Agriculture*, New York, NY: Scientific American Library.

Smith, R.L. (2009), *Premodern Trade in World History*, Abingdon, UK: Routledge.

Spolaore, E. and Wacziarg, R. (2009), "The Diffusion of Development," *Quarterly Journal of Economics*, 124, pp. 469-529.

Stock, J.H. and Yogo, M. (2002). "Testing for Weak Instruments in Linear IV Regressions," NBER Technical Working Paper, no. 284.

Tchernia, A. (1983), "Italian Wine in Gaul at the End of the Republic," in Garnsey, P., Hopkins, K. and Whittaker, C.R. (eds.), *Trade in the Ancient Economy*, Berkley, CA: University of California Press.

Thornton, J. (1982), "The Kingdom of Kongo, ca. 1390-1678. The Development of an African Social Formation," *Cahiers d'études africaines*, 22, pp. 325-342.

_____ (1998), *Africa and Africans in the Making of the Atlantic World, 1400-1800*, 2nd ed., Cambridge, UK: Cambridge University Press.

UNEP (2008), *Africa: Atlas of Our Changing Environment*, Nairobi, KN: UNEP.

U.S. Energy Information Administration [available at http://www.eia.gov/countries/].

Voyages: The Trans-Atlantic Slave Trade Database [available at http://www.slavevoyages.org/tast/assessment/estimates.faces].

Whatley, W. (2008), *Guns-For-Slaves: The 18th Century British Slave Trade in Africa*, mimeo.

Whatley, W. and Gillezeau, R. (2009), *The Impact of the Slave Trade on African Economies*, mimeo.

Wooldridge, J.M. (2002), *Econometric Analysis of Cross Section and Panel Data*, Cambridge, MA: MIT Press.

World mineral statistics archive [available at http://www.bgs.ac.uk/mineralsuk/statistics/worldArchive.html]

Zohary, D. and Hopf, M. (2000), *Domestication of Plants in the Old World*, 3rd ed., Oxford, UK: Oxford University Press.

Tables and Figures

Table 1

Average GDP across regions in 2000

Region	GDP pc in 2000	Ratio	Ratio (OLS)	Ratio (IV)
North America	27873	0.05	0.08	0.19
Oceania	20819	0.07	0.10	0.26
Europe	12620	0.11	0.17	0.43
Latin America	5889	0.25	0.36	0.92
Asia	3791	0.38	0.56	1.43
Africa	1447	1	1.47	3.75
Africa, counterfactual (OLS)	2128	0.68	1	2.55
Africa, counterfactual (IV)	5427	0.27	0.391	1

Sources: Maddison (2010) and Nunn (2008).
Notes: GDP pc in 2000 is the population weighted continental real GDP per capita in 2000 based on Maddison (2010). Ratio is the African GDP per capita in 2000 divided by that of the other continents. Ratio (OLS) is ditto for the counterfactual OLS estimates. Ratio (IV) is ditto for the counterfactual IV estimates. Armenia was counted as belonging to Europe along with those countries that have a majority of the population that is of European descent.

Table 2

Average slave exports, and exports as a fraction of population

	Atlantic	Saharan	Gaul (I)	Gaul (II)	Gaul (III)	Gaul (IV)
Yearly average	34211	5960	15000	15000	15000	15000
Ratio	1	5.74	2.28	2.28	2.28	2.28
Fraction	0.0005	–	0.0019	0.0014	0.0008	0.0004
Ratio	1	–	0.27	0.37	0.60	1.34

Sources: *Voyages: The Trans-Atlantic Slave Trade Database*; Ferdière (1988) and Maddison (2010).
Notes: Atlantic refers to the average number of slaves exported from Africa in the trans-Atlantic slave trade. Fraction of population was calculated using linear extrapolation from aggregate 25-year export data and linear extrapolation of population data from Maddison (2010). Gaul (I) and (ii) use a low and a high estimate of 8 and 11 million respectively for the population in Gaul during the high empire based on the population data for Europe in Maddison (2010). Gaul (III) and (IV) use the lower and upperd bound of 15 and 40 million respectively for the population of Gaul during the high empire in Ferdière (1988).

Table 3

Examples of bias in data used in the imputation of ethnicity

	1701-50	1801-50	T&T	Jam	Bra	4 Nunn	2 Voyages
Nunn	0.0063	0.5610	0.1545	0.000	0.1287	0.5978	0.1287
Voyages	0.2045	0.2913	0.0041	0.0953	0.4545	0.1052	0.5498
Ratio	0.03	1.93	37.59	–	0.28	5.68	0.23

Sources: *Voyages: The Trans-Atlantic Slave Trade Database* and Nunn (2008).
Notes: Nunn is the fraction of slaves in Nunn's (2008) sample that was recorded during the specified time period/location. Voyages is ditto for slaves shipped/disembarked in *Voyages: The Trans-Atlantic Slave Trade Database*. Ratio is Nunn divided by *Voyages*. T&T is Trinidad and Tobago. Jam is Jamaica. Bra is Brazil. 4 Nunn is T&T, Sierra Leone, Haiti & early colonial Peru. 2 Voyages is Bra & Jam.

Table 4

Summary of the controls in specification (1)-(6), Africa

Specification	Controls	
(1)		colonizer fixed effects
(2)	controls in (1) +	distance from the equator, longitude, minimum monthly rainfall, average maximum humidity, average minimum temperature, and proximity to the ocean measured by the natural log of coastline divided by land area
(3)	controls in (2) −	island and North African countries
(4)	controls in (2) +	Islam indicator, French legal origin, island and North Africa fixed effects
(5)	controls in (4) +	natural log of the annual average per capita production between 1970 and 2000 of gold, oil, and diamonds
(6)	controls in (5) −	island and North African countries

Table 5

Summary of the controls in specification (1), (2) and (4), Italy

Specification		Controls
(1)		Savoy fixed effects
(2)	controls in (1) +	distance from the equator, longitude, minimum monthly rainfall, average humidity, average minimum temperature, and proximity to the ocean measured by the natural log of coastline divided by land area
(4) & (5)	controls in (2) +	island and south of Italy fixed effects

Table 6

Relationship between slave exports and income

Dependent variable is log real GDP , ln$y$

Specification (1)

	Africa 1960	Africa 2000	Nunn 2000	Italy 1960	Italy 2000
ln(exports/area)	−0.028	−0.110**	−0.112**	−0.042	−0.050**
	(0.021)	(0.024)	(0.024)	(0.021)	(0.014)
Colonizer/Savoy	Yes	Yes	Yes	Yes	Yes
Constant	7.557**	7.924**	7.930**	8.498**	9.759**
	(0.552)	(0.629)	(0.634)	(0.081)	(0.053)
R-squared	0.20	0.51	0.51	0.35	0.46
Observations	52	52	52	20	20

Std. errors in parentheses;* sign. 5%; ** sign. at 1%.

Table 7

Relationship between slave exports, income and oil in year 2000

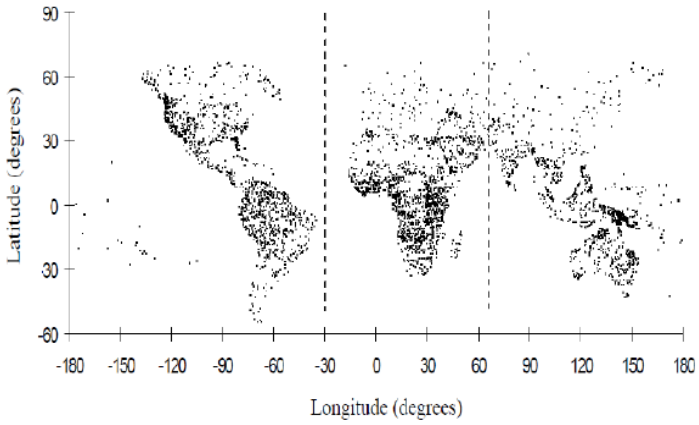
Dependent variable is log real GDP , ln$y$

Specification (5)

	Africa 1960	Africa 2000	Nunn 2000	Italy 1960	Italy 2000
ln(exports/area)	−0.025	−0.097**	−0.103**	0.025	−0.014
	(0.028)	(0.033)	(0.034)	(0.014)	(0.008)
Abs latitude	0.023	0.025	0.023	−0.010	0.015
	(0.014)	(0.017)	(0.017)	(0.042)	(0.023)
Longitude	0.007	−0.004	−0.004	−0.099*	−0.053*
	(0.004)	(0.005)	(0.005)	(0.037)	(0.020)
Min avg rainfall	−0.004	−0.002	−0.001	0.001	−0.001
	(0.005)	(0.006)	(0.006)	(0.003)	(0.001)
Avg max hum.	0.006	0.016	0.015	−0.005	0.003
	(0.009)	(0.011)	(0.011)	(0.022)	(0.012)
Avg min temp.	0.036	−0.005	−0.015	−0.023	−0.012
	(0.022)	(0.026)	(0.026)	(0.021)	(0.011)
ln(coastline/area)	0.076*	0.076	0.082*	0.000	0.006
	(0.034)	(0.039)	(0.040)	(0.008)	(0.004)
Island indicator	−0.298	−0.138	−0.150	−0.253	−0.061
	(0.431)	(0.498)	(0.516)	(0.173)	(0.095)
Percent Islamic	−0.003	−0.007*	−0.006*	–	–
	(0.003)	(0.003)	(0.003)		
French Legal Origin	−0.278	0.609	0.643	–	–
	(0.404)	(0.464)	(0.470)		
ln_oil_	0.080*	0.069**	0.078**	–	–
	(0.035)	(0.024)	(0.027)		
ln_gold_	0.028	0.012	0.011	–	–
	(0.022)	(0.018)	(0.017)		
ln_diamonds_	−0.001	−0.037	−0.039	–	–
	(0.025)	(0.029)	(0.043)		
North Africa/South	−0.015	-0.096	−0.304	−0.289	−0.213*
	(0.434)	(0.488)	(0.517)	(0.149)	(0.082)
Colonizer/Savoy	Yes	Yes	Yes	Yes	Yes
Constant	7.294**	5.308**	6.067**	10.780**	9.840**
	(1.082)	(1.222)	(1.204)	(2.598)	(1.429)
R-squared	0.65	0.78	0.77	0.94	0.96
Observations	52	52	52	20	20

Std. errors in parentheses;* sign. 5%; ** sign. at 1%.

Figure 1
Distribution of human cultures by longitude and latitude



Source: Collard and Foley (2002). Reprinted with kind permission of Professor Foley.
Notes: Each dot represents a culture in the Atlas of World Cultures.

Figure 2
Development of betas, 1960-2006, Africa specification 1

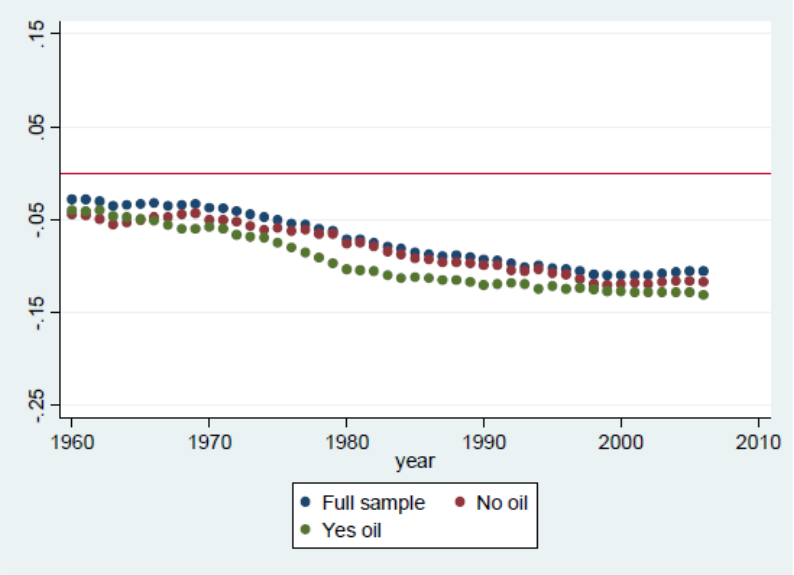


Figure 3

Development of betas with confidence intervals, 1960-2006, Africa specification 1

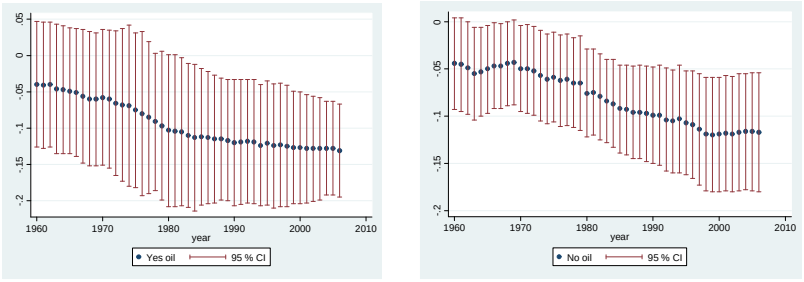


Figure 4

Development of betas, 1960-2006, Africa specification 5

Figure 5

Development of betas, 1960-2006, Africa specification 5

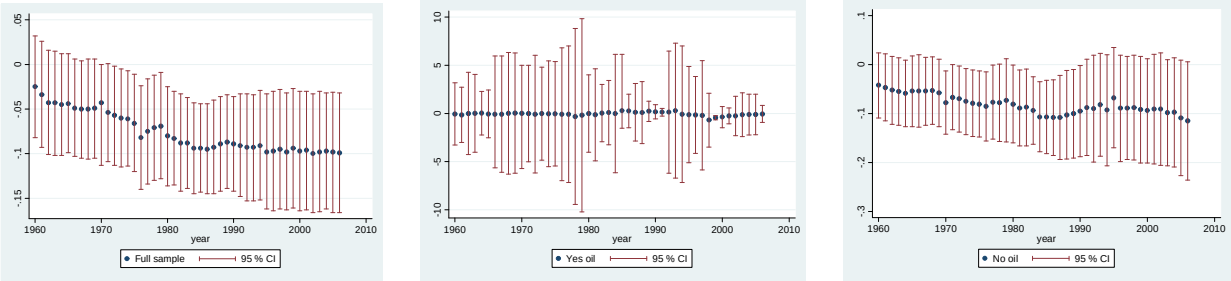


Figure 6
Development of betas, 1970-2004, Italy specification 1 & 5

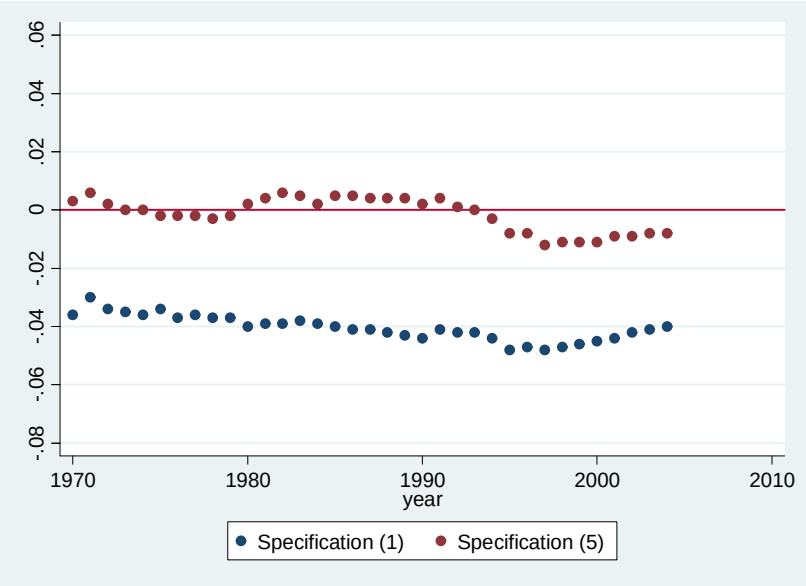
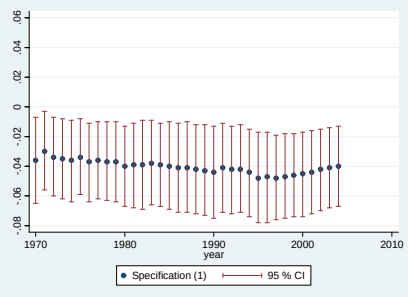
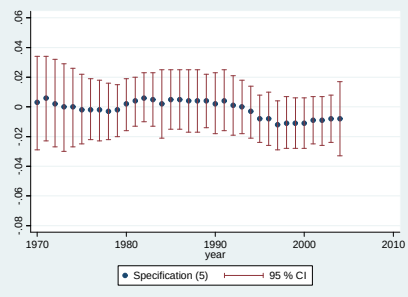


Figure 7
Development of betas with confidence intervals, 1970-2004
Italy specification 1 & 5





Appendix

Table A1
Relationship between slave exports and income

Specification (2)
Dependent variable is log real GDP, ln$y$

	Africa 1960	Africa 2000	Italy 1960	Italy 2000
ln(exports/area)	−0.007	−0.075*	0.026	−0.015
	(0.025)	(0.029)	(0.017)	(0.010)
Abs latitude	0.019	0.017	0.065	0.053*
	(0.014)	(0.016)	(0.034)	(0.020)
Longitude	0.008	−0.000	−0.095*	−0.064**
	(0.005)	(0.005)	(0.033)	(0.019)
Min avg rainfall	−0.004	−0.001	0.001	−0.002
	(0.006)	(0.007)	(0.003)	(0.002)
Avg max humidity	0.007	0.009	0.012	0.015
	(0.010)	(0.012)	(0.025)	(0.014)
Avg min temperature	0.025	−0.017	−0.001	0.000
	(0.024)	(0.028)	(0.023)	(0.013)
ln(coastline/area)	0.055	0.086*	−0.005	0.004
	(0.033)	(0.038)	(0.009)	(0.005)
Colonizer FE/Savoy	Yes	Yes	Yes	Yes
Constant	6.224**	6.685**	6.067**	7.463**
	(1.013)	(1.182)	(2.158)	(1.224)
R-squared	0.39	0.61	0.90	0.93
Observations	52	52	20	20

Std. errors in parentheses;* sign. 5%; ** sign. at 1%

Table A2

Relationship between slave exports and income

Specification (3)

Dependent variable is log real GDP, ln$y$

	Africa 1960	Africa 2000
ln(exports/area)	−0.054	−0.104**
	(0.035)	(0.036)
Abs latitude	0.010	−0.005
	(0.019)	(0.020)
Longitude	0.004	−0.008
	(0.006)	(0.006)
Min avg rainfall	0.005	0.008
	(0.008)	(0.008)
Avg max humidity	−0.000	0.008
	(0.012)	(0.012)
Avg min temperature	0.029	−0.038
	(0.027)	(0.028)
ln(coastline/area)	0.087*	0.089*
	(0.040)	(0.041)
Colonizer FE	Yes	Yes
Constant	7.554**	7.802**
	(0.750)	(0.769)
R-squared	0.42	0.64
Observations	42	42

Std. errors in parentheses;* sign. 5%; ** sign. at 1%.

Table A3

Relationship between slave exports, income and oil in year 2000

Specification (4)

Dependent variable is log real GDP, ln$y$

	Africa 1960	Africa 2000
ln(exports/area)	−0.023	−0.080*
	(0.030)	(0.035)
Abs latitude	0.022	0.020
	(0.015)	(0.017)
Longitude	0.008	−0.004
	(0.005)	(0.006)
Min avg rainfall	−0.006	−0.000
	(0.006)	(0.007)
Avg max humidity	0.004	0.009
	(0.010)	(0.011)
Avg min temperature	0.045	−0.004
	(0.024)	(0.027)
ln(coastline/area)	0.086*	0.093*
	(0.037)	(0.042)
Island indicator	−0.546	−0.299
	(0.461)	(0.525)
Percent Islamic	−0.006*	−0.008**
	(0.002)	(0.003)
French Legal Origin	−0.291	0.692
	(0.438)	(0.499)
North Africa indicator	0.530	0.449
	(0.421)	(0.480)
Colonizer FE	Yes	Yes
Constant	6.728**	6.313**
	(1.113)	(1.267)
R-squared	0.53	0.71
Observations	52	52

Std. errors in parentheses;* sign. 5%; ** sign. at 1%.

Table A4

Relationship between slave exports, income and oil in year 2000

Specification (6)

Dependent variable is log real GDP, ln$y$

	Africa 1960	Africa 2000
ln(exports/area)	−0.029	−0.125**
	(0.027)	(0.032)
Abs latitude	0.018	0.007
	(0.015)	(0.016)
Longitude	0.006	−0.010
	(0.005)	(0.005)
Min avg rainfall	0.007	−0.005
	(0.007)	(0.008)
Avg max humidity	−0.001	0.016
	(0.009)	(0.010)
Avg min temperature	0.023	−0.029
	(0.022)	(0.024)
ln(coastline/area)	0.077*	0.084*
	(0.032)	(0.035)
Percent Islamic	0.002	−0.005
	(0.003)	(0.003)
French Legal Origin	−1.146	−0.531
	(0.634)	(0.728)
ln_oil_	0.093*	0.073**
	(0.036)	(0.021)
ln_gold_	0.048*	0.025
	(0.020)	(0.017)
ln_diamonds_	0.005	−0.052
	(0.023)	(0.027)
Colonizer FE	Yes	Yes
Constant	8.138**	7.328**
	(0.588)	(1.256)
R-squared	0.74	0.81
Observations	42	42

Std. errors in parentheses;* sign. 5%; ** sign. at 1%.

Figure A1
Development of betas 1960-2006, Africa and 1970-2004, Italy

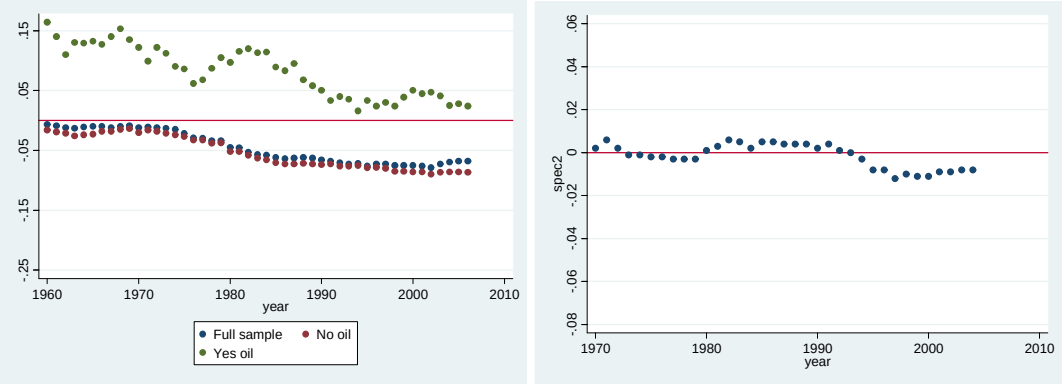


Figure A2
Development of betas with confidence intervals 1960-2006
Africa and 1970-2004, Italy

Figure A3
Development of betas 1960-2006, Africa

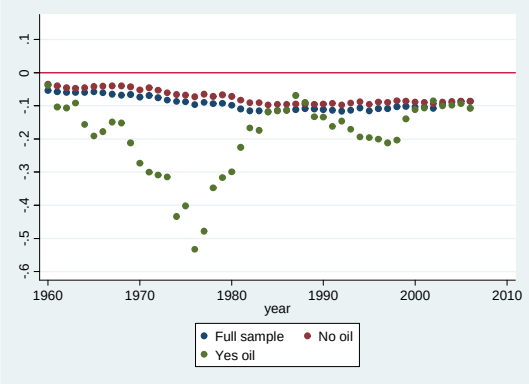
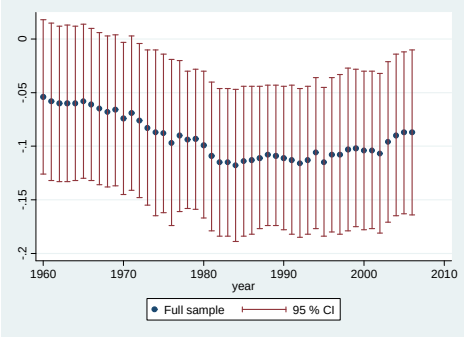
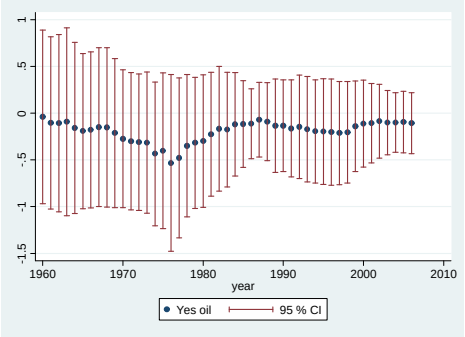


Figure A4
Development of betas with confidence intervals 1960-2006, Africa





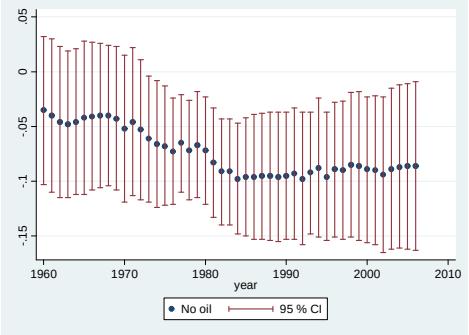


Figure A5
Development of betas 1960-2006, Africa

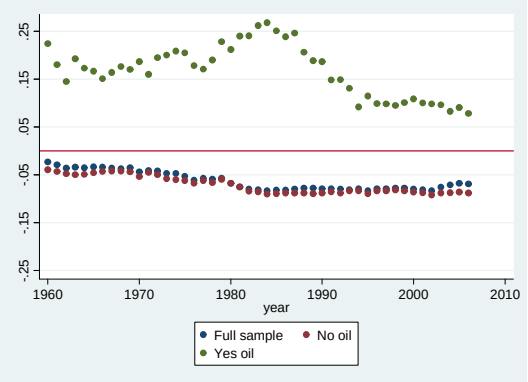
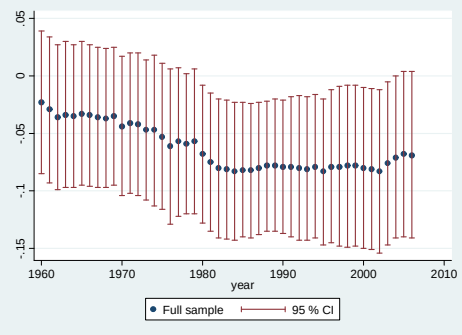
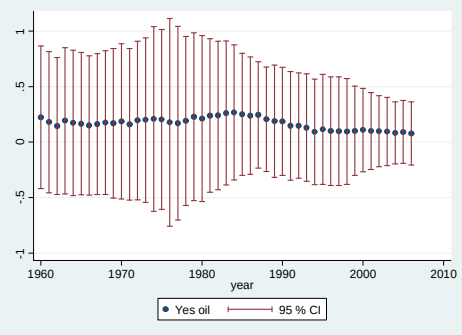


Figure A6
Development of betas with confidence intervals 1960-2006, Africa





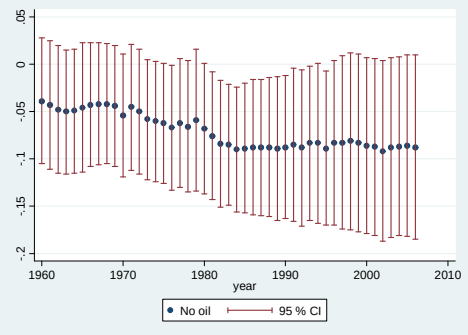
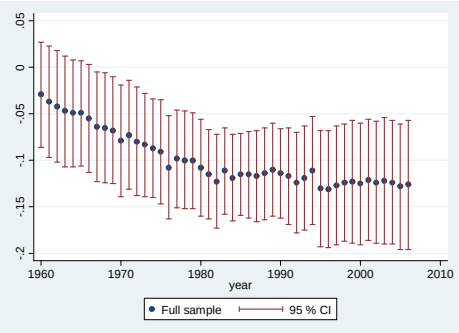
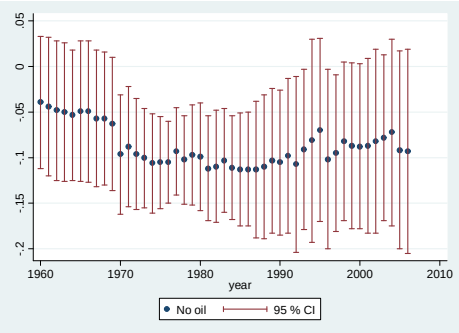


Figure A7
Development of betas 1960-2006, Africa

Figure A8
Development of betas with confidence intervals 1960-2006, Africa





Notes: For this specification, there are not enough observations to plot the case of countries that produce oil.

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