# On the Causes of the African Slave Trade and African Underdevelopment

Luis Angeles*

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**Abstract**

This papers analyses the causes behind Africa's unfortunate transformation into the source of the world's slaves over the early modern period. We discuss the economic and technological forces leading to it, and address questions such as why were most slave buyers Europeans and most slave sellers Africans. We then relate the discussion to the long-term determinants of African underdevelopment, and argue for the role of biogeography as an ultimate explanatory factor of Africa's past slave trade and its current economic situation.

**Keywords:** Africa; Slave Trade; Long-term development; Technologies; Biogeography; Culture.

**JEL classification:** O13, O14, O33, N17, N37.

## 1 Introduction

Starting from the middle of the 17th century, Africa was the scene of a socioeconomic phenomenon the likes of which the world had never seen before and will surely never see again. Large parts of the continent, from the Senegal river to the high plateau of Angola, became specialized in the capture, distribution, and selling of slaves. In the words of Martin A. Klein,

*Economics, University of Glasgow. Adam Smith Building, Glasgow G12 8RT, UK. Tel: +44 141 330 8517. Email: luis.angeles@glasgow.ac.uk .

"slave trading and slave production became the most important economic activities for many African states" (Klein 2003, p.504).

Slavery was of course as ancient as the first large civilizations. More than four thousand years ago ancient Egypt and Akkadian Mesopotamia made very large use of slave labour (Higman 1998). Since then, slavery has existed in some form or another in most if not all human societies until the late 19th century. In some cases, such as ancient Rome or the Muslim world, slaves were ubiquitous: they performed a variety of menial tasks in the households of the wealthy, rendered services in commerce and public administration, served in the army, and worked as raw labour in the mines and in large plantations. In other cases, such as China and India, slavery was only a marginal feature of society (Manning 1990, p. 28).

Slaves had come from Africa since ancient times, but Africa was far from being the only source of slaves. Indeed, Greeks and Romans had slaves whose origins laid all over Europe, the Middle East and Africa, while the Muslim world imported slaves from Eastern Europe, Africa and Central Asia. The three centuries that followed the beginning of Europe's maritime expansion saw Africa becoming practically the only source for the world's slaves.

Several aspects set the African slave trade of the early modern period apart, starting with its magnitude. This was essentially the consequence of the Trans-Atlantic slave trade, which took a total of 12.5 million Africans to the Americas in its three and a half centuries of existence. Africa became a land where the possibility of enslavement was pervasive. A recent calculation estimates that for the West and West Central coasts of Africa the probability of being sent as a slave to the Americas at some point during one's lifetime was an astonishing 9.3 percent during the period 1701-1850 (Whatley and Gillezeau 2011). And the impact of slavery on Africans' lives was even higher than what that figure suggests. First, Whatley and Gillezeau (2011) assume a constant probability of enslavement over a lifetime; but very few children were sent as slaves to the Americas. Among working-age adults the probability would have been easily twice as high. Second, do-

mestic slavery expanded in tandem with slave exports. Klein (2003, p.504), for instance, states that "It is probable that in western Africa during the eighteenth century, as many slaves were kept as were exported, as a result of increased availability and increased social differentiation". Finally, a considerable share of the people captured in slave raids died during their transport to the coast and while waiting to be bought - so that every slave exported represented more than one person captured.[1]

While the Muslim world had been importing African slaves since its earliest days, the magnitude of this trade was relatively stable at between 5,000 and 10,000 persons per year since the 10th century (Lovejoy 1983, p. 24). Though not negligible, this trade left those parts of Africa not in direct contact with the Muslim world largely untouched. Things changed with the arrival of European buyers. From its very modest beginnings, the Trans-Atlantic slave trade equalled the trade towards Muslim lands by the early 17th century. A turning point took place towards the middle of the 17th century with the development of sugar cane plantations in the Caribbean. Slave exports to the Americas were in the order of 20,000 persons per year by the 1660s and continued to grow until reaching a level of about 80,000 persons per year during the last four decades of the 18th century and the first three of the 19th century. With peak years reaching a level of 100,000 persons or more, the Trans-Atlantic slave trade became an order of magnitude larger than the older trade to the Muslim world. Hardly any region of Africa remained unscathed by this event.[2]

This different order of magnitude required a different system for ensuring the capture and supply of slaves; this was another feature that set the

[1] On this respect, Miller (1988) presents a set of numbers for the Angolan slave trade that send a chill down the spine: "Of 100 people seized in Africa, 75 would have reached the marketplaces of the interior; 85 percent of them, or about 64 of the original 100, would have arrived at the coast; after losses of 11 percent in the barracoons, 57 or so would have boarded the ships; of those 57, 51 would have stepped onto Brazilian soil, and 48 or 49 would have lived to behold their first master in the New World".

[2] The data on the Trans-Atlantic slave trade comes from the careful work of Eltis et al. (1999). Their updated estimates can be found on the web at www.slavevoyages.org .

African slave trade apart. Up to this point in history, slaves were a traditional by-product of wars - a convenient source of revenues but not the main motive for starting an armed conflict in the first place. Alternative methods of obtaining slaves were not unknown but of relatively little importance.[3] This changed in Africa. Wars were increasingly fought with the sole objective of obtaining slaves, and they became more common (Lovejoy 1983, chapter 4). And new methods of obtaining slaves became increasingly widespread: kidnapping and raiding, enslavement by judicial process, enslavement as a consequence of debts, and so on. Slavery became a central feature of many African societies.

Since the phenomenon of the African slave trade appears to be quite unique in history, it is perhaps not surprising that recent research has linked it to Africa's other sorrowful claim to distinctiveness: its dismal record in terms of economic development. The path-breaking work of Nunn (2008), who put together an estimate of the total exports of slaves from every African country to the different Eurasian buyers, shows a strong negative relationship between exports of slaves and current levels of economic development. Slave trading may handicap future economic development because the multiplication of small-scale wars and raids that characterized it lead to higher levels of ethnic fractionalization and lower levels of interpersonal trust.[4]

The objective of the present paper is to offer an explanation for the development of the African slave trade over the three and a half centuries following the year 1500. If recent results in the literature are right in pointing towards Africa's history as a cause of its lack of economic development, then an understanding of why the hugely disrupting slave trade of the early modern period took place in Africa and not somewhere else in the world

[3] An example would be the trade in Slavic people from Russia and Eastern Europe to Muslim lands, where the Varangian overlords obtained the slaves mainly through tribute (Findlay and O'Rourke 2007, p.76).

[4] See Nunn (2008) and Nunn and Wantchekon (forthcoming) for evidence on this. The link between ethnic fractionalization and economic development, and interpersonal trust and economic development, have been recognized previously in the literature (see Easterly and Levine 1997, Knack and Keefer 1997, and the subsequent literature).

should be high on the economists' and economic historians' agendas. As we document below, the literature is actually sparse in explanations and should benefit from contributions like the present one.

After discussin the slave trade, the paper extends the discussion into the long-term determinants of Africa's current economic development. The role of biogeographic factors is stressed both as an ultimate determinant of the slave trade and, through that channel, as an essential element in our understanding of Africa's present circumstances.

The rest of the paper is organized as follows. Section 2 offers a literature review highlighting how economists and economic historians have explained slavery and the slave trade. Weaknesses are identified in the available explanations, thus the need to advance less imperfect ones. Section 3 begins with that task by delineating the main economic forces at play in the slave trade between Europe and Africa. Sections 4 and 5 extend the discussion by addressing two important questions: (i) Why were most slave buyers Europeans (and not from elsewhere in Eurasia)? and (ii) Why were almost all slaves African?

Section 6 extends the discussion to consider the role of biogeography in the context of the slave trade, and links the subject with the long-term economic development of Africa. Section 7 offers a formal model that summarizes in a simple form many of the previous discussions, and the last section of the paper offers some concluding remarks.

## 2 A literature review

It seems quite remarkable that, having originated from all over the world throughout history, slaves increasingly became of African origin over the early modern period. Why, indeed, was Africa and not somewhere else in the world the source of the world's slaves?

Economic reasons are likely to figure prominently when addressing this question, for material profit can be clearly detected as the main motivation

for the trade on both sides of the Atlantic. Europeans were in need of labour for their highly profitable sugar plantations. African slaves became the solution for Europe's labour needs in the Americas for simple yet irresistible economic reasons: they were about two times cheaper than European indentured labour (which was in quite limited supply anyway) and at least four times cheaper that what European free labor would have cost.[5] Meanwhile, on the African side of the Atlantic, Europeans found that they did not need to bother with military excursions to the interior of the continent in order to obtain slaves. Africans took care of the raids and the capturing themselves and brought the resulting slaves to the ports and markets where Europeans and Muslims could buy them without further effort. Africans were persuaded to enslave and sale other Africans by the millions through the considerable rents to be gained by doing so. Evans and Richardson (1995) report that slaves were sold to European buyers for £30-£32 at the beginning of the 19th century, while prices for slaves in Africa's domestic market were in the £12-£20 range; a markup of at least 50% over the local price.

While the immediate reasons for the development of the African slave trade were the price differences just mentioned, it is not obvious why only Africa got involved in the massive export of slaves. We can easily dismiss a simple geographic explanation based on transport costs (Africa is far closer to the Caribbean than any region in Asia) by noting that Indian textiles formed a very large component of the goods that Europeans exchanged in Africa against slaves (Inikori 1992, p. 175. European textiles eventually replaced Indian ones, but not before the Industrial Revolution). Thus, Europeans were incurring the cost of going all the way from Europe to India and back to Africa in order to buy slaves there. If transport costs had been paramount, buying the slaves in India would have been a superior alternative.

[5] Appendix 1 offers some calculations in this respect. The point was made early on by Eric Williams in his seminal work on slavery in the Caribbean when he remarked that "The reason [for slavery in the Caribbean] was economic, not racial; it had to do not with the color of the laborer, but the cheapness of the labor" (Williams 1944, p.19).

Perhaps somewhat surprisingly, very few explanations have been advanced for the causes of the African slave trade. The economic analysis of slavery has developed into a rich and voluminous literature, but most of the attention has been focused on slavery in the Americas - with the question of the profitability of slave plantations in the Southern United States taking a prominent place.[6]

The best-know theoretical contribution on the causes leading to the rise or fall of slavery within a country is probably Domar (1970).[7] Domar's thesis is simply that slavery develops in land-abundant regions as a mechanism allowing the creation of rents for the land-owning elite. As population grows and the marginal productivity of labor decreases, slavery becomes unnecessary as the elite will be able to secure cheap labor inputs through the market. The idea has some problems fitting the empirical evidence: as Domar (1970) himself admitted, the great depopulation that followed the Black Death should have led to slavery in Europe - it didn't. The one instance of comprehensive empirical testing to which the theory has been subjected ended up rejecting it (Patterson 1977). The most fundamental reason for seeking beyond Domar's model, however, is that it ultimately does not relate to slavery at all.

The phenomenon that Domar (1970) was trying to explain was the rise and fall of serfdom in Russia - with some extensions to the rest of Europe. But most experts on slavery would make a clear distinction between slavery and serfdom - even if some similarities are no doubt present. As Finley (1980, p.299) put it, "Societies have never been reluctant to reduce substantial sections of their own people to debt bondage, serfdom, and the rest, but I know of no society that has tolerated the enslavement, at home, of its own people". Domar's thesis may (or may not) be a useful way of understanding how some members of a society lose important rights - particularly the

[6] Seminal works in this area are Conrad and Meyer (1958) and Fogel and Engerman (1974).

[7] Domar (1970) cited Nieboer (1900) as the source of his ideas. For a more recent theoretical treatment along the same lines see Lagerlof (2009).

right of free movement to seek a better remuneration for their work. Serfs lacked that right, but they did enjoy a number of other rights which were traditionally upheld in society: they could have a family, own property, and were not sold other than as part of the land. Slaves had none of those rights and were at the complete mercy of their master.

The literature on slavery has developed the concept of slaves as "outsiders" to societies (Finley 1980). Slavery has always been seen as a status reserved for foreigners, for those who do not belong to one's own people. This goes as far as having the same word to refer to a slave as to a person from a foreign country, as was the case for ancient Sumer (Isaac 1998). Serfs were inside the social realm - even if at its bottom - whereas slaves were always outside of it. An explanation other than Domar's becomes thus necessary.[8]

Turning towards the more historical side of the literature, a certain number of potential explanations can be identified. Philip D. Curtin has made the point that Africans' relative resistance to tropical diseases such as malaria and yellow fever made them preferable for the climate of sugar-producing regions (Curtin 1968, 1977). The point is well-taken, as 19th century data shows overall mortality rates for Africans in the Caribbean of about 40 per one thousand as against rates ranging from 85 to 138 per one thousand for Europeans in the same region (Curtin 1968, tables 1 and 3). A crucial point, however, is that the disease environment of colonial America was in fact man-made; the outcome of voluntary and forced migrations.

Human populations develop resistance to germs and diseases endemic to their own environment but are greatly vulnerable to germs from places with which they have little or no contact. Nowhere has this been of more consequence than in the Americas, where Old World's diseases reduced the aboriginal population by two-thirds according to conservative estimates (Mad-

[8] The literature also offers at least a couple of attempts at modelling the economics of the Trans-Atlantic slave trade: Findlay (1990) and Darity (1982). In both cases, however, the authors did not seek to explain why Africa was exporting slaves but took it as an assumption of their models.

dison 2005, p. 31) - and by 95% according to less conservative ones (Mann 2005). The diseases that afflicted Europeans in the sugar-producing regions of the Americas were not local: they came originally from Africa. Up to the 17th century, Africa's malaria and yellow fever had never spread beyond the Sahara since the mosquitoes on which they rely for transmission can only survive in tropical environments. It was the arrival of African slaves in the Americas that brought these diseases and turned the Caribbean and neighboring tropical lands into high mortality areas for Europeans. We would thus advance that the different mortality rates identified by Curtin were a consequence, not a cause, of the African slave trade.[9]

We do not go much further by noting that Europe's colonies in the Caribbean satisfied the three preconditions for a slave society as put forward by Moses I. Finley: "private ownership of land", "a sufficient development of commodity production and markets", and "the unavailability of an internal labour supply" (Finley 1980, p. 86). Yes, the Caribbean in the 17th century was a likely candidate for slave imports, but why only from Africa and why in such unprecedented numbers? Similarly, Jack Goody's observation that "slavery involves external as well as internal inequality, an unequal balance of power between peoples", and that such external inequality "has been especially common where states existed side by side with zones inhabited by 'uncontrolled', stateless or tribal peoples" (Goody 1980, p.24) is of limited use for us. Europeans were precisely not side by side with Africans, they chose to pay the price of travelling there to get their slaves, and the relationship between European and African states was not one of dominance (Thornton 1998).

An explanation of the African slave trade that has achieved a certain degree of acceptance was put forward a couple of decades ago by Patrick Manning in his 1990 monograph "Slavery and African Life". Manning (1990) argues that Africans' low productivity in agriculture, a consequence of Africa's

[9] In support of this interpretation is the fact that Europeans were indeed employed in sugar plantations as indentured labour before the massive arrival of African slaves in the second half of the 17th century.

less advanced agricultural technology (hoe-based instead of the plow-based agriculture of Eurasia), offered important arbitrage possibilities. In short, Europeans could offer to buy a slave for more than the value of its production, and the deal would be profitable for both parts since African slaves would be put to work using European technology.

Although apparently intuitive, the argument does not survive a careful analysis. The main problem with Manning's thesis is that if the productivity of agricultural labour was higher in Europe than in Africa it would have been profitable to buy African slaves and put them to work in the European countryside, something that was completely absent over the early modern period. The same would apply to many other regions in Eurasia which were also using the more advanced plow-based agriculture. Sociocultural factors aside, this did not happen because labour productivity in African agriculture was most likely not lower than labour productivity in Eurasia.

There is indeed no contradiction between the (well-established) fact that African agriculture was less technologically advanced than its Eurasian counterpart and the claim that labour productivity was similar in both regions. Labour productivity, the marginal change in total production due to an increase of labour, depends not only on technology but on the availability of all factors of production such as land, capital and labour itself. A long-standing theme among economic historians of Africa is precisely its relative labour scarcity and the large abundance of land, a fact that was clearly reflected on the land-intensive choice of techniques such as slash-and-burn agriculture and very long periods of fallow. Land abundance could then compensate for a less advanced agricultural technology.

The situation is best understood from the perspective of the Malthusian model. As is well known, Malthusian forces transform technological advances into larger populations - leaving production per capita unchanged because of decreasing returns in the presence of a fixed factor of production, in this case land. We would thus advance that the labour scarcity that economic historians have always emphasized in Africa was an endogenous

response to the less advanced agricultural technology of the continent (and, we may add, to the constraints that climate and the availability of plants and animals imposed).

Empirical evidence on labour productivity in agriculture for pre-colonial Africa is essentially inexistent[10], but good indirect evidence can be found in the literature on human heights as a measure of economic well-being. If labour productivity in agriculture is interpreted as the real wage in terms of agricultural goods, higher labour productivity in agriculture would translate into a better-nourished, and thus taller, population. Good information on the height of different African ethnic groups is given in Eltis (1990, table 1). The data refers to African-born slaves, which is the best we can do given the absence of any statistical data in pre-colonial Africa. The simple average height of the 21 groups listed is 163.89 cm. This is very much in line with average heights from all over Eurasia for the pre-industrial period. Clark (2007, p. 57) reports heights of 163 cm. for Indians, 164 cm. for the Chinese and 159 cm. for the Japanese. As for the Europeans, Africans' average height is very similar to those of countries such as Italy (162.2 cm.), Portugal (163.4 cm.) or Spain (163.7 cm), while Europe's richest areas (England, 166 cm.) are matched by some African groups such as the Yoruba (166.6 cm.).[11] There is thus no reason to think that Africa's labour productivity in agriculture was lower than in any of the advanced civilizations of Eurasia.

An additional problem with Manning's explanation is that it does not take into account the costs of acquiring slaves. A landlord or king selling his peasants into slavery would perhaps just compare the price he is being offered with the loss of agricultural production that the peasant's departure would entail. That, however, is not an accurate description of how the slave trade actually took place. As emphasized above, slaves were outsiders, so slave traders had to procure them from societies other than their own.

[10] See Thornton (1990) for some efforts along these lines. His numbers, though, refer to land and seed productivity; not to labour productivity.

[11] Data on European heights is from Floud (1994, table 1.1) and correspond to the second half of the 19th century, except for England (Clark 2007, p.57). The height of the Yoruba is from Eltis (1990).

Such an operation was costly: slave raids or wars had to be organized, the captives had to be transported, and they had to be fed - however badly - until the moment of the sale. Africans would have never exported slaves if the trade had not been profitable. These costs thus signified a constraint on the minimum price that slave buyers had to pay, and the analysis of the slave trade would be incomplete if we fail to consider them.

# 3 Explaining the African slave trade: basic economics

To be fair to Manning, he does have his intuition right in stating that "The logic of African supply of slaves depends, therefore, on the notion that slaves in the New World were more productive than free producers in Africa, with a margin large enough that New World slave owners could pay for the costs of transportation, mortality, and seasoning of their slaves" (Manning 1990, p.33-34). He was wrong, however, in assuming that these arbitrage opportunities were the consequence of labour productivity in agriculture; continuing with the previous quote: "As long as African agricultural technology, constricted by the limits of the hoe, was trapped at a level of productivity below that of Europeans, European buyers were able to pay consistently more than the value of an African person's produce at home".

Europeans were indeed able to make a profit buying African slaves, but this was because African slaves were bought almost exclusively against European manufactures[12], and the relative price of manufactured goods in terms of agricultural goods was much lower in Europe than in Africa. In short, we must consider at least two sectors in the economy in order to understand why Africa was exporting slaves.

African slaves were employed by Europeans in the production of sugar,

[12] In the 1780s, when slaves dominated African exports, the composition of imports into Western Africa was as follows: textiles 56.4%, alcohol 9.7%, tobacco 8.1%, miscellaneous manufactures 10.5%, iron 3.5%, food 1.8%, guns and gunpowder 8.6%, raw materials 1.7% (Eltis and Jennings 1988, table 2).

tobacco and cotton in American plantations. The value of their production in terms of manufactured goods, exchanged at European relative prices, comfortably exceeded the amount of manufactured goods they could have procured in Africa by working in agriculture or, for that matter, in manufacturing. An arbitrage opportunity thus existed thanks to the relative cheapness of manufactures in Europe; a consequence of Europe's higher productivity in the industrial sector.

As was the case in agriculture, Europe was well in advance of Africa in most or all industrial technologies.[13] In textile production, by far the largest industrial sector of any economy up to the 19th century, Africans used the distaff for spinning and simple looms for weaving, but had not adopted the spinning wheel - which spread throughout Eurasia during the Middle Ages and removed the main bottleneck in textile production. Marchetti (1979) mentions that the spinning wheel "speeded up by a factor of 10 or perhaps 100" the production of thread. The advent of the Industrial Revolution in England would of course broaden Europe's advantage by an additional order of magnitude.

In transport technologies Africans were also very limited: there were no vessels capable of long-distance travel, navigation was circumscribed to inland waters and short trips along the coast. The wheel had not been adopted, there were no pack animals except in the Sahel and transportation relied mainly on human porterage.

The one sector where Africans had been at some point in history at a similar level of sophistication as Eurasians was metallurgy. Although Africa did not experience a bronze age, its transition to iron making was relatively early (around 500 BC). Initially Africans' iron smelting was on a par with most of what Eurasia could offer, although their forging process was not as sophisticated. Over time, however, Africa's iron technology stalled and by the pre-modern period iron bars had become an important item that Europeans exchanged for African slaves.

[13] This paragraph and the next two are based on Austen and Headrik (1983).

This technological retard was not counterbalanced by Malthusian forces, as was the case in agriculture. The Malthusian model works in full swing in agriculture due to the fixity of land, whereas capital - the counterpart of land in industrial production - is indefinitely expandable given time and resources. Thus, while African farmers managed to feed themselves as well as Eurasian ones did (although at lower population densities), all indicates that the consumption of manufactured products in Africa was much below Eurasian standards, and that some manufactured goods such as firearms were not available at all.

Readers familiar with standard trade theory would observe that such a situation simply implies a comparative advantage for Europe in manufactures against a comparative advantage for Africa in agricultural products. Most African agricultural products, however, were not tradable over long distances during the early modern period due to their low value per unit of mass or volume (unlike the valuable spices of the East and the sugar or tobacco from the Americas). If Africa wanted to buy European manufactures it had to offer a product that could be profitably transported overseas. Gold fitted the bill but its production was geographically limited and could not be easily increased. Slaves, which could be "produced" anywhere in the continent in enormous quantities, became the export of choice.

The possibility of engaging into this exchange between European manufactures and African slaves was long inhibited by the lack of direct contact between the two regions. With Europe's maritime expansion of the early modern period this trade became possible, giving rise to the Trans-Atlantic slave trade.

# 4 Why Europe (and not the Muslim world, India or China)?

If the above discussion has shed some lights on why Africa became the source of the world's slaves from the 16th century onwards, insightful readers will

have noticed that it also induces additional questions that we address in this and the following section.

A first questionrelates to the identity of the slave buyers. The contrast between a technologically advanced Europe and a technologically backward Africa could very well be rephrased by changing the word "Europe" for "Muslim world", "India" or "China". Europe, after all, was not the clear technological leader of Eurasia before the Industrial Revolution. The spinning wheel, for instance, was not a European invention - it originated either in India or China (Temple 1986?).Cotton textiles and porcelaine were two manufacturing products that Europeans learned to produce only at the beginning of the 18th century by copying, respectively, the Indian and the Chinese. Why didn't any of these other advanced civilizations, all of which had the capacity of sending merchant ships to Africa (and in the case of the Chinese, a whole Armada[14]), develop the African slave trade before - or at least together with - the Europeans?

The answer to this question suggests itself by looking at the only non-European region to engage in the African slave trade in considerable numbers, the Muslim world. African slaves were employed in Muslim lands in the military, as administrators and, perhaps most important, in domestic service and as concubines (Lovejoy 1983, p. 15). Africans were usually not employed as a form of raw labour, with the exception of mining. There are only a few examples of African slaves being used in agricultural production.

This last observation is actually valid for all of Eurasia. Having employed agricultural slave labour in large numbers during Roman times, Europe had turned away from that mode of production during the early Middle Ages. China and India never saw a large number of slaves engaged in agriculture. The most likely reason for this has been alluded before: all advanced pre-industrial societies in Eurasia had in place a social structure that tied peasants to the land and guaranteed cheap labour. Slaves were not needed when

[14] I am of course refering to the voyages of admiral Zheng He at the turn of the 15th century. See Fernandez-Armesto ( ).

serfs (or their equivalent) were available to work the land. With the largest economic sector of pre-industrial times having no role for slave labour, the demand for slaves never took off before the 16th century.

The unprecedented growth in the European demand for African slaves was a result of the development of Europe's sugar industry, with tobacco and cotton playing an additional role. Sugar was particularly well-placed for the use of slaves as no special skills had to be learned, it required a combination of raw labour and capital in its production.[15] But sugar had come to Europe from the East, its refining process was probably invented in India sometime before the year 500 AD from where it spread to Muslim lands and China before finally reaching Europe after the eight century (Mintz 1985, p. 23). Thus, while none of the regions of Eurasia had a need for African slaves in their traditional agriculture, all of Eurasia was familiar with sugar. Why were Europeans the only ones to employ African slaves by the millions in its production?

The reason was not a lack of demand for sugar outside Europe. Sugar was a luxury item, but this was true everywhere in the Eurasian continent. Taking China as an example, Mazumdar (1998, p. 49) estimates the per capita consumption of sugar in pre-industrial China at 2 pounds per year, roughly in line with that of France at 2.2 pounds per year. British consumption per capita by the year 1800 was nine times this level (Mintz 1985, p. 67), but Britain's population being only about 6% of the overall European population, the effect was likely to be limited. Indeed, Mazumdar (1998) advances that the total production of sugar in China was about the same (roughly 250,000 tons per year) as the entire output of sugar reaching the world market in the year 1800, which we may equate to Europe's consumption.

The reason behind Europe's use of African slaves in sugar production lies, we believe, in geography. With the exception of the islands of the

[15] Fenoaltea (1984) develops this point at length by noting that slaves were not useful in care-intensive activities since they are motivated by the fear of punishment. The argument has its limits since many societies employed slaves as high-skilled labourers.

Mediterranean and the south of Spain, Europe's climate does not support sugar cane production. Europe's sugar industry took off with the incorporation of the Atlantic islands of Madeira, the Canaries and Cape Verde into the new Iberian empires - before exploding with the advent of production in the Caribbean and Brazil. All of these lands had little or no labour to man the plantations (usually as a consequence of the European's presence), and thus required the importation of large quantities of workers. From that perspective, importing labour from Africa in the form of slaves was much cheaper than trying to convince European peasants to relocate to these tropical countries.

The circumstances were different in the rest of Eurasia, where suitable land for sugar production was available in China, India and the Muslim world. Landlords could simply arrange for their serfs to dedicate part of their holdings to sugar cane production. Labour movements, if needed, were much easier to arrange within the same society. Exceptions to this rule could be found within the Muslim world, where the use of African slaves - alongside free labourers - has been documented in Cyprus, Crete and possibly the south of Mesopotamia (Mintz 1985). Interestingly, however, the development of this mode of production towards the exclusive use of slave labour came about only with the conquest of the Crusaders and the Italian city-states of Venice and Genova of the islands in the Eastern Mediterranean (Solow 1987, Mintz 1985).

To summarize, Eurasians had not much use for African slaves in their traditional agriculture because of the constraints already imposed on their own peasantry. The demand for slaves arose from Europe's expansion in the production of sugar (and other tropical crops). While sugar was consumed everywhere in Eurasia and the level of demand of the major Asian regions was in line with that of Europe, geography dictated that Europe could only produce sugar abroad. This required the displacement of large quantities of labour and African slaves constituted the most economical alternative.

## 5 Why only Africa?

The second question is related to a problem already mentioned when discussing Manning's explanation for the African slave trade. In short, slave production had a cost in terms of raids or wars, transportation and storage. The exchange of slaves for manufactures is a profitable business only if it covers the costs of slave production.

Another way to approach the question is by asking why slaves came only from Africa. The preceding section has made clear that Africa's technological retard in manufactures was a key reason for this. It is no mystery that the Americas, also less technologically advanced than Europe but thinly populated following the arrival of the Old World's germs and disease system, was in no position to supply slaves in large numbers. What appears much less evident, however, is why none of the rest of Eurasia served as slave providers to the Europeans. We have mentioned above that Europe had no technological advance over the most advanced parts of Eurasia until the late 18th century, but that still leaves regions such as Southeast Asia, Central Asia, and - indeed - Eastern Europe and Russia, as potential sources for slaves. Even more important, European manufacturing did become much more productive that their Eurasian counterparts from the late 18th century onwards - why did the slave trade not pick up then?

Transports costs are at least part of the answer. Russia and Eastern Europe were close enough to engage in trade of agricultural products against manufactures - without mentioning that the agricultural products of Eastern Europe matched well Western Europe's consumption patterns, a very different situation from that of Africa[16]. But that still leaves open the question of why regions such as India or Southeast Asia never exported slaves. India, in particular, saw its industrial output fall by almost three quarters during the 19th century due to the import of British manufactures (Bairoch

[16] A similar story applies to Central Asia, which was close enough to China and the Muslim world to export animal products, in particular live horses. It is also the case that both Eastern Europe and Central Asia did export slaves, especially to Muslim lands, but the trade never took the magnitude of the African one.

1982). It seems valid to ask why this huge level of imports was never paid with Indian slaves.

The answer, we believe, lies in the different costs of obtaining slaves across different societies. But claiming that slaves were easier to obtain in Africa than in India or Asia just begs the question of why that would be the case. To address this issue we need to step outside purely economic costs such as equipping an army or feeding the captives since these were in all likelihood similar throughout the Old World. We therefore propose to analyze the cultural aspects that made slave rading less costly in Africa.

Our point of departure is the observation, already made in the preceding section, that societies did not enslave their own members but reserved this meanest of status for outsiders. In the words of Finley (1980, p.143), "... the slave was always a deracinated outsider - an outsider first in the sense that he originated from outside the society into which he was introduced as a slave, second in the sense that he was denied the most elementary of social bonds, kinship".

The concept of an outsider is a cultural one, we regard as outsider someone who behaves differently, talks a different language, or prays to different gods. External appearance, what geneticists would call phenotypic differences, do not seem to have played a major role in determining who was liable to enslavement throughout history. Ancient Greeks and Romans felt equally inclined to enslave all barbarians, whether from neighboring Mediterranean regions or from across the Sahara, and Muslims acquired slaves from most regions they were in contact with.

The argument that we would like to put forward here is that the capture and trade of slaves was a less costly activity within Africa because of this continent's larger degree of *cultural fragmentation*. By this we mean that cultural areas, regions within which people would share some essential cultural elements, were smaller in Africa as compared to Eurasia. As a result, people within Africa were much more likely to see each other as "outsiders" than people within any of Eurasia's major regions.

How this translated into lower costs for obtaining slaves is not difficult to see. Let us assume that the enslaving of "insiders" was completely forbidden in all societies - so that would-be slave traders need to run operations against societies seen as distinct from their own. Eurasia's large cultural areas meant that this required long-distance operations and large-scale military actions, rendering the capture of slaves very costly. Africa's cultural fragmentation, on the other hand, implied that raids of even a few dozen men attacking villages from a nearby region would be a cheap and acceptable way to obtain slaves.

It is impossible to calculate a measure of cultural fragmentation for pre-colonial Africa, but present-day measures clearly show Africa's more divided cultural landscape. Fearon (2003), for instance, estimates cultural fractionalization by using linguistic distance as a proxy for cultural distance and finds that average scores in Africa are the highest in the world. And as is well-know since Easterly and Levine (1997), the related concept of ethnic fractionalization is particularly strong in Africa. Further evidence in support of Africa's distinctively high cultural fragmentation comes from analyzing the causes behind it, an exercise to which we turn in what follows.

In short, we advance that Eurasia's comparatively large cultural areas are the result of two mutually reinforcing structures that have proved particularly efficient in giving vast and disparate peoples a common cultural background: the state and religion.

States are powerful forces for the spread of cultural elements from their core to the areas they conquer. Even short-lived empires could have long-lasting consequences on the culture of large areas: Alexander's empire did not survive his death in 323 BC but Greek culture was hugely influential from Egypt to Bactria for centuries to come. The Greek language became the lingua franca of western Asia and non-Greek cities such as Alexandria were home to some of the most brilliant intellectual achievements of Greek civilization. All of Eurasia's great empires, Rome, China or the Ummayadd Caliphate, spread cultural elements through the provinces they conquered.

But the most radical consequence of state formation in our present context may not be on the cultural practices of the elites but on the everyday life of the common people. Sub-state political entities such as bands, tribes and chiefdoms encompassed a limited number of people and were in a constant state of warfare with each other. States, on the other hand, have an interest in ensuring a certain level of internal peace - if for no other reason than to guarantee the production on which taxes depend (Olsson 2000) and to better direct violence towards external enemies. Charles Tilly has made the point that, on a millennia perspective, deaths due to homicides (i.e. at the hands of civilians) have decreased enormously - and advances the rise of the state as a cause (Tilly 1990, p.67-68). It is thus the case that a given population of, say, a few million people, would experience much less internal violence if ruled by a single state than by a number of chieftancies or tribes. In addition to this, trade and communication have always been among the first beneficiaries of state and empire formation. The surge in such peaceful types of interaction, and the decline in violent ones, would naturally lead large populations to see each other as being part of a whole, as "insiders".

As it turns out, states were much less prevalent in Africa south of the Sahara than in any of the core areas of Eurasia. By the year 1500 AD the vast majority of Eurasia's population lived within states, whereas much of Africa was ruled by sub-state entities or by very small states. Only along the Sahel and in the Ethiopian highlands could we find long-lasting political entities roughly comparable to their Eurasian counterparts, and no empire of the magnitude of Rome, China or the Umayyad Caliphate had ever existed in Africa. The historian of Africa John Thornton is unambiguous on this point: "one can say with confidence that political fragmentation was the norm in Atlantic Africa. [...] the "typical" Atlantic African probably lived in a state that had absolute sovereignty but controlled a territory not exceeding 1,500 square kilometers [...] it could control as many as 20,000-30,000 people" (Thornton 1998, p. 105).

The phenomenon can be illustrated with the help of Figure 1, which uses the index of state development put together by Bockstette et al. (2002). The

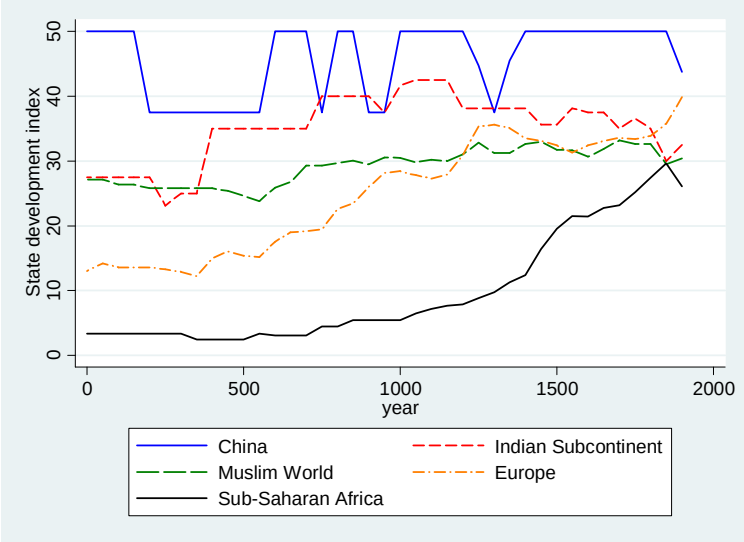
index is calculated for every present-day country and every 50-year period since the year 0 AD until the year 1950 AD, and takes values between 0 and 50 - larger values denote that larger fractions of the territory in question are ruled by a state.[17] We compute simple averages for Sub-Saharan Africa and for the four main Eurasian regions of Europe (where we include Eastern Europe, Russia and the Caucasus), the Muslim World (from Morocco to Afghanistan and Central Asia), the Indian Subcontinent and China. The overall pattern is, we believe, very clear. States are rare in Africa over the last two millennia, and particularly so in the 1500 years before the beginning of the Trans-Atlantic slave trade where the index is well below a value of 10 for most of the period. Most of Eurasia, on the other hand, has been ruled by states over this period - with China leading the way and Europe being the laggard given the relative retard of Eastern Europe.

But states are not the whole story. Some regions in Europe were divided among a myriad of very small states, like Germany and Italy before the 1870s, but slavery was absent in them like everywhere else in Europe. And in general we find that European states fiercely waged war against each other yet enslavement was not an acceptable treatment of conquered peoples or war prisoners. The reason was that Europeans belonged to a common cultural community which crossed political boundaries - Christianity.

The Christian world was just one of a few major geographical areas where religion or a system of philosophical thought provided a common world view to a large number of people. Islam was practiced in a continuum of lands from Marrakesh to Samarkand and gave them a common denominator: everywhere Muslims would find the Koran being recited in its original Arab language, people praying in the direction of Mecca five times each day and practices such as fasting and pilgrimage being observed. A comparable

[17] The data is available at http://www.econ.brown.edu/fac/Louis_Putterman/. A value of 50 corresponds to the case where a domestic government rules more than 50% of the territory in question, a value of 0 would be obtained if there was no government above the tribal level, with all intermediate values being also possible. Note that Bockstette et al. (2002) focus on a "State antiquity index", which is the actualized sum of the index of state development described above.

**Figure 1**
**State Development in Africa and Eurasia, 0-2000 AD.**




phenomenon characterized most parts of Eurasia; everywhere an elaborate religion or system of thought - Hinduism, Buddhism, Confucianism - gave millions of people a sense of common humanity and relatedness.[18]

Religion and the state reinforced each other: kings and emperors benefited from the legitimacy that only religious authorities could give while organized religions could expand and perpetuate themselves by becoming the official credo of a state. A people united by a common political entity and a common religion proved to be a remarkable military force, as best exemplified by the rise of Islam. It is perhaps precisely because of the paucity of states that none of the great Eurasian religions or belief systems managed to penetrate Africa beyond a belt of lands south of the Sahara and on its Indian ocean coast. Indeed, the regions of state formation and the regions adopting Eurasian religions overlap each other very well on African soil: Abyssinia and the Nubian kingdoms were Christian, while the many

[18] Some regions, most notably China, combined beliefs in different systems of thought to create a distinct cultural package that unified the population as well as a single religion.

kingdoms of the Sahel and the trading emporiums of East Africa were all Muslims. The rest of Africa practiced traditional religions, none of which ever reached the scale of Eurasia's major religions.

States and religions give a common cultural background to people over large regions or continents, making them see each other as similar in some fundamental ways. Many things were tolerated vis-a-vis other members of these cultural communities, but slavery was not one of them. Africa did not have the benefit of such a unifying cultural background and provided a fertile ground for enslavement.

In support of the above arguments, consider that the enslavement of people became increasingly rare in Eurasia over the first 15 centuries of our era while slavery was a fundamental characteristic of African societies up until the arrival of the Europeans (and independently of the earlier trade to Muslim lands). As summarized by Thornton (1998, p. 97) when referring to Africa's domestic slavery before the Trans-Atlantic trade, "The institution of slavery was widespread in Africa and accepted in all the exporting regions, and the capture, purchase, transport, and sale of slaves was a regular feature of African society". Europeans could then simply add their demand for slaves to the pre-existing demand from the local economy.

# 6 The fundamental causes of African underdevelopment

To summarize our arguments up to this point, we have advanced that Africans were bought as slaves by Europeans because the value of their labour in terms of manufactures was higher in the European economic area (which included European colonies) than in Africa. The exchange of slaves for manufactures was thus profitable for European buyers and African slave traders. Other areas of Eurasia were not interested in this trade (or, in the case of the Muslim world, to a much smaller degree) because the production of commodities like sugar could take place within their lands using their

own labour force. Europeans had to go overseas to produce such goods, and buying African slaves was the most economical solution for their labour needs.

Finally, we noted that slaves came only from Africa despite Europe's eventual overshadowing of every other region in the world in terms of manufacturing technology. This can be explained by the lower costs of acquiring slaves in Africa, a consequence of Africa's cultural fragmentation. The paucity of large states, and the limited penetration of any of the world's major religions (up to the year 1500 AD), help to explain this African characteristic.

If we try to push the causal linkages even further, we may wonder about the reasons leading Africa into a situation where the expansion of the slave trade seemed almost a natural outcome. Why, first of all, was Africa's technology in retard with respect to that of Eurasia? And even allowing for that, why did large regions of Africa - or even the whole continent - never become unified under a large empire or a major religion?

An answer to these questions is likely to require a very long term perspective on the economic development of African, and indeed human, societies. Africa's distinctiveness in the year 1500 AD was not the result of a few centuries but rather of several millennia. By that point in history empires and world religions had risen and fallen several times in Eurasia, whereas similar developments in Africa were much more modest.

Although we do not claim to settle this question here, a good starting point appears to be the differences in biology, geography and climate between Africa and Eurasia. The best exponent of this line of argument is perhaps Jared Diamond, as exemplified in his well-know 1997 monograph "Guns, Germs, and Steel. The Fates of Human Societies". Diamond's thesis is that the long-run economic development of societies around the world was heavily conditioned by the biological and geographical endowments of each region. Eurasia was lucky because it was richly endowed in domesticable plants

and animals which could support an agricultural civilization. Geography meant that the different elements of this winning biological package, first discovered in the Fertile Crescent and China, were able to travel east and west within Eurasia and spread their benefits. In comparison, Africa was double unlucky: it had very few plants and animals that could sustain an agricultural society and its tropical climate meant that it could not import Eurasia's superior lot. As a consequence Africa's transition to agriculture took place later and was more limited in its outcomes[19][20].

Although Diamond's thesis is persuasive when it comes to agricultural development, additional arguments are required if we wish to link biological endowments and climatic characteristics to developmental outcomes outside agriculture such as manufacturing technology or the existence of states. We turn to such arguments in what follows.

While the productivity of the agricultural sector does not directly constraint technological improvements in other areas of the economy, it does constraint total population under a Malthusian regime. At the level of large regions or continents, a larger population is likely to result in technological progress for reasons that are clear for readers familiar with the endogenous growth literature: more people means more potential inventors and a larger pool of resources that can be invested in research and development. We know since Kremer (1993) that, on a global perspective and over the very long run, economic growth has been proportional to total population. In

[19] Olsson and Hibbs (2005) and Putterman (2008) offer empirical support for Diamond's thesis. There is a growing empirical literature in economics showing the existence of strong "path-dependence" in very long-term economic development, see Comin et al. (2010) and Bockstete et al. (2002).

[20] As is so often the case, Diamond's thesis was anticipated by other authors in a less detailed form. William H. McNeill, for instance, when referring to the transition towards agricultural production noted that "Many communities in different parts of the earth moved in this direction, with results that varied in accordance with what was available in wild state to start from" (McNeill 1976, p. 36). McNeill (1976) would add as additional biological factors handicapping the economic development of Africa the higher density of germs (attacking humans) and weeds (attacking edible plants) that characterize the tropical rain forest. On top of that, the literature has emphasized other geographic handicaps of Africa such as the low percentage of land near the coasts, which renders commerce and communication difficult.

short, Africa's less productive agriculture created less surpluses to maintain a vigorous and inventive urban sector that could develop the industries.

And the consequences of a less productive agriculture and a smaller population do not stop there. Diamond himself argues that "the size of the regional population is the strongest single predictor of societal complexity" (Diamond 1997, p. 284). Two key aspects of societal complexity would be precisely the existence of a state and organized religion.

It is natural to think of a certain level of agricultural development as a pre-condition for the existence of states. As noted by McNeill (1982, p.7), "Early civilizations existed by virtue of transfer of food from its producers to rulers and men of power who supported themselves, along with a following of military and artisan specialists, on the food so secured". One of the conditions used by anthropologists to distinguish states from chieftancies and other sub-state organizations is precisely the existence of a class of non-food producing specialists (Flannery 1972). States required the existence of agricultural surpluses, and increases in state complexity and power were only possible through an increase in agricultural production that would sustain a larger army and a more specialized class of bureaucrats and artisans.

Agricultural development may be not just a necessary condition for the emergence of states - under evolutionary arguments it may also be a sufficient one. Societies that were able to generate agricultural surpluses may or may not chose to form states and to sustain an army. Those that do so, however, will have an advantage in military operations and over time will absorb the societies choosing a different path. Evolutionary forces at the society level would thus ensure that states emerge wherever agricultural development make it possible.

An additional argument is the fact that low population density makes nation-building difficult. Austin (2008, p. 1005) emphasizes this point for Africa: "It is widely agreed in the literature on Africa, [...], that low population density made it hard to tie people down, and relatively easy for them

to emigrate to avoid taxation or other state demands" (on this point see also Hopkins 2009, p. 174, and the literature cited therein).

The emergence of great organized religions may also be linked to agricultural development. It is quite probable that Africa had its share of highly inspired and charismatic philosophers and thought leaders; the equivalents of the Buddha, Confucius or Jesus. The development of Buddhism, Confucianism and Christianity, however, necessitated much more than a single inspired leader. It was the cumulative intellectual power of their successors that developed their initial insights into full-scale and organized religions or systems of thought (notice that neither the Buddha nor Jesus wrote a line during their life). The establishment of this mass of religious specialists was possible only in an environment of continual agricultural surpluses - once again a consequence of agricultural development.

We arrive then to an overall perspective in which the ultimate causes of the African slave trade are to be found in the continent's bad hand played by mother nature. The consequences of this biological and geographic handicap may even continue right up to the present if we accept that the slave trade is a major cause of Africa's lack of economic development[21].

Some evidence for this view of history is presented in table 1. We study the role of two factors, biogeographic endowments and the intensity of the slave trade, on economic development at two points in time: the years 1500 AD and 2000 AD. The unit of analysis is present-day nations. Biogeographic endowments are summarized by the number of years since the transition from hunther-gathering to agricultural production. Early transitions are

[21] An additional channel from biogeographic endowments to current economic development would be the colonial experience. There is no doubt that Africa's technological retard was a main reason for its eventual partition among European nations (Headrick 2010). A large literature starting with Acemoglu et al. (2001) has emphasized the institutional consequences of the colonial experience as a determinant of economic development. For studies of the effects of colonialsm on other present-day socioeconomic outcomes see Angeles (2007) on income inequality and Angeles and Neanidis (2009, 2010) on elite formation.

**Table 1**
**Biogeography and economic development, years 1500 and 2000.**

| | *Dependent variable:Log of Population density, year 1500* | | | *Dependent variable: Log of GDP per capita, year 2000* | | |
|---|---|---|---|---|---|---|
| Years since agricultural transition | 0.357 (0.047)** | 0.400 (0.053)** | 0.420 (0.061)** | 0.143 (0.040)** | 0.026 (0.037) | -0.029 (0.040) |
| Log of slave exports to country area | | 0.080 (0.028)** | 0.036 (0.058) | | -0.220 (0.021)** | -0.102 (0.035)** |
| Sub-Saharan Africa dummy | | | 0.459 (0.564) | | | -1.242 (0.344)** |
| Observations | 130 | 130 | 130 | 162 | 162 | 162 |
| $R^2$ | 0.27 | 0.30 | 0.30 | 0.07 | 0.33 | 0.37 |

Note: Robust standard errors in parenthesis. The symbols * and ** denote statistical significance at the 5% and 1% level.

associated with rich endowments in plants and animals or a geographic location facilitating their transfer. The intensity of the slave trade is measured by the log of total slave exports between 1400 and 1900 normalized by country area. Economic development is measured by GDP per capita in the year 2000 AD and, in accordance with the Malthusian model, by population density in 1500 AD. We also include a dummy for Sub-Saharan Africa because the measure of slave exports covers only African countries and may thus be picking up other non-measured aspects of this continent[22].

The first three columns of table 1 refer to the situation in the year 1500 AD. Economic development in the pre-industrial world of this time would be largely determined by agricultural technologies. We would thus expect Diamond's thesis to be in full force at this time, and biogeographic

[22] Data on the agricultural transition is from Putterman (2008), on slave exports from Nunn (2008), on GDP per capita from the World Bank and the Penn World Tables, and on population density in 1500 AD from Chanda and Putterman (2007). The present exercise complements and expands the analyses of Olsson and Hibbs (2005) and Putterman (2008), who do not consider slave exports, and of Nunn (2008), who limits his sample to Africa.

endowments to exercise a powerful influence on population densities. That is indeed what we observe. Column 1 shows that an earlier transition to agriculture has a statistically significant association with higher population densities. An extra thousand years since the transition is associated with a 43% increase in density and the variable explains 27% of the variation in the data.

Columns 2 and 3 control for the intensity of the slave trade and introduce the African dummy. Since slave exports took place mainly after 1500 AD, this variable should be interpreted as capturing those factors that made some countries more vulnerable to the slave trade than others. We find that the effect of biogeographic endowments remains statistically significant and even increases in magnitude. Future slave exporting countries, on the other hand, do not appear to be any different from those that did not experience that phenomenon in the coming centuries. Also worthy of notice, countries from sub-Saharan Africa are not below the level of economic development that we would expect given the date of their agricultural transition. The dummy for Sub-Saharan Africa is actually positive, though not statistically significant.

The results change in a revealing manner when we consider GDP per capita in the year 2000 AD. In column 4 we use the years since the agricultural transition as the only explanatory variable and find a positive and statistically significant effect, but considerably weaker than previously. An extra thousand years of experience with agriculture is associated with an income per capita 15% higher, and the variable is able to explain just 7% of the variation in the data.

When we add the log of slave exports, as we do in columns 5 and 6, biogeographic endowments are no longer related to current economic development. It follows that, when it comes to present-day income per capita, these endowments are important only through their effect on the magnitude of the slave trade. Slave exports have a strong negative relationship with economic development, and the size of the effect falls by half but re-

mains large and statistically significant when we introduce a dummy for Sub-Saharan Africa. The addition of these two variables greatly improves the fit of the regression, which now explains up to 37% of the data.

The interpretation of these results must be handled with care since they do not negate all role for geographic or climatic factors, particularly in Africa. As we understand them, these results indicate that the mechanisms emphasized by Jared Diamond were a major determinant of economic development around the year 1500 AD (and arguably at any time earlier), but no longer so by the year 2000. Thus, the biogeographic factors that made for an early agricultural transition are no longer a direct constraint on economic development. They may continue to exercise an indirect influence, however, because they determined the initial conditions under which the different regions of the world interacted. As we have argued above, for Africa this means a technological retard in manufacturing and the absence of states and large religions, which largely determined its path as a slave exporter.

In addition to that, geography may continue to constraint development through channels different than those emphasized by Diamond. This would be reflected in the negative and statistically significant coefficient on the African dummy. Geographic aspects such as Africa's low percentage of land near the coasts (and correspondingly large number of landlocked countries) had little or no relevance for an early agricultural transition but may be of great importance in today's world.

## 7 An illustrative model

Many aspects of the above discussion can be cast in the form of a simple mathematical model which may be useful to clarify some ideas. We consider a world economy with two regions, Africa and Europe, and leave aside the discussions concerning the other regions of Eurasia. Each regional economy has two sectors (agriculture and manufactures), may engage in slave production as a means to buy imports, and is subject to Malthusian forces.

Let us start with Africa. Agricultural production can be summarized by a standard aggregate production function of the form:

$$Y = AT^{\alpha}L^{1-\alpha} \tag{1}$$

In (1) $Y$ stands for total agricultural output, $L$ for labour within agriculture and $T$ for land ( *"terre"*). $A$ is total factor productivity within agriculture and will be assumed to depend on initial biogeographic conditions. In what follows, $T$ will be considered fixed and normalized to 1; so it can be omitted from the rest of our calculations.

Two types of agents inhabit this economy: farmers and non-food producers. Each farmer owns one unit of agricultural labor while each non-food producer owns one unit of non-agricultural labour and an equal share in all land rents. We assume that farmers are freely mobile within the agricultural sector but that they cannot migrate towards non-agricultural sectors. They would thus be paid the marginal product of their labor, that is:

$$w = \frac{dY}{dL} = \frac{(1-\alpha)A}{L^{\alpha}} \tag{2}$$

In (2) $w$ stands for the real wage and it's expressed in units of the agricultural product. This real wage is decreasing in total agricultural population because of the fixity of land.

We now add a Malthusian mechanism to the model by assuming that the total population working the land will increase whenever the real wage is above a certain "subsistence" level that we note as $\overline{w}$. This implies that technological innovations (a higher value for $A$) will result in a higher real wage only in the short term; over the medium to long term population will expand and bring wages back to their initial level.

It follows that, except for short term departures, the real wage will be fixed at $\overline{w}$ and equation (2) can be used to determine the endogenous level

of the farmer population, which we denote $\overline{L}$ :

$$\overline{L} = \left( \frac{(1-\alpha)A}{\overline{w}} \right)^{\frac{1}{\alpha}} \tag{3}$$

As mentioned above, land rents belong to non-food producers. Their amount can be calculated as the difference between total agricultural production and total labour income in agriculture:

$$R = Y(\overline{L}) - \overline{w}\overline{L} \tag{4}$$

Using (1) and (3) in equation (4) gives us the amount of land rents as a function of agricultural productivity and the real wage:

$$R = A^{\frac{1}{\alpha}} \overline{w}^{-\frac{1-\alpha}{\alpha}} (1-\alpha)^{\frac{1}{\alpha}} \frac{\alpha}{1-\alpha} \tag{5}$$

These rents are divided among non-food producers, whose number equal $L_{nf}$, and give them a per capita agricultural rent of $R/L_{nf}$. We will make use of the Malthusian mechanism once again and assume that these agricultural rents pin down the number of non-food producers in the same way as the real wage in agriculture determines the number of farmers. In other words, $L_{nf}$ will expand until $R/L_{nf}$ equals the subsistence wage $\overline{w}$. This determines the number of non-food producers as

$$\overline{L}_{nf} = \frac{R}{\overline{w}} = A^{\frac{1}{\alpha}} \overline{w}^{-\frac{1}{\alpha}} (1-\alpha)^{\frac{1}{\alpha}} \frac{\alpha}{1-\alpha} \tag{6}$$

which, given (3), can also be written as:

$$\overline{L}_{nf} = \frac{\alpha}{1-\alpha} \overline{L} \tag{7}$$

All that is left is to specify the nature of production in the manufacturing sector. We describe it by a simple aggregate production function with constant returns to scale with respect to labor:

$$M = A_m L_{nf} \tag{8}$$

Equation (8) shows that manufacturing is in the hands of non-food producers, and each of them is able to transform their endowment of one unit of labor into $A_m$ units of manufacturing. The constant returns to scale capture the idea that, despite the short-term fixity of capital, over the long term basically all factors of production involved in manufacturing can be reproduced. Manufacturing is thus free of Malthusian pressures.

At this point most models would derive demand functions for agricultural and manufacturing products and confront them with the respective supplies in the market. The distribution of production inside the economy is not really the focus of the present exercise, so we will abstract from this step for the sake of simplicity. Instead, we assume that manufactures are consumed only by non-food producers, so that farmers are limited to agricultural consumption. It thus follows that the per capita consumption of agricultural products is $\overline{w}$ for both farmers and non-food producers while each non-food producer will consume $A_m$ units of manufacturing on top of that.

We have not yet discussed what determines $A_m$, the technology used in manufactures. At the level of aggregation for which this model is intended (continents or civilizations), an assumption along the lines Kremer (1993) seems adequate: technology grows proportionally to the number of people available for creating new inventions. In the static framework presented above, the assumption can be introduced by assuming that $A_m$ is an increasing function either of $L_{nf}$, the number of non-food producers, or of total population $L + L_{nf}$ (the two are proportional). In accordance with our previous discussions, the model posits a causal chain going from biogeographic factors to agricultural technology, from agricultural technology to total population and, finally, from total population to manufacturing technology.

All of the above equations will also apply to Europe, with the sole difference of a richer initial endowment in biogeographic factors. This, of course, would lead to higher technological levels in Europe at the moment when the

two regions come into contact. Assume, in addition, that transport costs make agricultural products non tradeable.

In principle, the situation would not lead to any exchange between the regions since Africa cannot offer its agricultural products against European manufactures. We expand the model, however, by allowing non-food producers to engage into an alternative activity to the production of manufactures: the capture and selling of slaves. Quite simply, each non-food producer may chose to invest his unit of labour into a "capture technology" yielding $\phi$ slaves. The slaves can then be sold in an international market for a price of $P_S$ units of manufactures per slave. It follows that non-food producers will chose to engage in slave production if the income from doing so, $\phi P_S$, is higher than the income from sticking to manufacturing, $A_m$.[23]

The final element of the model is the determination of $P_S$. For this we may assume that slave buyers will employ their slaves in the production of manufactures.[24] A slave may produce manufactures using the production function given by equation (8), with the exception that their productivity would be lower than that of free labour. Thus, the per capita production of slaves is $\lambda A_m^*$, where $\lambda$ is a parameter between 0 and 1, and $A_m^*$ the level of manufacturing technology in Europe. Assuming that perfect competition on the side of slave buyers will erode any arbitrage gains, and abstracting from transport costs, this leads to a price per slave of $P_S = \lambda A_m^*$.

The model thus boils down the condition of whether Africa will become a slave exporter to a simple inequality. Africa would export slaves if

$$A_m < \phi P_S = \phi \lambda A_m^* \tag{9}$$

Equation (9) conveniently summarizes the two main aspects that made

[23] It is natural to assume that slaves are taken from the farmer population, which leads to the question of what happens to agricultural production. We circumvent this minor issue by assuming that agricultural production takes place before slave capture.

[24] This is a shortcut. Slaves would be employed in the production of a third type of good, say sugar, which would then be exchanged for manufactures using Europe's relative prices.

Africa the source of the world's slaves. First, the gap in manufacturing productivity between African and Europe - translated here as the difference between $A_m$ and $A_m^*$. Second, the low cost of acquiring slaves in Africa - translated here as a large number of slave captures per unit of time invested, $\phi$. The presence of only one of these elements may not be enough to verify the inequality in (9), but Africa was characterized by both of them. Moreover, both $A_m$ and $\phi$ may be regarded as ultimately determined by biogeographic factors; in which case the condition would simply require that such factors are sufficiently less favorable in Africa than in Europe.

# 8 Concluding remarks

It is perhaps no exageration to say that Africa was transformed by the Trans-Atlantic slave trade of the early modern period. It was, at any rate, one of the most remarkable events in African and indeed world history. While that should be enough to attract the attention of social scientists in general, economists and economic historians may feel particularly concerned by its analysis due to its potential role in present-day economic outcomes.

Moreover, economics appears as the very first tool of analysis for a phenomenon in which gain and profits were the *raison d'être*. It is from the perspective of differences in productivity, and the arbitrage possibilities that they engendered, that we have chosen to approach the subject. The questions raised along the way, however, have required us to broaden the scope of the analysis to areas that - although not completely foreign to economics - do not constitute its bread and butter.

Low costs of acquiring slaves are central in understanding why only Africa specialized in slave production. And while a discussion of costs is a staple of freshmen's economics courses, the cost differences that we discussed here are the outcome of cultural differences. No economic rationale can be easily invoqued for explaining why a person may be regarded as an outsider, and thus liable to enslavement, by a certain group. Surely British

slave traders would have found it profitable to send the poorest and meanest of England to work as slaves in the Caribbean plantations. But motives stronger than the possibility of gain were at play in making that impossible.

The curious thing, however, is that by pushing the questions even further into the past we have advanced what appear to be long-term economic factors explaining those cultural motives. People feel a sense of common belonging through a shared national or religious identity, but the existence of states and organized religion is itself ultimately a product of economic forces. These are not the economic forces of individual rationality and utility maximization, but forces that act at the level of societies or even continents and on a large historical scale.

The vision we end up with is, we believe, encouraging. Africa has been severely handicapped by its biogeography as long as economic production was mainly agricultural and cultural areas were limited in some way or another by agricultural surpluses. We have no reason to believe that Africans themselves are any less inventive or hard-working than other *homo sapiens* in the planet. In the new economic reality in which we live now the development of African nations should then be within the reach of the African people.

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## Appendix

### On the price of European laborers and African slaves

European indentured labor was used in the early years of the British and other Europeans' sugar colonies in the Caribbean; with the transition to slave labor taking place decisively towards the 1680s. Gemery and Hogendorn (1974) state that the price for indentured labour in the west indies in the 1680s was £10-£12 for four years of labour. Eltis et al. (2005, table 2) set the average price of an African slave over the period 1674-99 at £19.61. This price bought about 25 years of slave work (Eltis et al. 2005, p. 681). Using an annuity formula and a market interest rate for the period of 8% (Eltis et al. 2005, p. 681) we obtain a price of indentured labour of £3.02 - £3.62 per year while slave labor would come at £1.84 per year - or about half as much. Of course, this price does not include the maintenance cost of the labor, which in both cases falls on the owner, but as a first approximation we may assume that the cost was the same for both indentured labor and slaves (an assumption that probably makes slave labor appear dearer than it was).

Indentured labor was in limited supply and it is extremely unlikely that it could have supplied the labor needs of Europe's sugar plantations over the 18th century. For that, plantation owners would have been forced to turn to European farmers and offer a wage at least as high (and, in all probability, higher) than the ongoing market wage in Europe.

The wage of an agricultural laborer in England, as calculated by Clark (2007), is about 12d per day over the period 1650-1700. As in Angeles (2008), we may assume a working year of 260 days for pre-industrial England; which results in a yearly wage of exactly £13. This is not yet comparable with the £1.84 per year derived above for slave labor since English laborers were in charge of their own maintenance. The cost of maintenance for slaves can be estimated as follows (all data from Eltis et al. 2005). The value of exports per slave in the Caribbean in 1770 is £6.8 per year (table 1), which can

be equated to the value of production per slave. The share of labour in production was about 0.5 (Table 3) and Eltis et al. (2005) assume that maintenance costs are about half the marginal productivity of labour. With a Cobb-Douglas production function the marginal productivity of labour equals the production per worker times the share of labour, or £3.4 per year, which gives a figure of £1.7 per year per slave for maintenance costs.

Thus, inclusive of maintenance costs, a year of slave labor would cost £3.54 - or about a quarter of the market wage for agricultural labor in England.