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The Biological Standard of Living in Early 19th-Century West Africa:

New Anthropometric Evidence

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Abstract

Was the height difference between West Africans and Europeans that exists today already visible at the end of the Atlantic slave trade? We present the first study of changing heights for people born in West Africa during the early 19th century. The data set, not used before for anthropometry, documents men, born between 1800 and 1849 in what are now Ghana and Burkina Faso. Mostly purchased from slave owners, they were recruited into the Dutch army to serve in the Netherlands Indies. We find that height development was stagnant between 1800 and 1830 and deteriorated strongly during the 1840s. In international comparison and after taking selectivity issues into account, these West Africans were notably shorter than northwestern Europeans but not much shorter than Southern Europeans during this period.

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Introduction

The study of heights provides a promising approach to a better understanding of the modern economic history of Sub-Saharan Africa, for which conventional economic data are relatively sparse. This route is increasingly being explored for the colonial period, particularly in the case of Ghana (in different ways by Destombes 2001, 2006; Austin, Baten and Moradi 2007; Moradi 2008). For the precolonial era, Eltis (1982) examined a large data set relating to West Africans freed from slave ships and landed in Sierra Leone. Most of the freed slaves were from southern Nigeria.¹ We now present data on African men recruited as soldiers and embarked from the Dutch fort of Elmina, on the Gold Coast (in modern Ghana) to serve in the Dutch army in the Netherlands Indies. These recruits were mostly purchased from slave owners, and were evidently born either in northern Ghana and Burkina Faso, or probably in or near Elmina itself. This data set thus extends the geographical scope for anthropometric history in West Africa. More than that, this paper offers the first analysis of the development of height during the precolonial period in Sub-Saharan Africa, in that we study the changes heights of successive birth cohorts from the 1800s to the 1840s.

Sub-Saharan Africans today are on average 7-8 cm shorter than Europeans (Baten 2006). Has this always been the case? Research on height differences has shown that the food and disease environment plays the decisive role, as opposed to genetic differences. For example, a number of studies have found the heights on several continents in the late eighteenth and early nineteenth century, when the food and disease situation was relatively comparable around the world, to be remarkably similar. Again, West Africans are today, on average, shorter than people of West African descent in the Americas. In this study, we assess the hypothesis that during the early 19th century, inhabitants of West Africa were similar to Europeans in average height. Only later did European quality of nutrition and health environment increase greatly, hence African height fell back in relative terms.

¹ Yoruba and Igbo-speakers (the former included some from what is now the republic of Benin). See Eltis 1982, pp. 459-460.

By providing information on height trends in the early nineteenth century, the data set also permits an answer to the question whether Africa shared the height decline of the 1840s which was observable in the U.S. and the UK, i.e. on two continents widely apart. The following analysis is therefore pertinent for the history of physical welfare in West Africa and in the Atlantic world generally.

To assess both issues, we provide the first anthropometric trend estimates for early 19th-century West Africa and a careful assessment of potential selectivity issues. The anthropometric method is by now well-established and requires little introduction. Anthropometric evidence can shed light on questions that are otherwise difficult to answer. Moreover, the biological components of welfare are interesting in themselves: stature differences have been found to be typically correlated with life expectancy and health. This has allowed anthropometrics to make important contributions to crucial debates in economic history such as the standard of living debate, or the resolution of important puzzles like the antebellum puzzle and the early industrial growth puzzle (see Komlos 1998; Margo and Steckel 1983). Fogel (1994), following Waaler (1984), stressed in his lecture to the Nobel Prize committee that even for modern Norwegian males in the 1960s and 1970s, a height gap of 17.5 cm meant a higher probability of dying in the following period of no less than 71 percent. Baten and Komlos (1998) estimated that one centimetre in height equals about 1.2 years in life expectancy, with only negligible coefficient changes over time between the birth cohorts of 1860, 1900, and 1950, with the latter cohort having been adults from the 1970s to the present day.

In the early nineteenth century the areas that now comprise Ghana and Burkina Faso shared the general western African transition from the Atlantic slave trade to “legitimate commerce” (Hopkins 1973; Law 1995). On the Gold Coast, the latter meant principally the adoption of palm oil as an export commodity (Reynolds 1974; McCarthy 1983). Further inland, the kingdom of Asante revived the export of gold, this time as a substitute for slaves,

and also expanded its trade in kola nuts to Muslim societies in the savanna, especially northeast to the newly-formed Sokoto Caliphate in today's northern Nigeria (Austin 1995). The Gold Coast and Asante shared the characteristics of naturally forest vegetation, being inhabited mostly by people of Akan language and culture, and importing slaves from the savanna societies of northern Ghana and Burkina Faso. Among these, the stateless ones found themselves particularly vulnerable to slave-raiding by neighbouring states. Meanwhile, since the eighteenth century Asante had extracted annual tribute in slaves and livestock from the two major savanna states, Gonja and Dagomba (Wilks 1989, pp. 18-23; 66-8; Allman and Parker 2005, pp. 29-39; Arhin 1987). The whole region shared a further feature widespread in Sub-Saharan Africa, of labour being scarce in relation to land which, however, was of fragile fertility (Austin 2005, 2008).

The following discussion is structured as follows. We first present background information on the dataset, by describing the context of the recruitment in some detail and considering potential selectivity issues. We then describe our sample and provide first height trend estimates. These estimates will be compared within Africa with Eltis' sample of freed slaves followed by an intercontinental comparison. The final section concludes.

The process of recruitment

In this section, we will describe the recruitment process and its change over time in order to assess potential selectivity biases beyond the well-known minimum height requirement in our dataset. Our data were obtained from Dutch registers of West Africans recruited for military service in the Netherlands Indies. This is a well-studied episode in Ghanaian and in Dutch colonial history (see especially Van Dantzig 1966; LaTorre 1978, pp. 409-421; Yarak 1990, esp. pp. 106-114; Yarak 1997; Van Kessel 2005), though the data have not previously been used for anthropometrics. In all, 3085 men were embarked from the Dutch fort at Elmina on the Gold Coast, the southern part of present-day Ghana, between 1831 and 1872 (Van Kessel

2005). In the Netherlands-Indies, they were deployed for expeditions to Sumatra, Borneo, Celebes, Bali, Timor, as well as in the Aceh war.

Some of the men were recruited in Elmina itself; some were sent down to the coast by the Asantehene, the ruler of the major inland state, the kingdom of Asante;² and some were recruited by a Dutch mission in the Asante capital of Kumasi. The Dutch had some 10 forts on the Gold Coast, governed from the headquarters in Fort St. George d'Elmina. They had a limited jurisdiction on the immediate surroundings of the fort, obtained through negotiations with the local African 'city-state' of Elmina (Yarak 1990; Van Kessel 2005: p. 27). What made the whole recruitment operation possible, however, was the long-standing commercial and diplomatic alliance between the Dutch and Asante states. This relationship outlived their joint participation in the Atlantic slave trade, from which the Netherlands officially withdrew by passing an abolition act in 1814. For the Asantes, Elmina and the Dutch offered an outlet to the Atlantic trade, bypassing the rival alliance of the British and the Fante states. The Dutch paid Asante an annual *kostgeld*, a rent or tribute, from 1744 until the Dutch withdrew from the Gold Coast in 1872, handing over their possessions to the British (Yarak 1990). The last ship with recruits left for Java on April 20, 1872.

Discussions about the recruitment of African soldiers for the Dutch colonial forces can be traced back at least to the end of the Napoleonic wars. With peace, Britain returned the Netherlands-Indies to Dutch rule, but the Dutch found themselves in need of additional military personnel to secure their control. This situation worsened further when Belgium seceded from the Netherlands in 1831, reducing the number of possible new recruits. After the era of Napoleon, the availability of mercenaries decreased strongly due to the introduction of national military service in many European countries. Meanwhile the Dutch had heard good reports of the performance of black soldiers in British West Indies regiments, and believed that Africans would be more immune to the disease environment of the Netherlands

² The major studies of the Asante kingdom are Wilks 1989 and McCaskie 1995.

Indies (Yarak 1990, 1997, Van Kessel 2005). The Dutch Government therefore became interested in recruiting African soldiers' Action on this was to be complicated, not only by the Dutch having themselves banned the slave trade, but also by an Anglo-Dutch treaty of 1818 that allowed the British Navy to search Dutch vessels for slaves. This was one of the conditions for the return of the Dutch colonies after the Napoleonic Wars.

Therefore, it was decided in 1831 that a first test with about 1800 Africans should be undertaken (starting with a group of 50). Commander Last sent a messenger with instructions to the most important outer fortresses (Axim and Accra), emphasizing that only volunteers (not slaves) should be hired (*ibid.*, p. 45). However, this recruitment attempt was not very successful and on December 17, only 18 recruits left for Indonesia instead of the targeted 50.

In the meantime, two other troop ships for 50 recruits each were announced. Therefore, a messenger was sent to Kumasi, the Asante capital, to ask the King to help with prisoners of war, slaves, or free Africans (being a volunteer, even formally, apparently had become much less important). In addition to some gifts, it was argued that the Asante state would benefit from the sugar growing and other techniques which the recruits would acquire on Java and introduce to their communities after returning home. Simultaneously, recruitment at the coast continued. However, despite these efforts, not even half of the 50 men required went on board.³ The same happened for a third troop ship that left in 1832.⁴ The basic problem was the virtual impossibility of finding free recruits. Within the first six months of the operation Last had "felt compelled to offer a bounty of 1 oz. of gold (*f* 40) to new 'recruits'; this was necessary, he reported, in order to help pay off the recruits' debts. In other words, Last's "recruits" were probably "pawns" (Yarak 1990 pp. 107-108).

All in all, this history of early recruitment does not indicate a strong upward height selectivity. The recruitment officials were quite satisfied with anybody willing to serve at all. In Batavia, there was some unrest about the high costs of recruiting (three times as much as

³ These recruits are not included in our data set as the data were missing.

⁴ This ship is also missing from our data set.

for a European recruit), arising from the high per capita cost of transporting lower than expected numbers of men. Nevertheless, a positive attitude still existed about the expected resiliency of Africans in Indonesia, since the European recruits were not as robust against tropical diseases. After some discussion, it was decided to approach the Asantehene once again and to resume coastal recruitment. However, no volunteers enlisted. Therefore, the new commander, lieutenant-colonel C.E. Lands, decided to buy slaves inland to report them as recruits for Indonesia. The same happened with the slaves of other Dutch civil servants, soldiers, or African masters (*ibid.*, p. 54). The owner obtained 40 guilders as recruitment money. In addition, all slaves had to pay a certain amount to their masters during their lifetime. Since a slave compensated for his own costs within a year, all other money was profit (*ibid.*, p. 57). The Asantehene also sent some recruits, but most of them were sent back because they were either too young (some as young as 7) or physically or mentally incapable. In 1836, Lands had 130 recruits, mostly from the coastal areas.

The first 44 recruits of the 1831-1832 period were judged very positively by the Indonesian military, especially because of their lower mortality. As a consequence, more recruits were demanded. Therefore, in 1836, it was decided that another 2000 recruits should be found. This required a different recruiting approach. As a result, a mission headed by general-major Jan Verveer was sent to the Asante king. Like most other persons involved, he initially wanted to free the slaves before letting them sign a contract. However, he soon found out that there was limited enthusiasm to serve in Indonesia, and therefore he developed a system in which a slave could buy himself free by serving in Indonesia. The total amount could be earned in two years.

However, the mission to the Asante in 1837 did not have the intended consequences. As very widely in West Africa, there was no regular market in free labour services. Land being physically and institutionally abundant, and in the absence of production techniques offering economies of scale, it has been argued that there no wage rate which was in the

mutual interest of prospective employers and employees to agree (Austin 2005, pp. 155-170). Consequently, the only markets for long-term labour were in slaves and human pawns. As generally in West Africa, slaves were almost entirely foreigners. In this period most first-slaves held in Asante were northerners, known as *nnonkofuo* (simplified by Europeans as “Donkos”) as mostly purchased from in the market at Salaga in the southern savanna (Austin 2005, pp. 106-134), some 7 days’ march walk north of Kumasi (Wilks 1975 p. 36).

Hence, Dutch recruitment was aimed at obtaining “donkos”. This was relatively successful and soon, more than 200 new recruits were hired. In addition, on March 18, 1837, a treaty was signed with Asantehene Kwaku Dua I. The asantehene would deliver 1000 recruits within one year and allow the Dutch to open a recruiting office in Kumasi. Nonetheless, one year later, the asantehene had sent only 38 recruits. The recruiting post in Kumasi and the coastal recruitment post enlisted 219 recruits by January 1, 1838. For comparison: in 16 months, the asantehene sent 75 recruits compared to 515 recruits from the recruiting office in Kumasi (*ibid.*, p. 80). However, at the recruiting post, most slaves were either bought from Asante citizens facing government fines, or were re-sold by Asante slave traders who had bought them in the Salaga market (Yarak 1990 p. 268; Yarak 1997). In sum, the office in Kumasi recruited 1166 recruits (about half of the total number of recruits) between March 1837 and January 1842. In 1842, recruitment in Kumasi was terminated.

Several mutinies, a mixed experience with African soldiers, and British complaints about the recruiting practices led to a recruiting stop from December 1841 onwards. After a break of 15 years, recruitment started again in 1855 and resulted in more than 800 recruits being sent to Indonesia between 1855 and 1870. However, in the first 2.5 years after the re-start of African recruiting in 1855, only about 20 volunteers had enlisted. There was no office in Kumasi anymore, but a request to Asantehene Kwaku Dua was sent for further recruits (as he still owed a debt to the Netherlands). However, the number of recruits remained minimal. In the coastal areas, recruiting was also difficult, but a few hundred volunteers did enlist each

year (*ibid.*, p. 170). The remaining recruitment stopped with the Sumatra Treaty of 1871 with which the Netherlands surrendered their possessions at the Gold Coast to the British. This also meant a *de facto* end of African recruitment. The last ship with recruits left for Java on April 20, 1872 (note that the last measurements in our data set are from 1870).⁵ For years to come, Africans would serve in the Dutch-Indies army (for example in the Aceh war), since most of their contracts lasted between 10 and 20 years.

The issue of selection bias

So who were the recruits? There is no dispute that those obtained in Asante, or sent to Elmina by the Asantehene, were slaves, almost to a man, before they were, effectively, purchased by the Dutch. So were many of those obtained at Elmina. The latter also included men held in pawn, and perhaps some who were not pawns but nevertheless had large debts to pay (Yarak 1997). It is also possible, as Yarak has suggested, that some of the Elmina recruits were *efie nipa*, “children of the house”: typically the offspring of an enslaved woman and a free man (Yarak 1997). Their social status was slightly higher than that of first-generation slaves. Finally, there were a few – probably extremely few – free recruits. The predominance of slaves does not necessarily mean a complete absence of consent to military service. Verveer established an elaborate procedure designed to ensure that no one actually boarded the ship as a slave, nor did so without consent. Also, by the 1840s former soldiers were being returned to Elmina, demonstrating that the Dutch kept their promise to repatriate soldiers at the end of their contracts, and to pay them pensions. This presumably encouraged slaves to agree to follow their sale to the Dutch by agreeing to enlist (Yarak 1997). But this does not affect the fact that the former slaves had been slaves until bought by the Dutch.

⁵ Nevertheless, two further attempts were made to increase the number of Africans in the Royal Dutch Indies Army. First, between 1876 and 1879, about 30 Afro-American men were recruited. In 1890, a second attempt was made to recruit soldiers from Liberia. Although 182 Liberians left for Java, most of them returned disillusioned to Liberia in 1892 (Verhoog 1989, p. 23).

In principle, one might suppose that the slaves tended to be taller than the average of for the populations from which they were seized. But several arguments have been made that this effect is probably modest. First, Eltis (1982) has argued strongly that the bias between freed slaves and the underlying populations was quite small or even negligible. For example, he insisted that there were no observable slave price differences between regions with tall and short slaves: which should have been the case if height was a prominent selection criterion, as the slave trader would have tried to obtain many more slaves from regions with taller populations. Second, by the 19th century, physically strong (and tall) Africans were also demanded by Africa's plantations and farms. Third, evidence from slaves in Brazil suggests that slaves born in Africa were much shorter than those born in Brazil – if slaves in Africa had been chosen by height, we would have expected them to be taller, especially if the deadly shipping over the Atlantic implied additional selectivity in favour of the taller and healthier individuals (Baten, Pelger, and Twrdek 2007). Finally, Eltis observed that the height distributions from all regions were quite normal. If there had been something like a minimum height requirement of slaves or a height interval which was much less demanded, slaves from the regions with shorter stature should have displayed some shortfall.

The logic of this applies also to slaves held and traded within West Africa: slave raiders, and victorious armies, had an interest in capturing everyone who could move (see also Maier 1990). The only exception, in the case of the men recruited by the Dutch, was the MHR.

On the other hand, the specific geographical origins of the recruits are likely to have created some selection bias. LaTorre (1978) reported that he could identify the geographical/ethnic origins of 605 of 1170 individuals recruited by the Dutch mission in Kumasi (*Table 1*). Among those identified, 358 (59.2%) were Mossi and 48 (7.9%) were Gurma: making 67.1% from what is today Burkina Faso. A further 23.5 % (142) were from what is now northern Ghana. Most of the slaves recruited at Elmina were also *nnonkofuo*

(Yarak 1997). The predominance of people born in the savanna societies of northern Ghana and Burkina Faso is likely to have created a slight upward bias in the sample, in relation to the average for Ghana or West Africa generally. Twentieth-century data confirms the popular perception in Ghana that northerners have tended to be taller than southerners, even though the latter have enjoyed higher per capita incomes (Austin, Baten and Moradi 2007). In the case of the Mossi of Burkina Faso, in particular, this may be partly attributable to nutritional benefits derived from pastoralism and mixed farming in the savanna (even as late as the 1950s; see Moradi and Baten 2005). In studies on other world regions just as on Africa for the 1950s - 1970s period, this was normally seen as a “proximity-to-production advantage” for the inhabitants of the cattle-farming regions: since some cattle farming products (such as offals, milk, etc.) can normally not be transported and sold on markets, even the poorer parts of the population have access to animal protein. Animal protein was a scarce bottleneck product in pre- and early industrial times which helped to support the body in creating antibodies and living a healthier and longer life.

However, the cattle kept in the nineteenth (and early twentieth) century tended to be small, because of the risk of the animal form of sleeping sickness (trypanosomiasis). This prevented the keeping of large livestock in the forest zone and in wide but shifting parts of the savanna. A study by the colonial nutritionist in 1940 attributed the greater average height of northerners to a higher-protein diet, especially for children, in the form of groundnuts (peanuts).⁶ The general point is that an upward bias in the sample can be assumed. Fortunately, we could control for this upward bias in our regressions.

We will analyze the two recruitment periods separately below and check whether overlapping decades have similar anthropometric values.

⁶ **Error! Main Document Only.** Ghana national archives, Accra, ADM 11/1294, “Final Report on Nutrition Surveys in the Gold Coast 1940”, by Dr F. M. Purcell, the Gold Coast Dietetic Officer; and the various memoranda and other correspondence in the same file.

The new data set and first height trend estimates

Some measurement lists have been lost (among others perhaps those of 1871 and 1872) but we could find records of 2,259 soldiers who were recruited for the Dutch East India Army between 1831 and 1870 (*Table 2*). The recruitment year is known for 2,241 soldiers. The lists contained height, age, enlistment year, and birth place. Unfortunately, ethnicity and tribe were not directly reported. The largest single cohort was recruited in 1837, but substantial numbers enlisted also in 1839-1842 and 1859-1863, as described above. For the 2,259 soldiers, the birth year as well as height is reported, and height varies between 100 and 196.4 cm.⁷ The birth cohorts before 1800 and after the 1840s are documented by only very few cases, hence they were discarded here (*Table 3*).

The age of the recruits ranges between 11 and 46, hence there is no need to discard or control for older age. The young ages are too infrequent until age 17. After that, between age 17 and 22, we controlled for age with age dummies or restricted the age range to ages with a limited remaining growth probability (such as “above 20” or very conservatively, “above 22”) (*Table 4*).

Measures in feet and inches were used until 1842 and for 1,284 cases, whereas for the later period, metres were used. However, some 250 soldiers measured until 1842 were reported in metres as well. From 1816 onwards, the Netherlands officially used the metric system. Even in the first years of our recruitment period, metres were already used for some recruits. But until 1842, most were measured in feet. In the later years, the share of metres in total recordings increased steadily (in 1836, 1 out of 63; in 1840, 43 out of 276; and in 1860, 148 out of 148). Thus the average number of metre-observations should be close to 10% before 1842. After the recruitment break of 1843–1858, all heights were recorded in metres (*Table 5*).

⁷ The two observations at 100 cm can be discarded as outliers. They would not be included in below’s truncated regressions, anyway.

What was the minimum height requirement (MHR from here) in this period? In the earlier period, to 1842, the observed minimum height was 61 inches (162 cm, see *Figures 1 and 2*). This is almost exactly confirmed by the official minimum height requirement announced in 1826 as “vijf Voeten en twee Duimen Rhijnlandsche maat” (Van Dantzig 1966). There was one inch above the observed MHR, but this difference seems plausible given the officers’ difficulties in finding suitable recruits as described above. No change in the MHR in the period to 1842 is reported in the sources available to us. While this does not mean that the possibility of a change can be completely rejected, the similarity of the official MHR and the empirical height distribution suggests a stability of requirements over the period.

For the “metre period,” truncation is less visible. The distribution of heights is not strongly truncated at a single point, and it is not easy to see from the histogram whether truncation occurred, as heights are rounded to 158, 160, 162, and 165 cm. It could be that in the range of 150-159 cm, some observations are missing due to shortfall (a less consistent form of truncation), but it might also be that some shorter heights were rounded to 158 and 160 cm if that was a minimum height requirement. 158 cm would be a plausible truncation point (*Table 6*). It is reassuring that the two main recruitment periods before and after 1842 yield very similar height estimates (*Figure 3*), with an estimated truncation of 61 inches for the early period and 158 cm for the later period. Those “recruited” (purchased) in Asante, i.e. mostly slaves from the North, were slightly taller than coastal Africans. Recruits via Asante were especially numerous in 1837, and most of them were born in the 1800s (ca. 50%) and to a lesser extent in the 1810s (ca. 15%). Given that these recruits were about 1.4 cm taller than the other soldiers, the 1810s level might have been slightly overestimated in those two decades, but probably only in the range of less than half a centimetre. Apart from the Asante-recruitment dummy, we also included dummies for two major places, Elmina and Accra, but they were not statistically significantly different from the constant comprising all other regions. Other places are too infrequent in this sample to be analysed.

The time coefficients were added to the constant which reflects adults born in the 1810s in order to obtain a height trend not affected by the biologically shorter height below age 22. The result is graphed in Figure 3. In general, the 1800s-1830s saw a stagnation in heights, even if we take into account that the first two birth cohorts contained a considerable share of northerners and hence might be downward-adjusted by about half a centimetre. Interestingly, we observe a drastic height decline especially in the 1840s when many populations around the world experienced severe malnutrition: Europe had its last big famine, especially in Ireland; U.S citizens as well as Peruvians became significantly shorter, and Chinese stature declined during the following decade (Morgan 2007, Baten and Hira 2006, Baten, Pelger, and Twrdek 2007 on Peru). If this is not a coincidence, the transmission mechanism to West Africa remains to be clarified. The most likely explanation is the transmission of additional infectious diseases which always increase in times of famines and are easily transmitted even when contact between world regions is limited. Some evidence on this is provided by the regular comments of the Dutch government on various diseases in the region such as smallpox. For example, in a letter in 1837, Huydecooper (the Dutch recruitment officer in Kumasi) reported that “[t]errible things happen here from disease. The inhabitants of this city die in a horrible way. They complain of pains in their head, and within three days they are dead. And this happens to at least 40 or 50 a day. I have also been feeling ill, but I am feeling better” (quoted in Van Dantzig 1966, p. 24). One might suppose that the general expansion of international transport networks during this period helped in generating this spread of famine-induced epidemic diseases, but the revolution represented by regular steamer services did not reach West Africa until the 1850s. But then the steamer was hardly necessary for imports to West Africa, pathogenic or otherwise, given the sail-ship networks within which West Africa had been notoriously incorporated since the fifteenth century.

Comparison with freed slaves

We will use the Eltis data set on African slaves freed in Sierra Leone to compare our soldiers' heights with other samples and to find out whether our sample population of Dutch colonial army recruits is representative of wider height trends in Africa. A priori, we would expect military recruits to have been somewhat taller than slaves who were probably more representative of the underlying population. The slaves originated from a variety of regions in Africa, although only their port of origin and sometimes their tribal affiliation is known. As indicated above, we agree with Eltis that the victims of the Atlantic slave trade – including those freed from slave ships - were probably anthropometrically representative of the populations from which they had been captured (Eltis 1982).

We follow Eltis in taking only those aged 25 and above into account since either (1) growth in the early 20s was apparently quite substantial among slaves, or (2) the age group of 20-24 was born in a particularly bad period (there is a quite strong correlation between age and birth year in this sample). The height averages by decade are given in Figure 4; only cases with more than 35 males aged 25-50 were reported.⁸

Eltis described the African regions from which the slaves who embarked at certain ports typically originated. The tallest slaves were mostly of Yoruba origin, from what is now southwestern Nigeria and the republic of Benin (Eltis 1982, pp. 459-60). The heights of the slaves shipped from Mozambique were about average, whereas freed slaves from Ghana (the port of Anomabu) were relatively short. There might have been an anomaly among the latter, as relatively few slaves were shipped from the Gold Coast during this period.

If we compare the average soldiers' average heights with those of Eltis's freed slaves, the former appear taller, especially in the 1810s (*Tables 7 and 8*).⁹ In the 1800s, the soldiers were on a similar level as slaves from southwest Nigeria and Upper Guinea. After the height decline of the 1840s, the African soldiers recruited by the Dutch were literally on a similar

⁸ Height range 120-200 cm.

⁹ Selectivity arises not only through a minimum height requirement, but also through other forms of soldiers' height selection.

level as the average slave around 1790/1800. It is clear that slaves from southeastern Nigeria (Bight of Biafra), Gabon/Congo, and Angola were substantially shorter. In sum, being a military recruit (from Ghana or Burkina Faso) seems to have implied about 3 cm in additional height.

The data set on freed slaves can also inform us about the 1840s decline. Can we really rely on the decline observed in the military data set for the 1840s? Or could we be dealing with a simple sampling error? One possibility to countercheck this issue is to consult the Sierra Leone slave liberation data set, which also reports the heights of children. Clearly, the age information is not very accurate, as the age of older children was most likely estimated by officials. However, we can calculate approximated Height-for-Age-Z-Score-Values (HAZ-values) if we restrict ourselves to interpreting only value changes over time rather than absolute value levels. The idea behind Height-for-Age-Z-Score-Values is the age-standardization of heights on the basis of standard growth tables. Each individual height is compared with a reference table in which the height of U.S. children corresponds to a value of zero; thus, a child who is one standard deviation shorter in height has a HAZ of -1 . This allows the comparison of children of different ages.

As children's heights are mostly determined in the years before measurement, we compose this anthropometric indicator by decade of measurement (Baten 2000). The number of cases for both girls and boys is sufficiently large, even after removing outliers with HAZ-values below -5 or above 5 (*Table 9*). HAZ values were stable or slightly rising between the 1820s and 1830s, but during the 1840s, they declined strongly (*Figure 5*). This confirms the results obtained from a completely different source, the African recruits of the Netherlands Indies Army. Hence, we conclude that the marked height decline of the 1840s is a robust finding.

African heights in intercontinental perspective

How tall were West African soldiers in international comparison? Baten (2006) compiled a data set from a variety of sources, adjusting them as far as possible to male population means by eliminating all biases from age and selectivity problems. As it turns out, West African soldiers were on a similar level to the Dutch military conscripts who were quite representative of their country's population (*Table 10*). The U.S. population was considerably taller, as was the case for many populations in sparsely populated countries with high proximity to protein production (other examples were Argentina and later Australia). In contrast, Southern Europeans were shorter than the West African military recruits and similar in height to the African freed slaves (Italy is reported in Figure 6; Spain and Portugal had similarly low levels). However, we must be careful with the West African height levels as they were derived from military recruits, albeit mostly of slave origin, and apart from the minimum height requirement problem ruled out above, there might have been particularly strong selectivity issues resulting in an estimated height advantage of 3 centimetres vis-à-vis the heights of slaves freed from slave ships.

Conclusion

This paper has introduced what, for anthropometric history, is a new data set on West African military recruits who were born between the 1800s and 1840s and sent to Dutch Indonesia as soldiers. These recruits, from Ghana and Burkina Faso and mostly of slave origin, averaged about 3 cm taller than the average for African slaves during the 1810s; hence, there is probably some upward selectivity of army recruits.

Allowing for this sample bias, the data enable us to offer some information on the origins of the nutritional divergence between Africa on the one hand, and Europe and African-Americans on the other. We initially posed the hypothesis that while Africans today are considerable shorter than Europeans, this might not have been the case during the early 19th century. After correcting for possible height biases, we conclude this study with the finding

that West Africans (both soldiers and slaves) were notably shorter than northwestern Europeans but in fact similar in height to Southern Europeans after taking selectivity issues into account. On average, Europeans might have been somewhat taller, but much less than the difference we observe today. Again, the descendants of African slaves living in the Americas are taller, on average, than Africans in Africa; a difference which, in the United States, appears to have begun to develop even before the end of slavery (Eltis 1982 pp. 466-470).

In nineteenth-century history, a particularly important observation is that height development was stagnant between 1800 and 1830 and declined strongly during the 1840s. This result is confirmed by evidence on the heights of African children during the 1820s and 1840s which also displayed a strong decline during the latter decade. This height decline in the 1840s is striking because many populations around the world experienced severe malnutrition: Europe had its last big famine, and the U.S.- as well as some Latin American birth cohorts of the 1840s were drastically shorter than the preceding ones (Margo and Steckel 1983, Komlos 1998, Baten, Pelger, and Twrdek 2007 on Peru). Chinese stature declined during the mid-19th century (Morgan 2007, Baten and Hira 2006). Hence, we can conclude that the 1840s decline can be observed in at least some countries on the five largest continents. The transmission mechanism to West Africa still needs to be clarified. The most likely explanation is the transmission of additional infectious diseases which always spread in times of famines and are easily transmitted even when contact between world regions is limited.

Finally, Moradi (2008) and Austin, Baten, and Moradi (2007) have argued that the later colonial period in Ghana was characterized by a certain increase in heights (see also Moradi's work on Kenya: 2007, 2008). However, little is known about height trends before the 1870s. The Elmina data set can shed some light on this question. The height values for the birth cohorts of the 1800s to the 1840s can be estimated after adjusting for the minimum height requirement imposed by the Dutch colonial army. Thus, in further work we hope to

relate the evidence on the heights of people born in the early nineteenth century in what became Ghana to data from the colonial and post-colonial period.

References

- A'Hearn, B. (2003). "Anthropometric Evidence on Living Standards in Northern Italy, 1730-1860." *Journal of Economic History* 63, pp. 351-381.
- Arhin, K. 1987. 'Savanna contributions to the Asante political economy'. In E. Schildkrout (ed.), *The Golden Stool: Studies of the Asante Center and Periphery* (pp. 51-59). New York: American Museum of Natural History.
- Allman, J., Parker, J. (2005). *Tongnaab: The History of a West African God* (Bloomington: Indiana U.P.).
- Austin, G. (1995). "Between abolition and *jihad*: the Asante response to the ending of the Atlantic slave trade, 1807-1896". In Robin Law (ed.), *From Slave Trade to 'Legitimate' Commerce: the commercial transition in nineteenth-century West Africa* (pp. 93-118). Cambridge: Cambridge University Press.
- Austin, G. (2005). *Labour, Land, and Capital in Ghana: From Slavery to Free Labour in Asante, 1807-1956*. Rochester, NY: University of Rochester Press.
- Austin, G. (2008). 'Resources, techniques and strategies south of the Sahara: revising the factor endowments perspective on African economic development, 1500-2000'. *Economic History Review*, 61 (3), pp. 587-624.
- Austin, G., Baten, J., Moradi, A. (2007). "Exploring the Evolution of Living Standards in Ghana, 1880-2000: An Anthropometric Approach." *Working Paper LSE/Tuebingen/Oxford*.
- Baten, J. (2000). "Height and Real Wages: An International Comparison." *Jahrbuch fuer Wirtschaftsgeschichte* 2000-1, pp. 17-32.
- Baten, J. (2000). "Height and Real Wages: An International Comparison," in *Jahrbuch fuer Wirtschaftsgeschichte* 2000-1, pp. 17-32.

- Baten, J. (2006). "Global Height Trends in Industrial and Developing Countries, 1810-1984: An Overview." *Tuebingen Univ. Working Paper*. online http://www.wiwi.uni-tuebingen.de/cms/fileadmin/Uploads/Schulung/Schulung5/Paper/baten_global.pdf
- Baten, J., Pelger, I., Twrdek, L. (2007). "Height, Globalization, and Anthropometric Inequality in Brazil, Peru, and Argentina during the 18th – 20th Centuries." *Working Paper Univ. Tuebingen/Munich*.
- Destombes, J. (2001). "Nutrition and Hunger in Northern Ghana, c.1930-c.2000". Ph.D. dissertation, London School of Economics.
- Destombes, J. (2006). "From Long-term Patterns of Seasonal Hunger to Changing Experiences of Everyday Poverty: Northeastern Ghana, c.1930-2000". *Journal of African History* 47 (2), pp. 181-205.
- Dohmen, T., Falk, A., Huffman, D., Schupp, J., Sunde, U., Wagner, G.G. (2006). "Individual Risk Attitudes: New Evidence from a Large, Representative, Experimentally-Validated Survey." *CEPR Disc Paper* 5517.
- Eltis, D. (1982). "Nutritional Trends in Africa and the Americas: Heights of Africans, 1819-1839." *Journal of Interdisciplinary History* 12, pp. 453-475.
- Floud, R., Wachter, K., Gregory, A. (1990). *Height, Health and History. Nutritional Status in the United Kingdom, 1750-1870*. Cambridge: Cambridge University Press.
- Fogel, R. (1994). "Economic Growth, Population Theory, and Physiology: The Bearing of Long-Term Processes on the Making of Economic Policy." *American Economic Review* 84, pp. 369-95.
- Hopkins, A. G. (1973). *An Economic History of West Africa* (London: Longman).
- Komlos, J. (1985). "Stature and Nutrition in the Habsburg Monarchy: The Standard of Living and Economic Development in the Eighteenth Century." *American Historical Review* 90 (5), pp. 1149-61.

- Komlos, J. (1996). "Anomalies in Economic History: Reflections on the Antebellum Puzzle." *Journal of Economic History* 56 (1), pp. 202-214.
- Komlos, J. (1998). "Shrinking in a Growing Economy? The Mystery of Physical Stature during the Industrial Revolution." *Journal of Economic History* 58 (3), pp. 779-802.
- Komlos, J., Baten, J., eds. (1998). *The Biological Standard of Living in Comparative Perspective*. Stuttgart.
- LaTorre, J. R. (1978). *Wealth Surpasses Everything: an Economic History of Asante, 1750-1874*. Ph.D. dissertation, University of California, Berkeley.
- Law, R (1995). (Ed.), *From Slave Trade to 'Legitimate' Commerce: the commercial transition in nineteenth-century West Africa* (pp. 93-118). Cambridge: Cambridge University Press.
- Maier, D. J. E. (1990). "Military acquisition of slaves in Asante". In D. Henige and T. C. McCaskie (eds), *West African Economic and Social History: Studies in Memory of Marion Johnson* (pp. 119-132). Madison.
- Margo, R., Steckel, R.H. (1983). "Heights of Native Born Northern Whites during the Antebellum Period." *Journal of Economic History* 43, pp. 167-74.
- McCarthy, Mary (1983). *Social Change and the Growth of British Power in the Gold Coast: The Fante States 1807-1874* (Lanham MD).
- McCaskie, T. C. (1995). *State and Society in Pre-colonial Asante*. Cambridge: Cambridge University Press.
- Moradi, A. (2005). *Nutrition, economic development and civil wars in sub-Saharan Africa (1950-2000)*, Dissertation thesis, Faculty of Economics, University of Tuebingen.
- Moradi, A. (2007): "Towards an Objective Account of Nutrition and Health in Colonial Kenya: A Study of Stature in African Army Recruits and Civilians, 1880-1980." *Working Paper Oxford Univ.*

- Moradi, A. (2008). 'Confronting colonial legacies - lessons from human development in Ghana and Kenya, 1880-2000', *Journal of International Development* 20, 1107-1121.
- Moradi, A., Baten, J. (2005). "Inequality in Sub-Saharan Africa 1950-80: New Estimates and New Results." *World Development* 33 (8), pp. 1233-1265.
- Morgan, S. (1998). "Biological Indicators of Change in the Standard of Living in China during the 20th Century," in J. Komlos and J. Baten (eds.): *The Biological Standard of Living in Comparative Perspective*. Stuttgart: Franz Steiner.
- Reynolds, E. (1974). *Trade and Economic Change on the Gold Coast 1807-1874* Harlow, UK: Longman.
- Steckel, R.H., Floud, R., eds. (1997). *Health and Welfare during Industrialization*. Chicago: University of Chicago Press.
- van Dantzig, A. (1966). "The Dutch Military Recruitment Agency in Kumasi." *Ghana Notes and Queries* 8-214.
- van Kessel, I. (2005). *Zwarte Hollanders: Africaanse soldaten in Nederlands-Indië*. Amsterdam: KIT-publishers.
- Verhoog, J. (1989). "De werving van Westafrikanen voor het Nederlands-Indische leger, 1831-1872." *Mededelingen van de Sectie Militaire Geschiedenis Landmachtstaf* 12, pp. 5-26.
- Wilks, I. (1989) *Asante in the Nineteenth Century: the Structure and Evolution of a Political Order* (2nd edn, with new preamble, Cambridge: Cambridge University Press).
- Yarak, L. W. (1990). *Asante and the Dutch 1744-1873*. Oxford: Oxford University Press.
- Yarak, L. W. (1997). "New sources for the study of Akan slavery and slave trade: Dutch military recruitment in Asante and the Gold Coast, 1831-72." In R. Law (ed.), *Source Material for Studying the Slave Trade and the African Diaspora* (pp. 35-60). Stirling: Centre of Commonwealth Studies, University of Stirling.

Tables and Figures:*Table 1. Birthplaces of Kumasi Recruits
for the Dutch East Indies*

	Number	% of identified places
<hr/>		
AKAN		
Asante	1	0.2
Bron	3	0.5
<hr/>		
NORTHERN GHANA		
Dagomba	65	10.7
Other	77	12.8
<hr/>		
BURKINA FASO		
Mossi	358	59.2
Gurma	48	7.9
OTHERS	53	8.8
<hr/>		
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TOTAL IDENTIFIED	605	100.00

Source: Simplified from LaTorre 1978, Figure 7-7, pp. 417-418.

Table 2. Number of cases by measurement year

qyear	Freq.	Percent
1831	18	0.80
1836	53	2.37
1837	588	26.24
1838	17	0.76
1839	253	11.29
1840	276	12.32
1841	173	7.72
1842	158	7.05
1859	70	3.12
1860	146	6.51
1861	123	5.49
1862	100	4.46
1863	98	4.37
1865	34	1.52
1868	50	2.23
1870	84	3.75
Total	2,241	100.00

Source: National Archive of the Netherlands, Den Haag, Archival Deposit "Indonesian Army -- Muster Lists"

Table 3. Number of cases by birth decade

bdec	Freq.	Percent
1790	4	0.18
1800	134	5.93
1810	1,234	54.60
1820	191	8.45
1830	432	19.12
1840	256	11.33
1850	8	0.35
Total	2,259	100.00

Source: see Table 2

Table 4: Number of cases by age

age	Freq.	Percent
11	1	0.04
12	1	0.04
13	2	0.09
15	3	0.13
16	6	0.27
17	22	0.98
18	72	3.22
19	122	5.46
20	166	7.42
21	180	8.05
22	224	10.02
23	216	9.66
24	304	13.60
25	327	14.62
26	234	10.47
27	107	4.79
28	100	4.47
29	49	2.19
30	53	2.37
31	19	0.85
32	5	0.22
33	3	0.13
34	6	0.27
35	3	0.13
36	2	0.09
39	1	0.04
40	2	0.09
41	2	0.09
43	1	0.04
45	1	0.04
46	2	0.09
Total	2,236	100.00

Source: see Table 2

Table 5: Number of cases by type of measure (foot vs. metre)

Qyear	Freq. [in metre]	Freq. [in feet]
1831	16	2
1836	2	51
1837	51	537
1838	1	16
1839	42	211
1840	53	223
1841	39	134
1842	48	110
1859	70	
1860	146	
1861	123	
1862	100	
1863	98	
1865	34	
1868	50	
1870	84	
Total	957	1,284

Source: see Table 2

Table 6: Truncated regression estimates of heights of West African recruits

	Coef. (1)	P > z	Coef. (2)	P > z	Coef. (3)	P > z	Coef. (4)	P > z
b1800	-1.223	0.215	-0.709	0.939	-0.703	0.939	-1.340	0.180
b1820	-0.965	0.385	-0.909	0.789	-0.902	0.788	-0.922	1.388
b1830			0.568	0.796	0.565	0.795	0.663	0.277
b1840			-3.595	0.118	-3.567	0.117	-2.729	0.004
age17	0.013	0.997	-24.833	0.086				
age18	-4.415	0.013	-4.683	0.298			-4.313	0.011
age19	-2.784	0.036	-0.113	0.961			-2.481	0.041
age20	0.361	0.713	-0.331	0.886	-0.328	0.886	0.082	0.929
age21	-1.742	0.093	-0.399	0.807	-0.395	0.806	-1.135	0.217
Delmima							-1.009	0.357
Askanti							1.426	0.053
Accra							0.457	0.763
Constant	168.434	0.000	168.105	0.000	168.153	0.000	168.162	0.000
N	1357		1659		628		1894	
Log like- lihood	-4117		-2097		-2004		-5740	

Source: see Table 2

Table 7. Heights of West African soldiers compared with freed African slaves, by birth year and today's location of port (Eltis 1982)

Co	1780	1790	1800	1810	1820	1830	1840
Ao				160.5			
Bj	167.0	167.0	167.1	164.9			
Cgga		164.5	162.3	163.3			
Ci		163.0	165.1				
Cm		163.8	162.8	165.9			
Gh		163.2	164.1	164.1			
Mz			167.6	164.1			
ng-e	165.1	163.7	164.0	164.3			
ng-w	167.3	167.8	166.8	166.1			
Sgamb	166.5	166.5	165.4	165.4			
gh early			167.2	168.4	167.5		
gh late				168.2	167.3	168.7	164.6
gh both			167.2	168.3	167.4	168.7	164.6

Notes: The ports were classified according to their location today, although it is clear that only a certain share of the slaves shipped from those ports was born in the given country. Abbreviations: ao – Angola, bj – Benin, cgga – Congo and Gabon, ci – Ivory Coast, cm - Cameroon, gh - Ghana, mz – Mozambique, ng-e Nigeria (East), ng-w Nigeria (West), sgamb – Senegal/Gambia region (many born in the Sahel zone), gh early and late – Ghana soldier sample, early (and late) period, gh both reports the average.

Source: Eltis database on African-American Slave History, <http://wilson.library.emory.edu:9090/tast/>; see also Table 2

Table 8. Number of cases of freed African slaves (Eltis 1982)

Co	1780	1790	1800	1810
Ao				158
Bj	41	447	557	475
Cgga		57	304	143
Ci		52	60	
Cm		106	130	51
Gh		63	76	125
Mz			73	46
ng-e	110	1348	3551	906
ng-w	81	1046	1377	1000
Sgamb	47	357	668	464

Notes and sources: see Table 7.

Table 9. HAZ-values and numbers of cases of children (age 1-14, HAZ –5 to 5)

Gender	Decade	HAZ-value	N
Male	1820	-0.318355	3841
Male	1830	-0.2410841	7624
Male	1840	-0.9444467	1504
Female	1820	-0.3973894	3205
Female	1830	-0.3073781	5225
Female	1840	-0.7034219	645

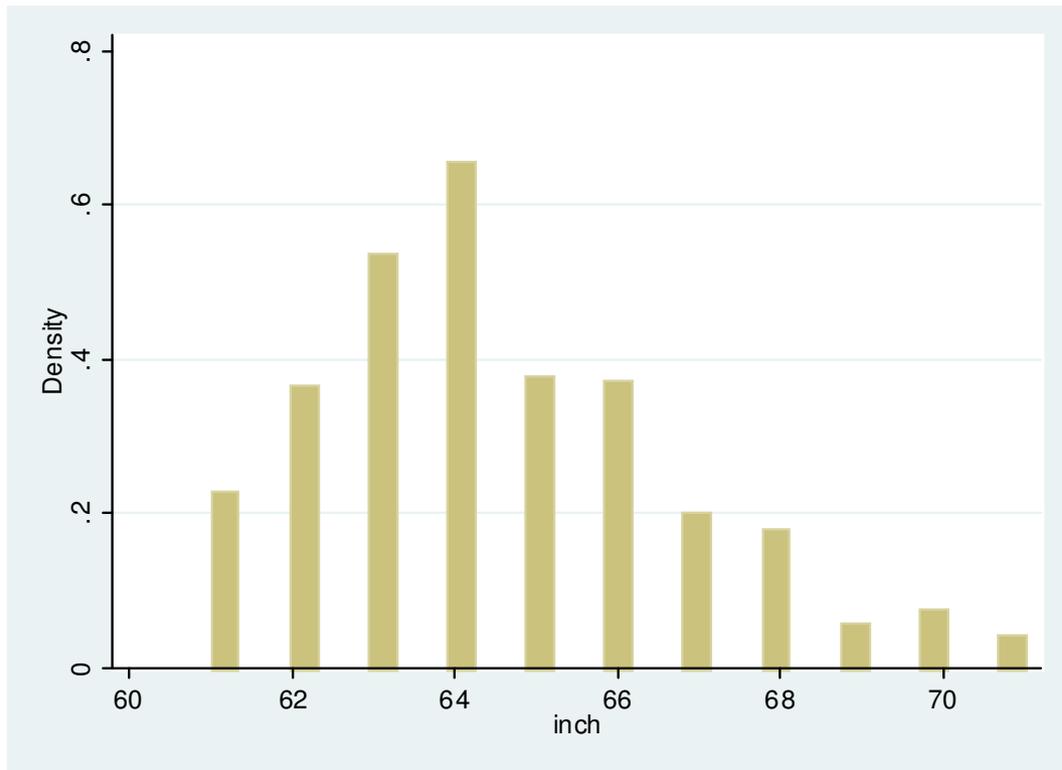
Source: see Table 7

Table 10. West African soldiers in international comparison

	1800	1810	1820	1830	1840
China (to Indon.)				161.5	162.3
Netherlands		165.7	167.2	167.7	166.8
UK		166.7	167.0	166.6	166.0
Italy		163.5	164.8	163.1	163.0
U.S.		173.0	173.2	173.0	171.7
West Africa	167.2	168.3	167.4	168.7	164.6

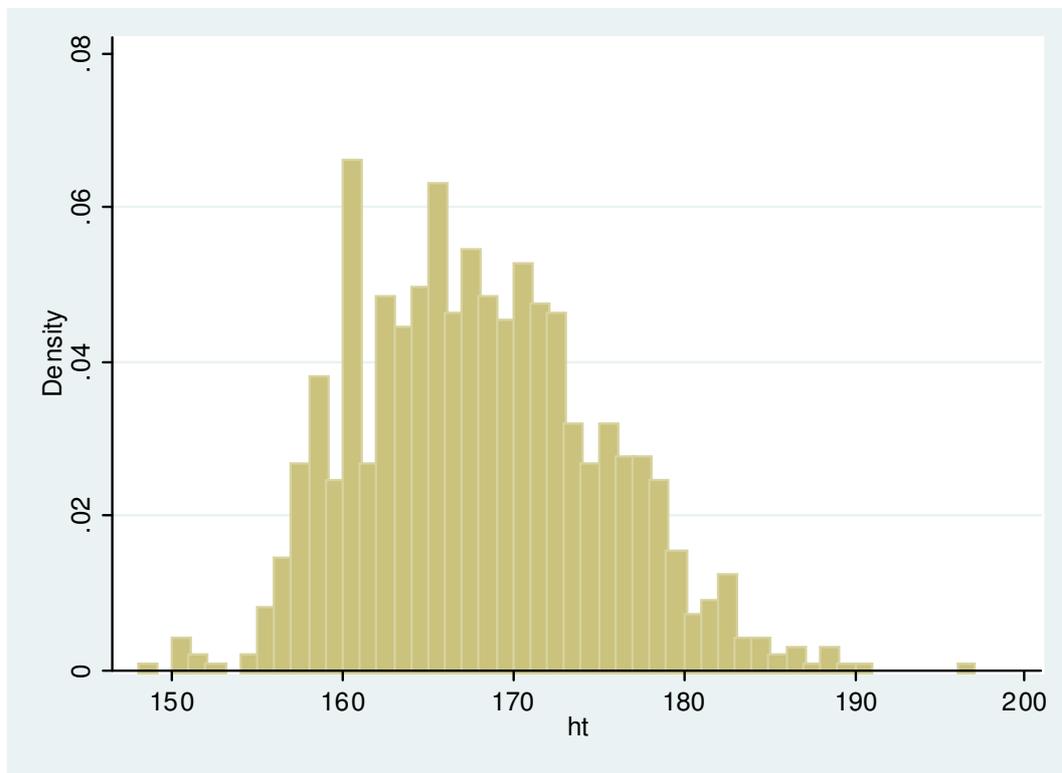
Source: Baten (2006), and see Table 2.

Figure 1: Distribution of heights reported in feet and inches



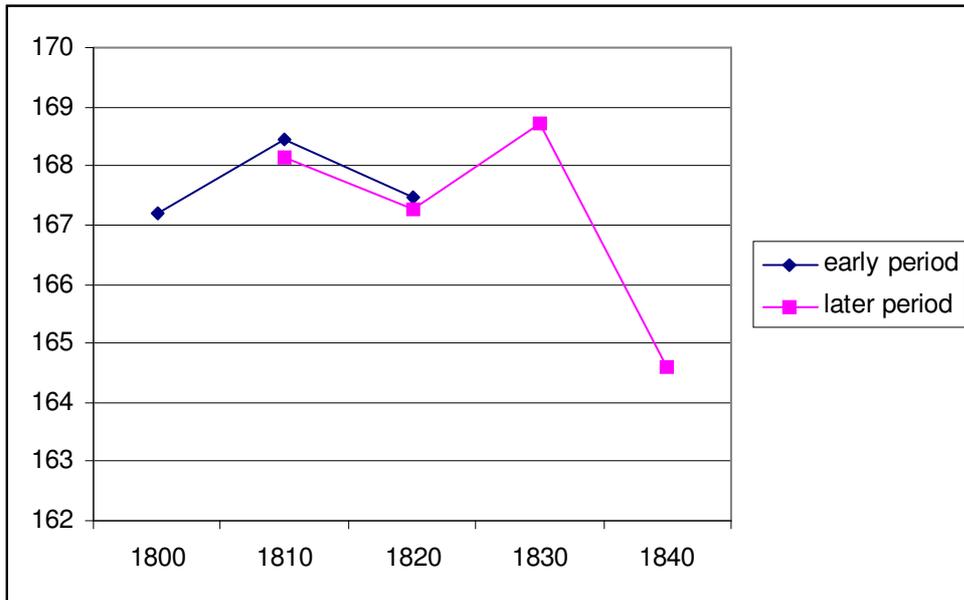
Source: see Table 2

Figure 2: Distribution of heights reported in centimetres



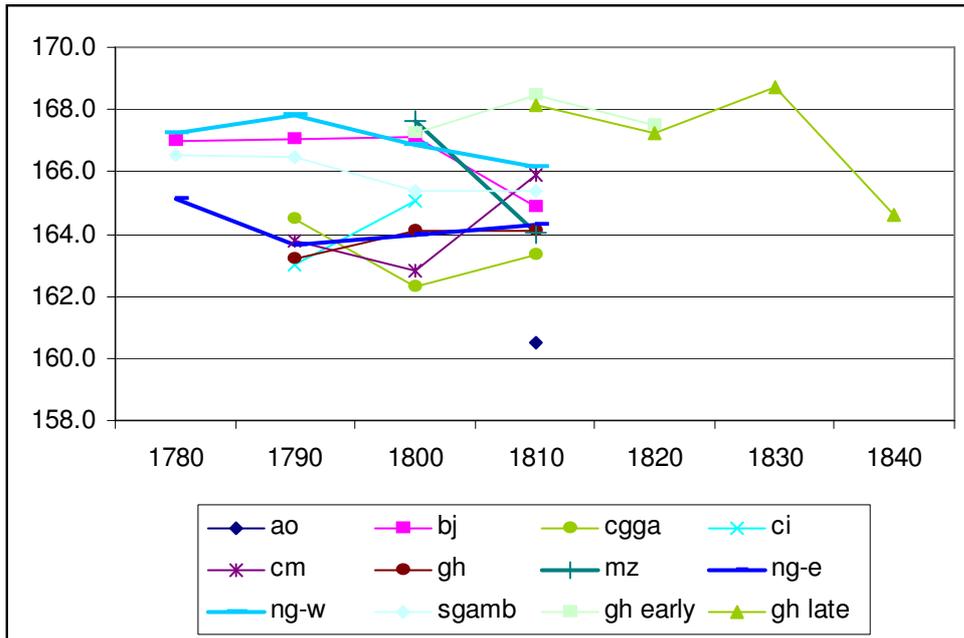
Source: see Table 2

Figure 3. Height trends, early (until 1842, foot measures) versus later period (metre measures)



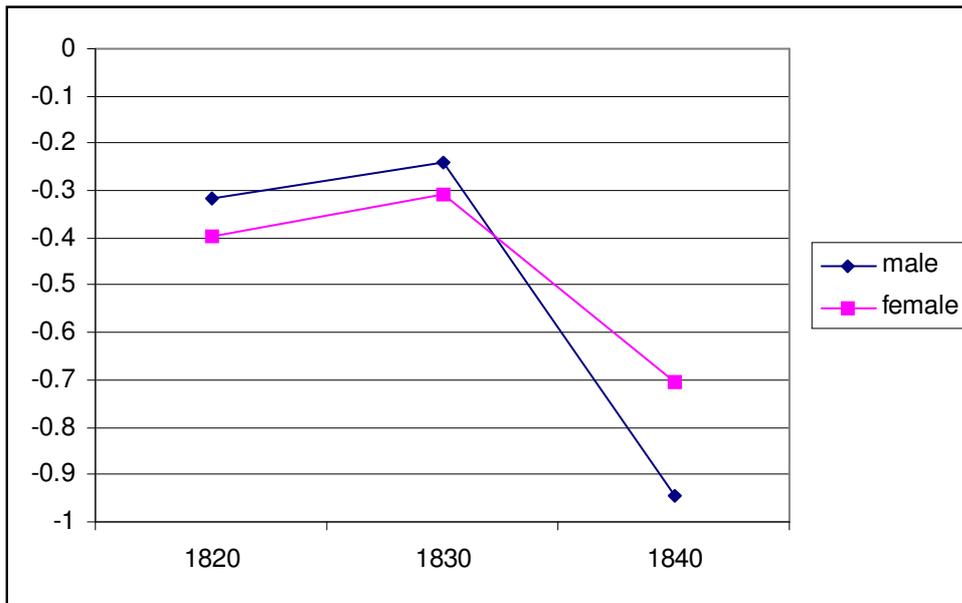
Source: see Table 2

Figure 4. West African soldiers' heights compared with freed African slaves, aggregated by birth decade and ports of origin (arranged by today's country)



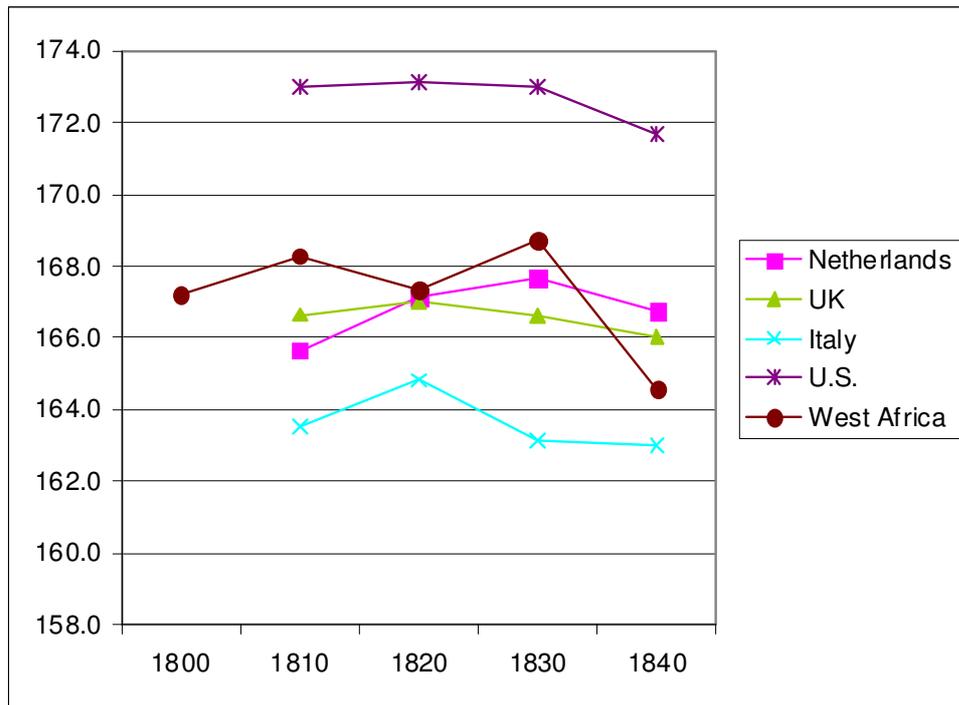
Source: calculations based on the Eltis (1982) data set and our new data set.
 Notes: see Table 7. Source for slave sample: see Table 7 (and Eltis 1982).

Figure 5: HAZ-values of freed slave children (age 1-14, HAZ -5 to 5)



Source: see Table 7.

Figure 6: West African soldiers' heights in international comparison



Source: Baten (2006) based on Drucker/Tassenaar (1997); Steckel and Floud (1997); A'Hearn (2003); Komlos (1998) using data from Floud et al. (1990).