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**The Biological Standard of Living in Early Nineteenth-Century West Africa:
New Anthropometric Evidence for Northern Ghana and Burkina Faso**

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Abstract

West Africans are on average shorter than Europeans today. Whether this was already the case at the end of the Atlantic slave trade is an important question for the history of nutrition and physical welfare. We present the first study of changing heights for people born mostly in what are now northern Ghana and Burkina Faso during the early nineteenth century. The data set, not used before for anthropometry, documents men born between 1800 and 1849. 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 Ghanaian and Burkinabe recruits were notably shorter than northwestern Europeans but not shorter than Southern Europeans during this period.

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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.¹ For the precolonial era, Eltis examined a large data set relating to West Africans freed from slave ships and landed in Sierra Leone.² Most of the freed slaves were from southern Nigeria,³ and Eltis went on to examine changes in the heights of Yoruba-speakers in his sample.⁴ Until now, that is the only study of changes in the heights of people born in West Africa before colonization. We now present data on African men recruited as soldiers and embarked from the Dutch fort of Elmina, on the Gold Coast (in what is now Ghana), to serve in the Dutch army in the Netherlands Indies. These recruits were mostly purchased from slave owners, and were 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 an analysis of the development of height during the late precolonial period in West Africa, in that we study the changes between the heights of successive birth cohorts from the 1800s to the 1840s.

Sub-Saharan Africans today are on average 7-8 cm shorter than Europeans.⁵ Has this always been the case? Research on height differences has shown that the food and disease environment is the decisive determinant of average height, as opposed to genetic differences. For example, West Africans are today, on average, shorter than people of West African descent in the Americas. Slaves of African origin in the Caribbean of the nineteenth century were also quite tall, especially if the nutritional situation was relatively favourable.⁶ The Americas of the early nineteenth century emerge as an outlier both for white and black

¹ In different ways by Destombes, 'Nutrition and hunger'; idem, 'Seasonal hunger'; Austin, Baten and Moradi, 'Exploring'; Moradi, 'Human development'.

² Eltis, 'Nutritional trends'.

³ Yoruba and Igbo-speakers (the former included some from what is now the republic of Benin). See Eltis, 'Nutritional trends', pp. 459-60.

⁴ Eltis, 'Welfare trends'.

⁵ Baten, 'Height trends'.

⁶ And the creoles were taller than Africans born in Africa. See Higman, 'Growth'; Higman, *Slave populations*, Meredith John, *Plantation slaves*, pp.64-5.

populations, because the amount of protein consumed there was much higher than in either Europe or Africa.⁷ Again, a number of studies have found that heights on the three Old World continents in the late eighteenth and early nineteenth century, when the food and disease situation was relatively comparable around the world, were remarkably similar.⁸ Accordingly, in this study, we assess the hypothesis that during the early nineteenth century, inhabitants of West Africa were similar to Europeans in average height. Only later did the quality of European nutrition and health environment increase greatly, hence African heights fell back in relative terms.

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 US and the UK, i.e. on two continents wide 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 anthropometric trend estimates for a sample mostly from early nineteenth-century northern Ghana and Burkina Faso, accompanied by a careful assessment of potential selectivity issues. The anthropometric method is by now well-established and requires little introduction. The biological components of welfare are interesting in themselves: stature differences have been found to be typically correlated with life expectancy and health. This allows anthropometrics to shed light on questions that are otherwise difficult to answer. Thus it has made important contributions to crucial debates in Western economic history such as about whether the standard of living declined during the British Industrial Revolution, or the resolution of important puzzles like the combination of rising incomes and falling heights in the antebellum US.⁹ The significance of height for life

⁷ Baten, 'Height trends'.

⁸ Recently surveyed by Steckel, 2009; Baten, 'Height trends'.

⁹ See Komlos, 'Growing economy'; Margo and Steckel, 'Heights of native born'.

expectancy was emphasised by Fogel in his Nobel Prize lecture.¹⁰ He noted that even in such a wealthy country as 1960s-70s Norway, a height gap of 17.5 cm among males meant that the shorter men had a higher probability of dying in the following period of no less than 71 percent.¹¹ 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.

Turning to West Africa, to avoid confusion it is necessary to disentangle the ambiguous name ‘Gold Coast’. Though by 1957 this was the name given to the whole of what became the independent state of Ghana, in the nineteenth century it primarily referred to the territory between the coast and the largest of the inland African states, the kingdom of Asante (see Figure 1).¹² The Gold Coast ‘proper’ and Asante shared the characteristics of natural forest vegetation, being inhabited mostly by people of Akan language and culture,¹³ and importing slaves from the savanna societies of northern Ghana and Burkina Faso, as well as re-exporting them to European slave ships. 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.¹⁴ 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.¹⁵

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’.¹⁶ About 1,209,000 slaves are estimated to have been shipped from the Gold Coast

¹⁰ Fogel, ‘Economic growth’.

¹¹ Fogel was following Waaler, ‘Height’.

¹² The major studies of the Asante kingdom are Wilks, *Asante* and McCaskie, *State and society*. For economic history, see LaTorre, ‘Wealth surpasses’ and Austin, *Labour*, pp. 1-201, 456-504.

¹³ The most notable exception being Accra, whose inhabitants and chiefs were not Akan but Ga-speaking.

¹⁴ Arhin, ‘Savanna contributions’; Wilks, *Asante*, pp. 18-23, 66-8; Allman and Parker, *Tongnaab*, pp. 29-39.

¹⁵ Hopkins, *Economic history*; Austin, ‘Resources’; on Asante specifically, Austin, *Labour*, pp. 56-95, 471-80.

¹⁶ Hopkins, *Economic History*, pp. 124-35; Law, *Slave trade*; Eltis, ‘Trade’.

between 1641 and 1840, including some 255,000 from Elmina.¹⁷ British abolition came into force in January 1808. After that, an estimated 14,600 more slaves were embarked from the Gold Coast, the last voyage being in 1840. This suggests that the abolition was largely effective on the Gold Coast, though some of the slave traffic was re-routed to the neighbouring Slave Coast, east of the Volta river, out of reach of the now abolitionist forts on the Gold Coast. Shipments from Elmina were restricted to 131 slaves, all in 1814, the year the Netherlands prohibited slave trading.

The form and importance of the transition to ‘legitimate commerce’ varied according to distance from the coast and control of the kinds of land suitable for supplying the more profitable commodities. The blow to export earnings was greatest on the coast. On the Gold Coast itself, adaptation principally took the form of developing palm oil as an export commodity.¹⁸ Palm oil exports began by 1812 but rose only gradually before booming in the 1830s-40s (678 tons exported to Britain in 1830, 3,153 in 1843).¹⁹ Further inland, the kingdom of Asante revived the export of gold to Europe, this time as a substitute for slaves. LaTorre estimated that the volume of gold exported from Akan goldfields (the majority of which were either in Asante or controlled by it) rose ten times from 1808-12 to 1843-52, before dwindling thereafter.²⁰ But it also turned more towards trade with other West African societies, especially by expanding the export of kola nuts to Muslim societies in the savanna. Specially, Asante kola producers benefitted from increasing demand from the newly-formed Sokoto Caliphate, centred in what is today northern Nigeria. Kola was popular there because it was unusual in being a stimulant permitted under the theocratic rule of the Caliphate, whose own purchasing power proceeded to expand, particularly because it exported cotton textiles

¹⁷ Eltis and Richardson, *Atlas of the Transatlantic Slave Trade*, pp. 89-90 and map 76; Eltis, Halbert et al., *Transatlantic Slave Trade Database*. Last accessed 124 May 2011. The numbers in the rest of this paragraph are from the latter source.

¹⁸ Reynolds, *Trade*, pp. 37-102. McCarthy, *Social Change*.

¹⁹ Lynn, *Commerce*, pp. 22-3.

²⁰ LaTorre, ‘Wealth surpasses’, pp. 366-80.

throughout much of West Africa, as well as of slaves to Asante.²¹ LaTorre estimated that the value of Asante kola exports to the Caliphate rose ‘at least ten times’ during the nineteenth century.²² The enlargement of the trade between Asante and the northern savanna, including the Sokoto Caliphate, was facilitated by the Asante kingdom’s establishment of a relatively secure market at Salaga, not far to the north of Asante itself.²³ Thus, while seaborne trade from the Gold Coast took several decades to reach the levels so violently achieved before 1808, the inland trade of the Asante kingdom at least, was broadly on an upward trend for much of the early and middle nineteenth century. Crucially in the context of this paper, Asante continued and apparently expanded its permanent importation of slaves from the north, both through purchases and tribute, to provide labour for its expanded output of kola and gold, while also re-exporting slaves for retention in the economies of the Gold Coast itself.²⁴ Writing in mid-century, the veteran British merchant Cruickshank wrote that ‘immense numbers’ of slaves of savanna origin ‘are being annually imported’ by Fantes on the Gold Coast from Asante middlemen.²⁵

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.

I

This section describes the recruitment process and its change over time in order to assess potential selectivity biases beyond the well-known Minimum Height Requirement (MHR) in

²¹ Lovejoy, *Caravans of kola*; Austin, ‘Between abolition and jihad’; Abaka, *Kola*.

²² LaTorre, ‘Wealth surpasses’, p. 365.

²³ Wilks, ‘Asante policy’; Wilks, *Asante*, pp. 261-7.

²⁴ Austin, ‘Between abolition and jihad’; Austin, *Labour*, pp. 47, 114-34, 484-90,

²⁵ Cruickshank, *Eighteen Years*, vol. II, p. 244.

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, though the data have not previously been used for anthropometrics.²⁶ In all, 3,085 men were embarked from the Dutch fort at Elmina on the Gold Coast, the southern part of present-day Ghana, between 1831 and 1872.²⁷ In the Netherlands-Indies, they were deployed for expeditions to Sumatra, Borneo, Celebes, Bali, Timor, as well as in the Aceh war (which began in 1873).

Some of the men were recruited in Elmina itself; some were sent down to the coast by the Asantehene, the ruler of the Asante kingdom; and some were recruited by a Dutch mission in the Asante capital of Kumasi. The Dutch had some ten forts on the Gold Coast, governed from the headquarters in Fort St. George d'Elmina.²⁸ What made the whole recruitment operation possible was the long-standing commercial and diplomatic alliance between the Dutch and Asante states.²⁹ 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.³⁰ The last ship with recruits left for Java on 20 April 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 soldiers to secure their control. Meanwhile the Dutch had heard good reports of the performance of black soldiers in British West Indies regiments, and believed that Africans

²⁶See especially Van Dantzig, 'Military recruitment'; LaTorre, 'Wealth surpasses', pp. 409-421; Yarak, *Asante and the Dutch*, especially pp. 106-114; Yarak, 'Dutch military recruitment'; Van Kessel, *Zwarte Hollanders*.

²⁷ Van Kessel, *Zwarte Hollanders*.

²⁸ They had a limited jurisdiction on the immediate surroundings of the fort, obtained through negotiations with the local African 'city-state' of Elmina (Van Kessel *Zwarte Hollanders*, p. 27), and usually in effect subject to Asante agreement (Yarak, *Asante and the Dutch*, especially pp. 53, 59, 70-1, 128-31, 242.).

²⁹ Examined in detail in Yarak, *ibid*.

³⁰ *Ibid.*, pp. 133-70.

would be more immune to the disease environment of the Netherlands Indies.³¹ The Dutch government therefore became interested in recruiting African soldiers.

The government decided in 1831 that a first test with about 1800 Africans should be undertaken, starting with a group of 50. Commander Last in Elmina sent a messenger with instructions to the most important outer fortresses, Axim and Accra, emphasizing that only volunteers (not slaves) should be hired.³² However, this recruitment attempt was not very successful and on 17 December, 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.³³ The same happened for a third troop ship that left in 1832.³⁴ 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”.³⁵

In Batavia, there was some unrest about the high costs of recruiting (three times as much as for a European recruit), arising from the high per capita cost of transporting lower than expected numbers of men. Nevertheless, Dutch officials still maintained a positive attitude about the expected resilience of Africans in Indonesia, since the European recruits

³¹ Yarak, *Asante and the Dutch*, pp. 106-7; Yarak, ‘Dutch military recruitment’; Van Kessel, *Zwarte Hollanders*.

³² Yarak, *Asante and the Dutch*, p. 107; Van Kessel, *Zwarte Hollanders*, p. 45.

³³ These recruits are not included in our data set as the data were missing.

³⁴ This ship is also missing from our data set.

³⁵ Yarak, *Asante and the Dutch*, pp. 107-8.

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.

The underlying problem the Dutch faced was that, as 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 was no wage rate which was in the mutual interest of prospective employers and employees to agree.³⁶ Consequently, the only markets for long-term labour were in slaves and human pawns. As generally in West Africa, slaves were almost entirely foreigners within the society in which they were held. In this period most first-generation slaves held in Asante were northerners, known as *nnonkofuo* (simplified by Europeans as ‘donkos’). They were mostly purchased in the market at Salaga in the southern savanna,³⁷ some 7 days’ march walk north of Kumasi.³⁸

Therefore, the new commander, Lieutenant-colonel C.E. Lands, ‘took the next logical step’, of buying slaves who could then be reported as recruits for Indonesia.³⁹ The owner got the 40 guilders as recruitment money which otherwise volunteers would have received. In addition, all slaves had to pay part of their monthly wages to their masters during their lifetime. A slave thereby compensated for his own purchase price within a year, so all other money was profit.⁴⁰ Lands was thereby able to buy slaves from other Dutch civil servants and soldiers, and from African masters.⁴¹ He himself ‘purchased slaves on his personal account, pocketing the government bounty and a portion of each recruit’s pay.’⁴² In 1836, Lands had 130 recruits, mostly from the coastal areas.

³⁶ Austin, *Labour*, pp. 155-70, 495-8.

³⁷ Austin, *Labour*, pp. 106-34.

³⁸ Wilks, ‘Asante policy’, p. 36.

³⁹ Yarak, *Asante and the Dutch*, p. 108.

⁴⁰ Kessel, *Zwarte Hollanders*, p. 57.

⁴¹ *Ibid.*, p. 54.

⁴² Yarak, *Asante and the Dutch*, p. 108. 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.

The first 44 recruits of the 1831-2 period had been judged very positively by the Indonesian military, especially because of their lower mortality. More recruits were sought. The government in Amsterdam decided to seek the Asantehene's help in recruiting another 2,000 men. To this end, a large mission headed by Major-General Jan Verveer was sent to Kumasi in January 1837.⁴³ In the absence of volunteers Verveer recognised that, realistically, Dutch recruitment had to be aimed at obtaining "donkos". On 18 March 1837, he signed a treaty was signed with Asantehene Kwaku Dua I. The Asantehene agreed to deliver 1,000 recruits within one year and allowed the Dutch to open a recruiting office in Kumasi.

But, a year later, the Asantehene had sent only 38 recruits. Worse, after nearly five years he had supplied a total of only 235 men, despite having received an advance of 2,000 guns in 1837 for what was supposed to be the first 325 men.⁴⁴ The recruiting offices in Kumasi and Elmina had enlisted a combined total of 219 recruits by 1 January 1838. Indeed, the Kumasi post did relatively well, buying slaves mostly from Asante citizens facing government fines, or from Asante slave traders who had purchased them in the Salaga market.⁴⁵ In all the Kumasi office recruited 1,166 recruits between March 1837 and January 1842. At that point, several mutinies, mixed experience with African soldiers, and British complaints that the recruiting practices smacked of slave trading, led to a recruiting stop.

Recruitment resumed in 1855 and eventually resulted in more than 800 recruits being sent to Indonesia between 1855 and 1870.⁴⁶ However, Governor Van den Bossche reported in 1857 that in the first two and a half years since the restart of African recruiting in 1855, only twenty men had enlisted, and (in Yarak's words) 'all of them had done so in order to escape debt or pawnship.'⁴⁷ There was no office in Kumasi anymore, but a request was sent to Asantehene Kwaku Dua was sent for further recruits, reminding him that he still owed a debt

⁴³ Yarak, 'Dutch military recruitment', pp. 4-7.

⁴⁴ *Ibid.*, p. 9.

⁴⁵ Yarak, *Asante and the Dutch*, p. 268; Yarak, 'Dutch military recruitment'.

⁴⁶ Van Kessel, *Zwarte Hollanders*, p. 157.

⁴⁷ Yarak, 'Dutch military recruitment', p. 14.

to the Netherlands. This approach produced a bare trickle of recruits. According to Yarak, citing Van den Bossche's successor Nagtglas in 1862, most of the recruits, even from the coast, were slaves and non-Akan by birth.⁴⁸ In other words, as before, they were 'donkos'. This will be important for our analysis below, as we find a height decline during the last birth decade. Given that the latest cohorts were still mostly of North Ghana and Burkina Faso origin, the regional origin did not change.

Finally, under the Sumatra Treaty of 1871 the Netherlands surrendered their possessions at the Gold Coast to the British. This meant a *de facto* end of African recruitment.

II

So who were the recruits? How large were the potential selection biases? 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 - in effect - 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.⁴⁹ 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.⁵⁰ 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

⁴⁸ Ibid., pp. 15-16.

⁴⁹ Yarak, 'Dutch military recruitment'.

⁵⁰ Ibid.

slaves to agree to follow their sale to the Dutch by agreeing to enlist.⁵¹ But this does not affect the fact that they had been slaves until bought by the Dutch.

In principle, one might suppose that the slaves tended to be taller than the average of the populations from which they were seized. But several arguments have been made that this demand-side effect was probably modest. First, Eltis has argued strongly that the bias between freed slaves and the populations from which they came was quite small or even negligible.⁵² For example, he insisted that there were no observable differences in the prices obtained for slaves between regions with tall and short slaves: which should have been the case if height was a prominent selection criterion, as the slave traders would have tried to obtain many more slaves from regions with taller populations. Second, physically strong (and tall) Africans were also demanded by Africa's plantations and farms, and the demand for slaves within West African economies was high in this period.⁵³ Third, evidence about slaves in Brazil and the Caribbean suggests that slaves born in Africa were much shorter than those born in the New World – whereas if slaves in Africa had been chosen by height, we would have expected them to be taller, especially if the deadly voyage over the Atlantic implied additional selectivity in favour of the taller and healthier individuals.⁵⁴ Finally, Eltis observed that the height distributions from all regions were quite normal. If there had been a MHR of slaves or a height interval which was in much less demand, fewer short slaves would have been embarked.⁵⁵ Again, if merchants paid a premium for taller slaves, prices and volumes of slaves traded in those areas with taller populations would have been higher. This does not appear to have happened in the nineteenth century.⁵⁶ The logic of this applies also to slaves held and

⁵¹ Ibid.

⁵² Eltis, 'Nutritional trends'.

⁵³ As already noted for Ghana. See further below.

⁵⁴ See Appendix.

⁵⁵ Eltis, 'Nutritional trends'; pp. 455-6.

⁵⁶ Ibid., p. 455.

traded within West Africa: slave raiders, and victorious armies, had an interest in capturing everyone who could move.⁵⁷

On the other hand, the specific geographical origins of the recruits are likely to have created some selection bias. LaTorre reported that he could identify the geographical/ethnic origins of 605 of 1,170 individuals recruited by the Dutch mission in Kumasi (*Table 1*).⁵⁸ 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*.⁵⁹ In sum, assuming that we can generalize the identified ethnic affiliation to the other recruits, more than 90 percent of our recruits were born in northern Ghana and Burkina Faso. The predominance of people born in these savanna societies is likely to have resulted in a substantially higher anthropometric average of 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.⁶⁰ 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 1960s).⁶¹ 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 offal and milk) 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

⁵⁷ See also Maier, 'Military acquisition'.

⁵⁸ LaTorre, 'Wealth surpasses'.

⁵⁹ Yarak, 'Dutch military recruitment'.

⁶⁰ Austin, Baten and Moradi, 'Exploring'.

⁶¹ Moardi and Baten, 'Inequality'.

pre- and early industrial times which helped to support the body in creating antibodies and living a healthier and longer life.⁶²

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. Rather, 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).⁶³ The general point is that a higher average stature in the sample can be assumed.

In this respect, the fact that we lack data for the majority of Last's few recruits of 1831-2⁶⁴ may be no disadvantage. If Yarak is right that they were probably pawns, they may have come from the poorer section of the free population of Elmina. We know that within nineteenth-century West Africa, at least in politically centralised societies such as Elmina, there could be sharp differences in the quality of the diet of the poor compared to the elite, in both protein sources and in the quality of staple foodcrops.⁶⁵ Slaves were at the bottom of the ladder, hence it is helpful for the consistency of our sample that it mostly comprises first-generation slaves, who were born free in savanna societies. Pawns were more often free people (usually junior relatives) rather than slaves.⁶⁶ If they came disproportionately from people brought up in the poorer households in Elmina society, they were probably below than the average height of the Elmina population, which itself was probably below the average of the northern population.

⁶² Baten, 'Protein supply'.

⁶³ 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.

⁶⁴ Ibid.

⁶⁵ For an observation from early 1870s Asante, see the observations of Bonnat: Perrot and van Dantzig (eds), *Marie-Joseph Bonnat*, p. 643. See also the poem 'Talauci (Poverty)', written in Hausa by al-Hājj 'Umar of Salaga, early in the colonial period. A translation by I.A. Tahir is printed in Goody, *Cooking*, pp. 194-203,

⁶⁶ The major study of pawning in African history is Lovejoy and Falola (eds), *Pawnship*.

III

In this section, we describe the new data set and provide first height trend estimates. Some measurement lists have been lost but we could find records of 2,259 soldiers who were recruited for the Dutch East India Army between 1831 and 1870. The recruitment year is known for 2,241 soldiers (Appendix Table A.1). 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 (*Table 2*).⁶⁷

The age of the recruits ranges between 11 and 46, hence there is no need to discard older ages (Appendix Table A.2). 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 3*). Measures in feet and inches were used until 1842 and for 1,284 cases, whereas for the later period, metres were used (see Appendix, especially Table A.3).

What was the MHR in this period? In the earlier period, to 1842, the observed minimum height was 61 inches (162 cm, see *Figures 2 and 3*). The official MHR was announced in 1826 as ‘vijf Voeten en twee Duimen Rhijnlandsche maat’, i.e. 63 inches (165 cm).⁶⁸ Thus the observed MHR was slightly below the official one, which is not surprising 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

⁶⁷ The two observations at 100 cm can be discarded as outliers.

⁶⁸ Van Dantzig, ‘Military recruitment’.

truncation occurred, as heights are rounded to 158, 160, 162, and 165 cm. Inspecting Figure 3, 158 cm would be a plausible truncation point for this period. It is reassuring that the two main recruitment periods before and after 1842 yield very similar height estimates for the overlapping period (see Appendix Figure A.1), with an estimated truncation of 61 inches for the early period and 158 cm for the later.

We estimated three different truncated regressions, for the early, late, and the whole period (*Table 3*). We always regressed height on a set of dummies, for birth decade, age and region. The birth decade coefficients for the 1800s to 1830s were insignificantly different. Only the 1840s saw a significantly lower height (regression 3 in *Table 3*). This decline in height is quite noteworthy, and we will discuss it further below.

Those ‘recruited’ (purchased) in Asante, i.e. mostly slaves from the North, were 1.4 cm taller than those obtained on the coast, some of whom were born there rather than being first-generation slaves from the north. 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.

A core question that we need to answer here is whether the height level in our sample is higher because we focus on a specific region, or whether there might be an additional bias from using a soldier sample, even after adjusting for the effect of MHR. Our military sample from northern Ghana and Burkina Faso has higher values than the freed slave sample collected by Eltis from Sierra Leone records. The average of West African slave heights of the 1800 birth cohort was 165.4 (declining to 165.0 in the 1810s),⁶⁹ whereas for this cohort we observe 167.2 cm for our soldier sample stemming mostly from the savanna societies north of

⁶⁹ This might be partly due to age misreporting, as Eltis stressed on several occasions: if slaves were decently tall, their age was estimated as being adult even when they were in fact adolescents. Hence the average adult height was underestimated in this last cohort, when the share of adolescents was probably high.

Asante.⁷⁰ In the following birth decade, the soldiers increased somewhat in height (insignificant in the regressions), only to fall back in the 1820s. Hence the difference for 1800 was 1.6 cm, quite similar to the coefficient which we obtained by comparing the recruits who were recruited in Asante with the rest of the sample. We conclude that the difference in height levels was probably caused by regional height differences, rather than a bias caused by the fact that we study a soldier sample here (after adjusting for MHR effects).

Are voluntary soldier samples upwardly biased in general? The fact that most recruits in our sample had been slaves raises serious doubt how much the issue of volunteer-bias arises. One has to wonder whether a slave, bought by the Dutch, considered that he now had a real choice about whether to become a soldier and board a ship to serve as one. There probably was an element of choice exercised in some cases, but probably less than with most ‘volunteer soldier’ samples.

In so far as volunteer-bias is relevant here, Baten and Blum studied the institutional contexts of voluntary soldier measurement in a number of world regions for the 1810-1980 period.⁷¹ They included them in a series of bias-analysis regressions. For the effect of a sample coming from a voluntary soldier context, they assessed 401 height samples (each sample represented one country-birth decade observation, each based on hundreds or thousands of underlying individual height values) from North America, Western Europe, Latin America and Africa during later periods which were based both on voluntary soldier data (after MHR adjustment), as well as other institutional contexts (such as evidence from general military conscription of the whole population, prisoner data, anthropological samples). When Baten and Blum regressed human stature on a full set of country and birth-decade dummies and on those potential-bias variables, the coefficient of the voluntary soldier context turned

⁷⁰ The West Africa average is based on slaves of the ports in today’s Benin, Ivory Coast, Ghana, Nigeria and Senegal/Gambia. The comparison should not be with the ‘Ghana’ observations of the slave sample, because this was a very small sample (N=76), and we do not know whether those slaves originated from a specific subsample of the Ghanaian population.

⁷¹ Baten and Blum, ‘Growing taller’.

out to be insignificant, compared to the other measurement contexts. The coefficient for voluntary soldier was small (-0.31 cm), and even negative. This global evidence supports our result that we observe regional differences rather than a soldier bias.

The time coefficients of Table 3 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 4. In general, the 1800s-1830s saw relative stability in heights. We should discuss the question whether the decline in the 1840s was perhaps caused by an elimination of the previous bias. Actually we do not find evidence for this in the data: Yarak cites a dispatch from the Dutch governor in 1862, that 'most of the recruits, even from the coast, were slaves and non-Akans by birth', i.e., they were 'donkos', born in the northern savannas. So even in the last period, when of course there was no mission in Kumasi and the Asantehene was sending down only a trickle of recruits, it was mostly northern-born people. This speaks for the regional consistency of the sample.

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 became significantly shorter, and Chinese stature declined during the following decade.⁷²

If this is not a coincidence, the transmission mechanism to West Africa remains to be clarified. One possible hypothesis 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. 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

⁷² Steckel and Floud, Health; Baten, Ma, Morgan and Wang, 'Evolution'.

their head, and within three days they are dead. And this happens to at least 40 or 50 a day".⁷³

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 sailing-ship networks within which West Africa had been notoriously incorporated since the fifteenth century.

Equally, the decline in heights shown in our sample may have no causal relationship with the declines observed on other continents during the same decade. From his freed slave sample, Eltis found an earlier decline in heights specifically among those of Yoruba origin. This started among cohorts born in the late 1790s, intensified after c.1810, and was continued at least to the end of the period to which the sample relates, c.1822. The slump in height coincided with the decline of the Oyo empire of southwestern Nigeria. Eltis suggested that increased intensity and geographical spread of armed conflict, within what had been the pax Oyo, led to both increased slave capturing (more Yorubas were embarked in the Atlantic slave trade) and reduced nutritional status (the two being probably linked, in either or both directions of causality).⁷⁴

For northern Ghana and Burkina Faso in the 1840s, two possible sources of violence that may have disrupted the feeding of children may be noted. One is warfare, in the form of the major Asante campaign in the central Gonja area of northern Ghana in 1841-4.⁷⁵ However, this would have been unlikely to have affected the Mossi population of Burkina Faso, from whom (as we have seen) many of the slaves/recruits were to be drawn. The other possibility is increased slave-raiding in the savanna hinterland of Asante, in response to rising slave prices. Whereas the British abolition act was followed by a slump in the prices of slaves

⁷³ Quoted in Van Dantzig, 'Dutch military recruitment', p. 24.

⁷⁴ Eltis, 'Welfare trends', especially pp. 529, 537-40.

⁷⁵ Wilks, *Asante*, pp. 275-9.

in West Africa until c.1820, including on the Gold Coast, there was a substantial recovery in prices in the 1820s and 1830s, which was sustained at least until 1850.⁷⁶ This resurgence is consistent with the admittedly scattered observations available for slave prices on the Gold Coast itself and in the markets in which Asantes bought slaves.⁷⁷ The Dutch recruiting mission to Kumasi presumably contributed a bit to this upward pressure: LaTorre commented that the price paid by the Dutch recruiter in 1837-42 was ‘probably a premium’.⁷⁸ But any connection between the price of slaves, or Asante northern policy, and child welfare in the 1840s remains circumstantial at best.

IV

We will use the Eltis data set on African slaves freed in Sierra Leone to compare our northern Ghanaian and Burkinabe heights. A priori, we would expect recruits from northern Ghana and Burkina Faso to have been somewhat taller than slaves who were more often coming from coastal and forest-zone population groups (except those who were embarked in the Senegal and Gambia ports). The slaves originated from a variety of regions in Africa, although only their port of origin and sometimes their ethnic 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. The height averages by decade are given in Table 4 and Figure 4; only cases with more than 35 males aged 25-50 were reported.⁷⁹

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.⁸⁰ The heights of the slaves shipped from

⁷⁶ Lovejoy and Richardson ‘British abolition’.

⁷⁷ LaTorre, ‘Wealth surpasses’, pp. 439-43; Austin, *Labour*, pp. 128-34, 488.

⁷⁸ LaTorre, ‘Wealth surpasses’, p. 440.

⁷⁹ Height range 120-200 cm.

⁸⁰ Eltis, ‘Nutritional trends’, pp. 459-60.

Mozambique were about average, whereas freed slaves from Ghana (the port of Anomabu) were relatively short. The latter finding may have been anomalous, as relatively few slaves were shipped from the Gold Coast during this period.

If we compare the northern Ghanaian and Burkinabe recruits' average heights with those of Eltis's freed slaves, the former appear quite tall (Figure 4).⁸¹ In the 1800s, the soldiers were literally on a similar level as slaves from southwest Nigeria, Benin and Mozambique (Table 4). After the height decline of the 1840s, the African soldiers recruited by the Dutch were about the same average height as the freed slaves born around 1790-1800. It is clear that slaves from southeastern Nigeria (Bight of Biafra), Gabon/Congo, and Angola were substantially shorter.

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 HAZ 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 US 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.⁸² The number of cases for

⁸¹ Selectivity arises not only through a MHR, but also through other forms of soldiers' height selection.

⁸² We based this on the finding of Baten, 'Height', that the heights of children are strongly influenced by the years before measurement. See Appendix for more details.

both girls and boys is sufficiently large, even after removing outliers with HAZ-values below -5 or above 5 (Figure 5, Appendix Table A.5). 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.

V

How tall were the recruits from what is today northern Ghana and Burkina Faso in international comparison? Baten 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.⁸³ As it turns out, the northern Ghanaian and Burkinabe recruits were of similar height to the Dutch military conscripts who were quite representative of their country's population (Figure 6, Appendix Table A.6). The US 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 northern Ghanaian and Burkinabe recruits and even than the slightly shorter average West African freed slaves (Italy is reported in Figure 6; Spain and Portugal had similarly low levels). Hence our main results also hold if the slave height estimate is included in the comparison.

VI

Summing up, 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 northern Ghana and Burkina Faso and mostly

⁸³ Baten, 'Global height'.

enslaved before they were purchased and recruited as soldiers, were about 1.6 cm taller than the average for freed West African slaves during the 1800s. We discussed intensively in this study whether this difference is due to the institutional context of military recruitment (even after adjusting for the MHR) or due to regional height differences, and arrived at the latter explanation. Hence we would interpret the heights from this region, as well as those from Western Nigeria, Benin and Mozambique in the freed slave sample as the upper bound of early nineteenth century documented African heights, whereas other African regions represent the lower bound (this especially true of Angola).

Allowing for those regional differences, the data enable us to offer some information on the origins of the nutritional divergence between Africans on the one hand, and Europeans and African-Americans on the other. We initially posed the hypothesis that while Africans today are considerably shorter than Europeans, this might not have been the case during the early nineteenth century. After correcting for possible height biases, we conclude this study with the finding that West Africans - both soldiers and freed slaves - were notably shorter than northwestern Europeans but similar in height to Southern Europeans, after taking regional differences into account. On average, Europeans might have been somewhat taller, but the difference was much less than it is today. Again, the descendants of African slaves living in the Americas are taller, on average, than Africans in Africa; a difference which, in the US, appears to have begun to develop even before the end of slavery.⁸⁴

Our conclusion is ambiguous with respect to the controversy about the effects of the Atlantic trade on African welfare. It is widely acknowledged that the selective adoption of American crops, especially maize but also peanuts and even cassava (being drought-resistant, though not particularly nutritious), enhanced the food security of African populations.⁸⁵ Slave exports also increased the purchasing power of political and commercial elites, and the terms of trade moved in Africa's favour, especially during the later eighteenth (and early nineteenth)

⁸⁴ Eltis, 'Nutritional', pp. 466-470.

⁸⁵ E.g. McCann, *Maize*.

centuries.⁸⁶ Conversely, the slave trade deterred, disrupted and distracted from peaceful economic activities, including the feeding of the next generation.⁸⁷ In this context, that West Africans tended to be shorter than northwestern Europeans may support the view that the latter effect outweighed the former: but of course we do not know the situation on the eve of the Atlantic trade, in the fifteenth century.

In nineteenth-century comparative 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 measured 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 suffered its last major famine, and the US birth cohorts of the 1840s were drastically shorter than the preceding ones.⁸⁸ Chinese stature declined during the mid-nineteenth century.⁸⁹ Hence, we can conclude that the 1840s decline can be observed in at least some countries on the five largest continents. Whether there was a causal link between the height decline in West Africa and that seen elsewhere remains to be clarified. If there was a transmission mechanism, the most likely 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. But it may be that the decline in West Africa was independent of global epidemiology, and was instead a result of social disruption because of war or of intensified slave raiding in response to increasing demand for slaves for commodity production, for overseas and intra-regional markets. At the present stage of research, this remains speculative.

⁸⁶ Eltis and Jennings, 'Trade'; Eltis, 'Trade': on the distribution of African income from the trade, Evans and Richardson, 'Hunting for rents'.

⁸⁷ Inikori, 'Africa'.

⁸⁸ Margo and Steckel, 'Heights', Komlos, 'Shrinking'.

⁸⁹ Baten et al., 'Evolution'

Finally, Austin, Baten, and Moradi have argued that the colonial period in Ghana was characterized by a certain increase in heights.⁹⁰ 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 MHR 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.

⁹⁰ Austin, Baten, and Moradi, 'Exploring'; Moradi, 'Confronting'; see also Moradi's work on Kenya, 'Towards'.

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

| | Number | Percent of identified |
|---------------------|--------|--------------------------|
| AKAN* | | |
| Asante | 1 | 0.2 |
| Bron | 3 | 0.5 |
| NORTHERN GHANA | | |
| Dagomba | 65 | 10.7 |
| Other | 77 | 12.8 |
| BURKINA FASO | | |
| Mossi | 358 | 59.2 |
| Gurma | 48 | 7.9 |
| OTHERS | 53 | 8.8 |
| TOTAL IDENTIFIED | 605 | 100 |

Source: Simplified from LaTorre 'Wealth Surpasses', Figure 7-7, pp. 417-418.

Note: * AKAN refers to the language family of southern and central Ghana

Table 2. 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 |
| 1840 | 256 | 11.33 |
| 1830 | 432 | 19.12 |
| 1850 | 8 | 0.35 |
| Total | 2,259 | 100.00 |

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

Table 3: Truncated regression estimates of heights of North Ghanaian* and Burkinabe recruits

| | Coef. (1) | P > z | Coef. (2) | P > z | Coef. (3) | P > z |
|-------------------|-----------|--------|-----------|--------|-----------|--------|
| Ages included | 17-46 | | 20-46 | | 18-46 | |
| Recruitment years | 1831-42 | | 1843-70 | | All | |
| b1800 | -1.223 | 0.215 | - 0.703 | 0.939 | -1.340 | 0.180 |
| b1820 | -0.965 | 0.385 | -0.902 | 0.788 | -0.922 | 1.388 |
| b1830 | | | 0.565 | 0.795 | 0.663 | 0.277 |
| b1840 | | | -3.567 | 0.117 | -2.729 | 0.004 |
| age17 | 0.013 | 0.997 | | | | |
| age18 | -4.415 | 0.013 | | | -4.313 | 0.011 |
| age19 | -2.784 | 0.036 | | | -2.481 | 0.041 |
| age20 | 0.361 | 0.713 | -0.328 | 0.886 | 0.082 | 0.929 |
| age21 | -1.742 | 0.093 | -0.395 | 0.806 | -1.135 | 0.217 |
| Elmima | | | | | -1.009 | 0.357 |
| Asante-recr. | | | | | 1.426 | 0.053 |
| Accra | | | | | 0.457 | 0.763 |
| Constant | 168.434 | 0.000 | 168.153 | 0.000 | 168.162 | 0.000 |
| N | 1357 | | 628 | | 1894 | |
| Log likelihood | -4117 | | -2004 | | -5740 | |
| Std.Dev. | 7.47 | | 7.51 | | 7.48 | |

Source: see Table 2. Notes: * The evidence includes a small number of Southern Ghanaians, but its height level is mostly determined by Northern Ghanaian and Burkinabe heights. Only height values above 120 cm were included. In regression 1 and 3, a truncation point of 162 cm was used, in regression 2 158 cm. The birth cohorts before 1800 and after the 1840s are documented by only very few cases, hence they were discarded here. As the number of cases aged 17-19 were too small for the later period, those were omitted from regression 2.

Table 4. Heights of Northern Ghanaian and Burkinabe soldiers compared with freed African slaves, by birth year and today's location of port

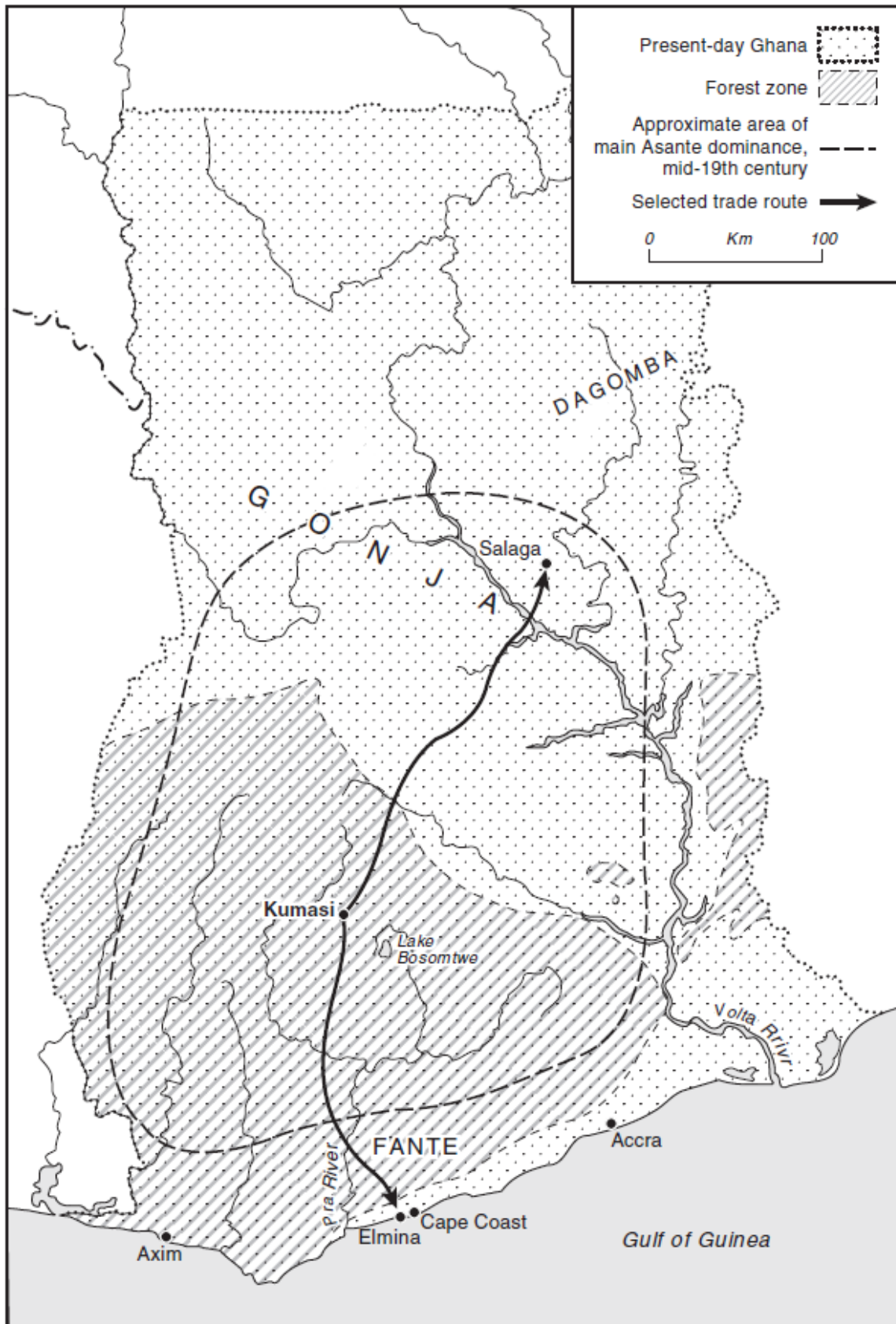
| Today's countries | 1780 | 1790 | 1800 | 1810 | 1820 | 1830 | 1840 |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|
| Angola ports | | | | 160.5 | | | |
| Benin ports | 167.0 | 167.0 | 167.1 | 164.9 | | | |
| Congo and Gabon ports | | 164.5 | 162.3 | 163.3 | | | |
| Ivory Coast ports | | 163.0 | 165.1 | | | | |
| Cameroon ports | | 163.8 | 162.8 | 165.9 | | | |
| Ghana ports | | 163.2 | 164.1 | 164.1 | | | |
| Mozambique ports | | | 167.6 | 164.1 | | | |
| Nigeria (East) ports | 165.1 | 163.7 | 164.0 | 164.3 | | | |
| Nigeria (West) ports | 167.3 | 167.8 | 166.8 | 166.1 | | | |
| Senegal/Gambia ports | 166.5 | 166.5 | 165.4 | 165.4 | | | |
| Ghana/Burkina Faso early | | | 167.2 | 168.4 | 167.5 | | |
| Ghana/Burkina Faso late | | | | 168.2 | 167.3 | 168.7 | 164.6 |
| Ghana/Burkina Faso 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 proportion of the slaves shipped from those ports was born in the given country. Senegal/Gambia region (many born in the Sahel zone). 'Ghana/Burkina Faso' both reports the average of the early (1831-42) and late (1843-70) sample. We follow Eltis in taking only those aged 25 and above into account since growth in the early twenties was apparently quite substantial among slaves, and/or the 20-24 age group was born in a particularly bad period (those of this age group were concentrated on few birth years in this sample).

Source: Eltis database on African-American slave history,

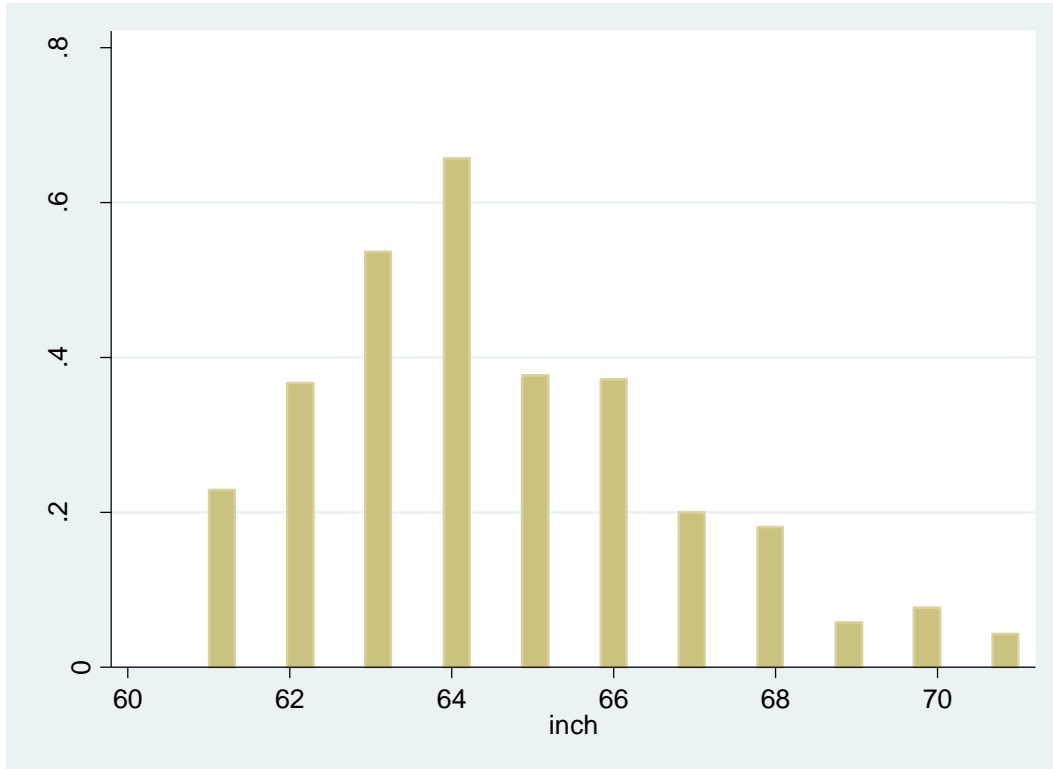
<http://www.slavevoyages.org/tast/resources/slaves.faces>. See also Table 2.

Figure 1: Elmina, Asante and 'Ghana' in the Mid-nineteenth Century.



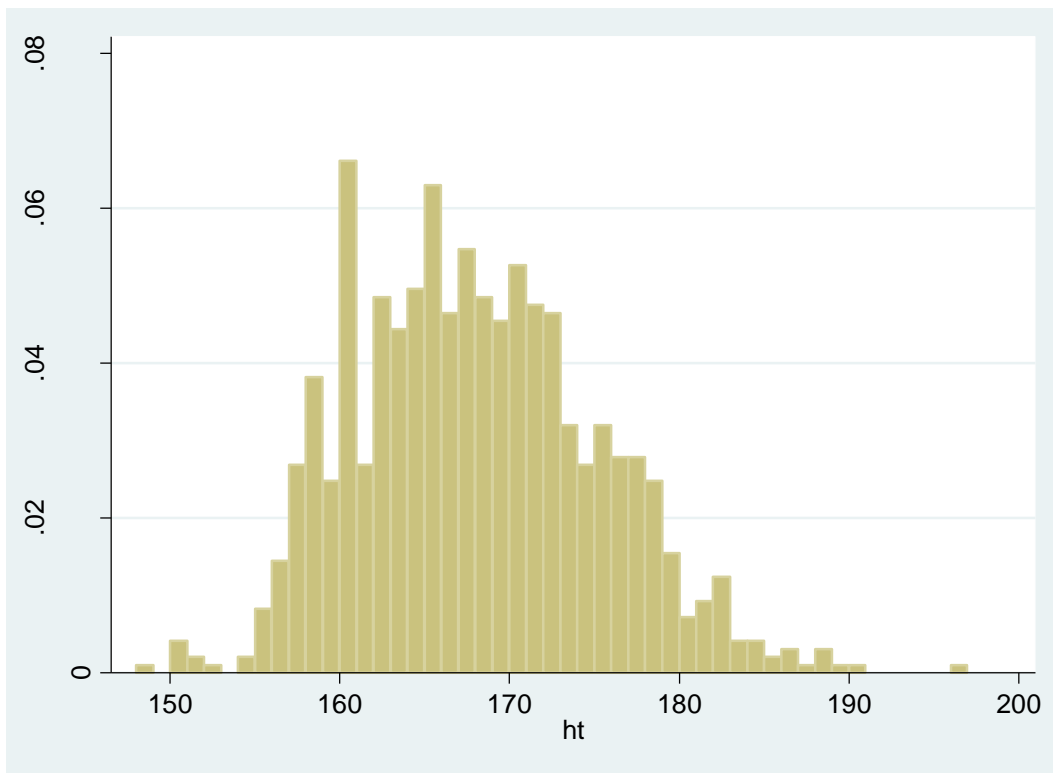
Acknowledgment: drawn by Mina Moshkeri, LSE cartographer.

Figure 2: *Distribution of heights reported in feet and inches*



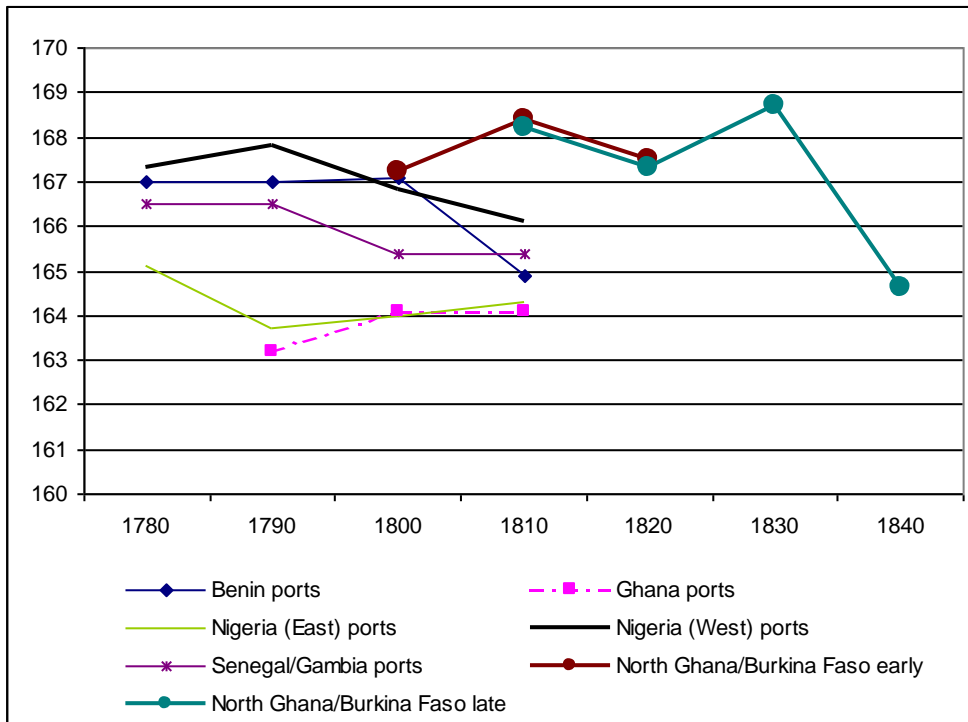
Source: see Table 2

Figure 3: Distribution of heights reported in centimetres



Source: see Table 2

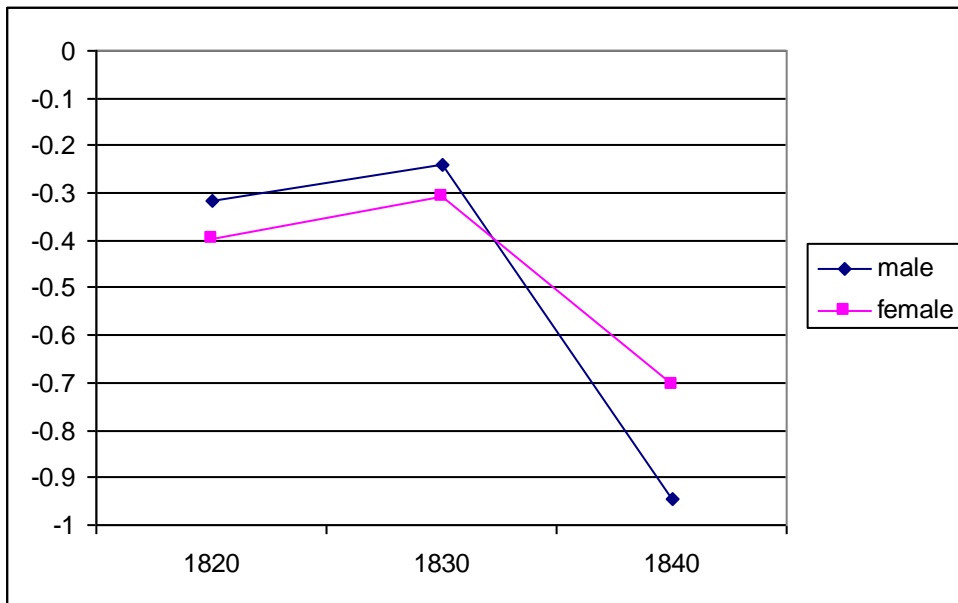
Figure 4. Northern Ghanaian and Burkina Faso soldiers' heights compared with freed African slaves, aggregated by birth decade and ports of origin (arranged by today's country)



Source: calculations based on the Eltis data set, see table 4, and our new data set.

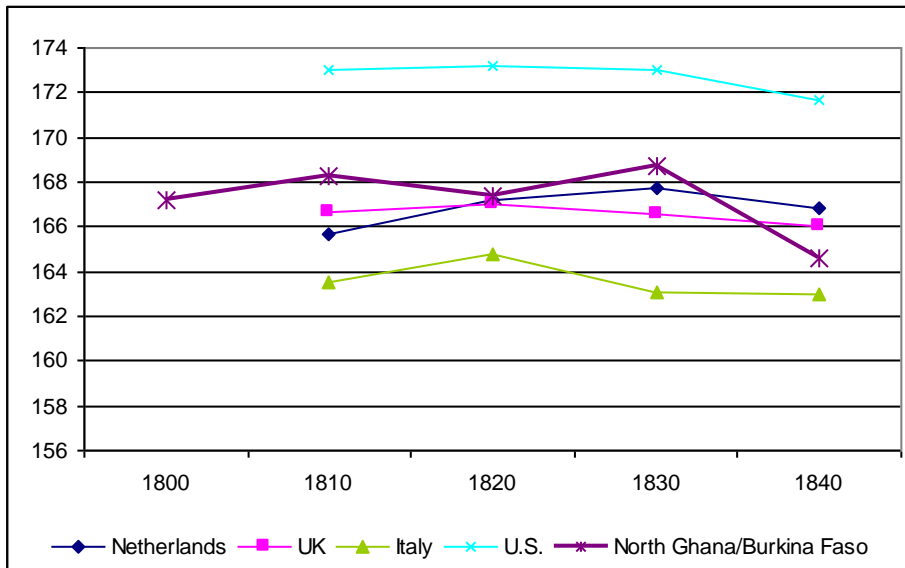
Notes: On the number of underlying cases, see Appendix Table A.4.

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



Source: see Table 4.

Figure 6: Northern Ghana/Burkina Faso heights in international comparison



Source: Baten, 'Global', based on Steckel and Floud, 'Health' (and the Drucker/Tassenaar study therein); A'Hearn, 'Anthropometric'; Komlos, 'Shrinking', using data from Floud et al., 'Height'. For the numerical values, see Appendix Table A.6

Appendix (should be made available via internet)

Appendix Table A.1. 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 |

Appendix Table A.2: 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

Appendix Table A.3: 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

Some 250 soldiers measured up to 1842 were reported in metres as well. Yet the Netherlands had officially used the metric system since 1816. 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). The average proportion of metre-observations was close to 10% up to 1842. After the recruitment break of 1843–1858, all heights were recorded in metres (*Appendix Table A.3*).

Appendix Table A.4 Number of cases of freed African slaves (Eltis, 'Nutritional trends')

| Co | 1780 | 1790 | 1800 | 1810 |
|-----------------------|------|------|------|------|
| Angola ports | | | | 158 |
| Benin ports | 41 | 447 | 557 | 475 |
| Congo and Gabon ports | | 57 | 304 | 143 |
| Ivory Coast ports | | 52 | 60 | |
| Cameroon ports | | 106 | 130 | 51 |
| Ghana ports | | 63 | 76 | 125 |
| Mozambique ports | | | 73 | 46 |
| Nigeria (East) ports | 110 | 1348 | 3551 | 906 |
| Nigeria (West) ports | 81 | 1046 | 1377 | 1000 |
| Senegal/Gambia ports | 47 | 357 | 668 | 464 |

Notes and sources: see Table 4.

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

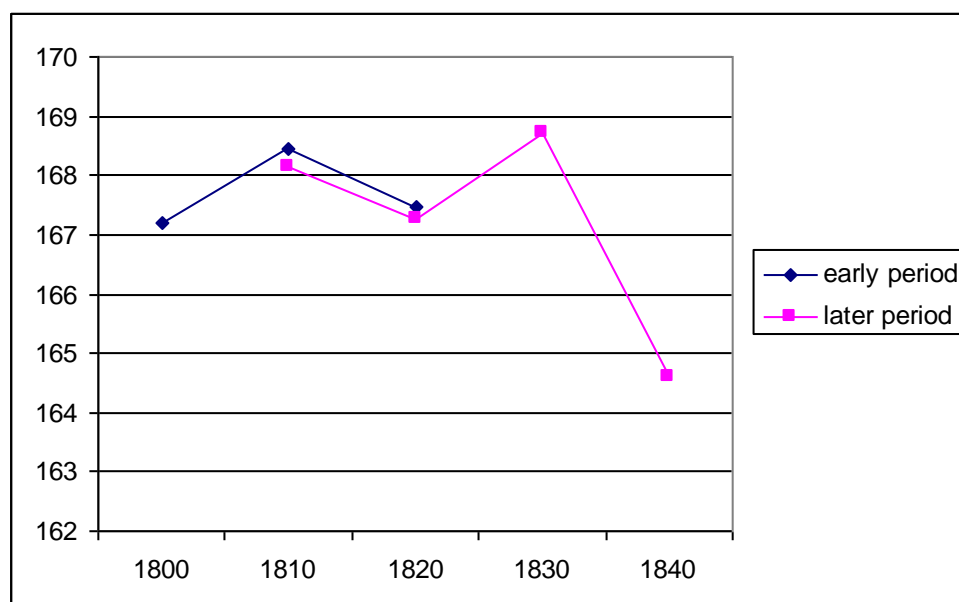
| Gender | Decade | HAZ-value | N |
|--------|--------|------------|------|
| Male | 1820 | -0.318355 | 3841 |
| Male | 1830 | -0.2410841 | 7624 |
| Male | 1840 | -0.9444467 | 1504 |
| Female | 1820 | -0.3973894 | 3205 |
| Female | 1830 | -0.3073781 | 5225 |
| Female | 1840 | -0.7034219 | 645 |

Source: see Table 4

Appendix Table A.6. Northern Ghanaian/Burkinabe 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 |
| North Ghana/Burkina Faso | 167.2 | 168.3 | 167.4 | 168.7 | 164.6 |

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

Appendix Figure A.1. Height trends in (mostly northern) Ghana and Burkina Faso, early (until 1842, foot measures) versus later period (metre measures)

How tall were African slaves in Brazil and the Caribbean?

The heights of slaves born in Africa and slaves born in the Caribbean have been compared by a number of studies on the New World slavery: see Higman, 'Growth'; Higman, *Slave*

populations. Those studies found that often the slaves born in Africa were substantially shorter than Caribbean-born slaves. For example, African-born slaves in Trinidad in 1813 were 2.6 cm shorter than slaves born in the Caribbean colonies (Higman, 'Growth', p. 374). This was probably caused by the more adverse disease and nutritional situation in Africa, although the Caribbean sugar colonies also had a reputation for being terrible places in terms of disease environment. Taking another example, Baten, Pelger and Twrdek, 'Anthropometric history', expected slaves disembarked in Brazil to be at least as tall as slaves born in Brazil, given that the former had survived the terrible journey across the Atlantic, which probably only the healthiest and tallest could have survived. In contrast, they found that slaves born in early 19th century Africa were on average some 4 cm shorter than slaves born in Brazil.

Were the height levels we observed in the new sample unrealistically high, if we compare it to slightly later West African samples?

A glance at the earliest height levels of Africans born in Africa that can be documented from other sources might indirectly shed some light on the question whether our estimate of 167.2 cm for northern Ghana and Burkina Faso is unrealistically high. Anthropologists started to take height and other body measures during the late 19th century, also in West Africa. For example, Conradt, Döring and von Danckelmann took small height samples in Togo, from various tribes, and published the original heights in the *Zeitschrift für Ethnologie* between 1891 and 1896. If we only average those male adult Togolese who were born between the 1850s and the 1870s, Togo heights were 167.1 cm (age \geq 20, N=38). While this anthropological sample is small and from a slightly later birth period, height levels were mostly in the range of our new sample, which might indicate that it was not unrealistic for this specific region. The height level for Ghana in Austin, Baten and Moradi, 'Exploring' was almost 170 cm for the birth decade of the 1880s.

Why are adult heights organized by birth decade, but children heights by decade of measurement?

The famous anthropologist James Tanner, in his *Foetus into man* (1990), explained the growth of the human body as a ‘target seeking process’, because the individual might be at a survival disadvantage when growing too large: large people require more nutrients, and hence might more easily die from harvest failures than shorter persons. For this reason, the body of a child has a biological mechanism to decide the amount of growth each year: if times are bad, growth is delayed, and if times are good, growth of the human body is quick. As a result, in poorly nourished populations in the 18th and 19th centuries people often continued to grow into their mid-twenties. Tanner suggested that ‘a low mean height at age 18 may be due to real stunting of growth and still be present at 25, or may be due simply to a delayed tempo and overcome by age 25.’ (Tanner, *Foetus*)

Baten, ‘Height’ correlated both the period after birth and years before measurement with a number of nutrition and disease proxies, and found that for children the statistical relationship with height is always with the year before measurement, while for adults the years after birth have the strongest impact on final adult stature.