The Anthropometric History of Brazil during the 19th Century

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Abstract

This study focuses on the anthropometric history of Brazil during the 19th century, and tests hypotheses of the literature concerning welfare trends. We found that non-farm Brazil went through difficult times around the middle of the century, but made substantial progress in nutritional status between the 1860s and the 1880s.

Resumo

Este estudo centra-se na história antropometrica do Brasil durante o século 19, e testa hipóteses de literatura sobre tendências do bem-estar social. Nós achamos que o Brasil não agrícola passou por momentos difíceis em meados do século, mas fez um progresso substancial na questão de alimentação entre os anos 1860 e 1880.

Introduction

Anthropometric evidence can shed light on questions that are otherwise difficult to answer. The biological components of welfare are interesting, as stature differences have often been found to be correlated with health and life expectancy (Komlos 1985, Steckel 1995). In his lecture to the Nobel Prize committee, Robert Fogel (1993) stressed that for Norwegian males in the 1960s and 1970s, a height gap of 17.5 cm increased the probability of dying in the following period by no less than 71 percent, clearly a substantial amount. Mounting evidence suggests that increasing heights go along with better cognitive abilities as well as stronger physical robustness. Finally, height can also lead to GDP growth, as Arora (2001) argued. Little is known about welfare trends in Brazil during the early and mid-19th century. One of

the attempts to suggest welfare measures for Latin American countries has be done by Maddison (2001). He decided to work with strong assumptions in order to develop a first estimate for a number of countries, which he hoped would be improved in later welfare measurement research. For example, Maddison had to assume in his GDP per capita estimations for Brazil that the growth rate from 1820-1850 was similar to the period from 1850-1913, for which the first data-based estimates have been put forward by Goldsmith (1986). Hence the idea behind this study is to use historical anthropometric indicators to check whether the current knowledge about the evolution of welfare in Brazil during this time is correct or not. That is important because current knowledge is based on relatively weak GDP estimates, which is admitted by the authors themselves.

Now, height and GDP per capita clearly do not measure the same components of welfare. GDP is much more sensitive to urbanisation and industrialisation, whereas height development reflects the biological components of the standard of living, as height tends to be correlated with health, longevity, and the quality of nutrition (Steckel and Floud 1997, Komlos and Baten 1998). Nevertheless, as a structuring idea we can use Maddison's assumptions about GDP development (Table 1) to generate initial hypotheses about welfare development in Brazil.[1] We will subsequently test how much the development in height deviated from those hypotheses based on income development assumptions and estimates. The hypotheses to be tested is that Brazil had a very modest upward trend in its standard of living during the early 19th century, similar to the second half of the century, but on a very low level, and that anthropometric values developed in a similar manner.

A smaller data set of the early period has been studied previously by Frank (2006). We will test whether his positive results for the 1850-1860s hold firm when the data set is ex-

[1] Apart from the conceptional differences between height and GDP measurement of living standards, we should also mention the general doubts about the strategy with which to estimate GDP based on backward interpolation, see Fukao et al. (2007).

panded from 1,142 to 6,771 observations. We will also extend the anthropometric history of Brazil into the 1880s, when heights began to increase substantially.

The paper is structured as follows: describing first the country's non-anthropometric history based on the existing literature on export performance and population history, the anthropometric data is going to be discussed, and our new findings will be presented and interpreted. Then several robustness and representativeness tests are going to be implemented. Finally we will present a conclusion.

Brief Social and Economic History of Brasil

Brazil's economy was characterized by an agrarian, monocultural structure in the 18th century. In 1815, Brazil became a monarchy with equal rights and obtained independence from Portugal in 1822. Compared to all other Latin American countries, Brazil's independence was unique. Unlike its neighbors, Brazil remained a monarchy after its independence from Portugal. Furthermore, Brazil underwent a comparatively peaceful transition to independence and in spite of repeated attempts of secession, the entity of Brazil remained intact. Moreover, Brazil developed from a state into a nation (Bernecker et al., 2000) with Rio de Janeiro as its unchallenged capital. Though political conditions were stable, the Brazilian economy is often assumed to have been growing too slowly or even to have stagnated due to low productivity in domestic agriculture and a lack of capital, infrastructure, and financial institutions. The slow transition to industrialization started relatively late (at the end of the 19th century). Traditional Latin American economic history claimed that after independence, Brazil fell under the economic control of Great Britain, which is also in line with the Latin American dependency framework. In fact, Brazilian trade was heavily biased towards Great Britain due to special treaties. However, Haber and Klein (1994) argue that "Brazilian policy makers were not British puppets" and that it is not clear whether this development was necessarily a consequence of its independence or of Brazil's relationship with Great Britain.

The institution of slavery still played a vital role. Brazil was the last country to abolish slavery under British pressure in 1888, although new slave imports had already been prohibited in 1850. The consequence of this prohibition was a lack of workers in the prospering coffee plantations in the south. There was a big slave exodus from the stagnating sugar plantations in the northeast to the south, and additional European immigrants came in large numbers. The coffee planters pressed Brazil's central government and the government of São Paulo province to pay the transportation costs of immigrants from southern Europe (Leff, 1994), who otherwise might have gone to the United States or Argentina, where wages were higher. Coffee Planters were more willing to finance immigration from Europe than from within Brazil, as they preferred white European to black Brazilian workers. Brazil was an agricultural economy prior to independence and continued to be so afterwards.

The sugar exports of Brazil, which lead the world market until 1815, stagnated due to growing competition with other Latin American sugar-producing countries, and later the sugar beet producers in Europe. Thus, coffee soon overtook sugar as the most important export staple. The North-eastern sugar and cotton exports declined and per capita incomes fell behind the South-eastern boom region (Leff, 1994).

Johnson and Frank (2006) point out that focusing on aggregate economic performance tends to obscure the level of wealth and economic dynamism found in the southeast of Brazil. Moreover, Frank (2006) found out that mean wealth in Rio de Janeiro in the first half of the 19th century was surprisingly large and growing significantly, although the entire period was marked by a high level of inequality.[2]

What can be said about the nutrition of Brazilians? The available amount of animal protein per capita was potentially higher in inland Brazil, as the specialization in cattle farming might suggest (Bauer, 1986). However, meat was consumed both in fresh and in dried form, which had different health implications (Kiple, 1989). Whereas in the Northeast the

[2] They calculated a Gini coefficient of 0.87 for the 1820s and 1850s in Rio de Janeiro and estimated a top decile share of 77(respectively) 78 percent.

base of the diet was dried meat and manioc flour, the diet in Rio de Janeiro and São Paulo in the 19th century was fresh meat and beans for the rich and dried meat and cornmeal or manioc flour for the poor. In Minas Gerais both rich and poor consumed a great deal of pork, corn-meal, and beans while in Rio Grande do Sul the diet centered on fresh meat, cereals, and vegetables. Kiple (1989) pointed out that the diet of dried meat and manioc was seriously thiamine deficient, [3] and that beriberi, the major deficiency disease caused by a lack of thia-mine, was discovered to be a serious health problem in Brazil during the latter half of the 19th century. However, the high consumption of beans helped to overcome some of the health problems, and bean soup with offal (feijoada) became an indispensable national dish (Fish, 1978). Its protein rich nutrients enhanced the diet of many Brazilians.

New anthropometric evidence on Brazil

Our Brazilian sample contains 6771 male prisoners from the Rio de Janeiro city jail who were measured between 1861 and 1903.[4] We have information on height, origin, occupation, birth place, age and skin color. The number of cases allows estimates for the birth cohorts of the 1810s to 1880s (Table 2). The standard deviations of height are relatively high, as we would expect for a country with relatively high inequality. The information on height was measured in Portuguese feet, and from 1879 onwards in meters. One Portuguese inch corresponds to 2.75 centimeters. However, Frank (2006) found out that due to measurement error in the Rio prison, it is more appropriate to use the equivalent of 2.73 centimeters for one Portuguese inch. In the prison records, some individuals were reported both in centimeters and feet, and an analysis of those double measurements allowed to reconstruct the corrected feet measure. We follow his reasoning and adopt this approach.[5]

[3] The process of salting and drying destroys the thiamine and mostly also the fat in the meat.
[4] Rio de Janeiro/Brazil: Arquivo Público do Estado do Rio de Janeiro – APERJ – Depositum Casa de Detenção do Rio de Janeiro.
[5] We should note the possibility that the upward trend might be less pronounced, if the result of Frank about the inch measure being 2.73 cm is incorrect. In this case, there would also be a substantial increase, but it would be 0.7 cm smaller between the 1840s and the constant, for example (see Appendix A.2 available from the authors). However, we are convinced that Frank's assessment of the inch measure employed is correct and that the trends presented here are as strong as described.

The prisoners came from many different regions (Figure 4) and countries. We have information on migrant status and can hence control for it. We pooled the information on skin color into three categories (white, black, and other or rather "brown") as the description of skin color for persons of mixed race was manifold and the terms used by the contemporaries could hardly be defined accurately (e.g. crioulo, moreno, acaboclado, fula, cabra).

How can we assess height differences by occupational groups? We use the Armstrong scheme concerning occupations to get a clearer understanding of the social structure of the Brazilian society. The Armstrong classification scheme (Armstrong 1972) was developed for 19th century censuses, aiming at capturing the skill and social status level of occupations during this period (see Table 3 for a very brief overview). Clearly, there are some occupations which can stretch in reality from very low to very high skill levels and social status as well. But in practice, this classification scheme has proved useful for a number of applications. In anthropometric history, it has been used in a number of studies (for example, see Johnson and Nicholas, 1995). The lowest status and skill group (1) consists of unskilled workers, this also includes domestic servants and similar low status groups. The second group includes semi-skilled occupations which do not require a long craftsmen-type education, such as a painter. The category (3) "skilled" consists mainly of craftsmen or other persons who had a similar skill level and responsibilities. Category (4) are semi-professional occupations such as clerks or telegraphers. Those occupations require clearly a somewhat higher skill level, but not as much as category (5), the professionals, who typically attended a high school or university (for example, lawyers and doctors), or who have a very high social status, such as entrepreneurs. We have a category for prisoners whose occupation is unknown (group 0) and we coded the farmers as a separate group, as those might have benefited from their direct access to food and land-ownership.

How representative is our data? In prison samples, there might be height bias and occupational bias. Height bias is defined as a certain gap between the heights of prisoners and

the heights of the total population, whereas occupational bias means that prisoners typically had more often lower-class observations than the overall population. It has been found in other studies that the height bias of prison samples is typically not as large as the occupational bias, partly because some height is required for criminal activities that involve violence (Baten, 1999). Nevertheless, we agree with Frank (2006) that the sample is somewhat biased towards the poorer reaches of society. In Table 4 we compare the measurement cohort of the 1870s of our sample with the Brazilian census of 1872 (Recenseamento, 1872). The share of unskilled workers was actually quite similar for the sample and the census population, but the prison sample has about 10 percent more semi-skilled workers than in the 1872 census for Brazil. On the other hand, semi-professionals are lacking to a similar amount in the sample. Professionals are largely absent in the sample, with less than 1 percent, compared to 5.5 percent in the census population. If we compare the share of slaves in our data and in the census, it is almost equal. We have more persons described as "black" in the sample (10 percent), and similarly less "other" (neither white nor black), compared to the census. This might be a true difference, or it might be due to different definitions regarding skin colour used in the prison and for the census.

Another strategy to assess the representativeness of historical samples is to compare the age heaping behaviour in the sample and in the underlying population. The idea of an age heaping analysis is that people who are not able to state their exact age often report an age rounded to multiples of five, and those persons are typically less educated than people who report their age exactly (Baten, Crayen, and Manzel, 2008). Age heaping indices such as the "Whipple Index" tend to have a strongly negative correlation with other human capital indicators such as literacy, and even stronger – in modern times – with measures of mathematical skills (as reported in the PISA survey, see A'Hearn, Baten, and Crayen, 2008). The Whipple Index is calculated by dividing the number of persons reporting a rounded age ending with 0 or 5 by the total number of people, and this is multiplied with 500. Values substantially higher

than 100 indicate problematic numeracy: the higher, the worse. Manzel and Baten (2008) estimate a value of 205 for the Brazilians born in the 1850s (i.e. in the centre of our sample period). With our data we obtain an index of 178 for this birth decade. Hence, our sample has a slightly positive selection, although in this case, it is easily explained by the fact that our sample is more urban than the overall Brazilian population. Are those differences large? Overall the Whipple index can vary between 0 and 500, with typical values between 100 (no age heaping, good numeracy) and 500 (extreme age heaping, bad numeracy).[6] Values near 500 can be observed in the Middle East and South Asia during the 19th century, whereas European industrial countries had values close to 100. Latin America varied between almost 100 (Argentina, 1890s) and 290 (Ecuador, 1880s), hence a difference of 27, as we find it for Brazil, can be judged as small, but not negligible. We conclude from this exercise that the Brazilian sample does not have a strong negative educational bias, compared to the whole Brazilian population.

The results of our three height regressions are reported in Table 5. We estimate three different specifications, regression 1 (Col.1) controls for the migrant status in general whereas in regression 2 (Col.2) dummy variables for the origin of the migrants are included. Regression 3 (Col.3) focuses on the subsample of slaves only. These regressions can help to shed light on the following questions:

How did Brazilian heights develop over time, according to this sample collected in Rio de Janeiro prison? In general, the Brazilian heights stagnated first, but after the 1860s, the time coefficients show a distinct upward trend. This is no statistical artifact, as the result is robust in both models including the whole sample (Table 5), and it is also visible in the raw height data (Table 2 and Figure 1). Brazilians born in the 1880s - which is the constant in regression 1 and 2 - were 2.75 cm taller than those born in the 1810s. At this point, we cannot finally determine whether this upward trend was caused by regional income growth, or

[6] A value of 0 would mean complete avoidance of all multiples of five.

perhaps by an improving disease environment. Some observers would argue that the eradication of the great tropical diseases such as yellow fever only started with the health campaigns during the early 20th century mainly initiated by foreign institutions like e.g. the Rockefeller International Health Board (e.g. Löwy, 1997 and 1999).

Are there significant regional height differences and does migration play a role here? A potential bias for the anthropometric trend results from the fact that our data stems from a prison in Rio de Janeiro, located in the booming southern coffee region. Was the positive height trend predominantly caused by the fact that the region developed successfully, and did northeastern heights stagnate or decline? Although all Brazilian convicts covered by our data were measured in the prison of Rio de Janeiro, their places of birth varied widely. Of the adult males born in Brazil, only 58 percent were born in the southeast, and a negligible amount in the west (see Figure 4). In contrast, 39% were born in the northeast; their height development actually resembled that of the south (Figure 2). The heights of the early and latest birth cohorts were quite similar to those of the southerners, and the middle cohorts were even taller. Could this have been caused by selective migration from the northeast to the south? Most migrant studies focusing on this period find that migration from poorer to richer regions was initially characterized by a positive selectivity of migrants relative to those people who stayed, whereas migrants' human capital declined somewhat later on. Translated into anthropometric values, this would imply that the heights of the early cohorts are slightly overestimated, whereas those of the later cohorts are modestly underestimated. However this would give even more credit to our main finding - the upward trend of height in Brazil. We conclude that the strong upward trend in height was probably not caused by selective migration.

A second potential distortion of the trend could be foreign migration. There was considerable migration to Brazil, especially in the second part of the century and mostly from Portugal. Could the strong height increase have been brought about by the migration of taller

individuals? If the trend is estimated for persons born in Brazil only, the trend is almost identical. [7] Moreover, those who emigrated from Portugal, who were the largest group of migrants, were not statistically different from those born in Brazil (Table 4, Col. 2). In contrast, the German, British, and North American migrants were 3-4 cm taller, Romanic immigrants (from Italy, Spain, Portugal, France) were not significantly different from Brazilian born and migrants from other countries were 1.56 cm taller.[8]

Apart from the trend estimate, the height information allows a rough impression of regional differences of height in Brazil (Figure 4). We only discuss height estimates based on at least 30 observations and assume that not all those differences were caused by selective migration. The tallest Brazilians were living between São Paulo and Bahia, and in Paraíba. Except for the latter two, Northeasterners were relatively short, and this applies also to the coastal regions of Rio de Janeiro, Santa Catarina, and Espírito Santo. If we compare those height patterns with Bauer's map of agricultural specialization, we see that most of the tall regions can be characterized as cattle and grain producing, with an emphasis on the former, plus the booming São Paulo and Minas Gerais coffee plantation belt which also attracted many tall European migrants (Bauer, 1986).[9] Moreover, in Minas Gerais there was a remarkably high number of "free" slaves (so-called escravos de ganho). The number of slaves per slave-owner was low, so the region was characterized rather by smaller fazendas, which sometimes might have allowed more human contact between slaves and slave-owners (Klein, 1986). In contrast, the plantation economies of the Northeast (Cotton, Sugar, Tobacco) and the more Southern coast (Cacao in Espírito Santo) did not lead to favorable anthropometric values, perhaps because the workers were living far away from the inland protein abundance, or because inequality of purchasing power and housing was high. Even the taller population

[7] Figure available from the authors.
[8] All those groups are based on sufficiently large numbers of cases.
[9] In other countries, very strong advantages of proximity have been found (Baten, 1999). The proximity to the production of perishable proteins had the effect of relatively positive health and height levels, even among populations of modest purchasing power e.g. milk or offal, which could not be transported and traded over longer distances before the mid-20th century (see Baten, 1999; Komlos, 1996).

of Paraíba can be explained by this difference between cattle/coffee and other plantations, as the interior cattle economy stretched to the coast at that point. The disappointing height performance of the Rio the Janeiro region might be influenced by the fact that the city of Rio de Janeiro underwent a dynamic expansion to one of the two largest cities in Latin America (Klein, 1986). Hence, the population in Rio might have suffered from an "urban penalty", a hypothesis that has been also put forward by Frank (2006).

Which occupational differences of height can we observe in Brazil? Brazil actually had quite modest occupational differences concerning heights between the Armstrong categories 1 to 4, between the unskilled and skilled. The big exceptions in Brazil are the professionals, who were as much as 3.2 cm taller than unskilled workers. It seems that Brazilian inequality was more determined by the difference between the really well-off and the rest, not as much between unskilled workers and skilled craftsmen. Farmers were actually shorter in this sample, but we have only 64 observations on farmers aged 20-60[10]. Apparently they did not benefit from direct access to food and land-ownership, as we assumed before. Naturally, there were not many farmers in the city of Rio de Janeiro, and those might have been the particularly unsuccessful farmers who went to the city to seek alternative employment. In fact, we do not know if these farmers really lived in Rio or if they were just transferred there for arrestment.

Are there height differences regarding skin colour and were slaves worse off? Interesting are also the differences between white and black, slaves and non-slaves. Figure 3 compares the height differences by skin colour in the 1810s-1840s and the 1850s-1880s. White people were initially relatively short in Brazil, but they also increased the most, namely by more than a centimeter between the early and later half of the sample. The height of black people and "other" races developed less positively. Why might that have been the case? After

[10] We also controlled for age composition by including the 19-22 and 51-60 year-olds in the Brazil regression. The results were as expected, with the exception of the 51-60 year-olds who were not significantly shorter. Among the young men, growth continued until the age of 20 or 21.

the abolition of slavery in Brazil, the obligation of the landlords to care for their slaves ceased, and a large part of the black population lived without adequate housing and might have even suffered from worse nutrition than before. In general, slaves were shorter by one centimeter, and black people were taller by 0.7 centimeter (Table 4, Col. 2). Given that there were no white slaves, to a certain extent those differences cancel each other out. But the interesting finding is really that black people were not shorter than white people in Brazil. The relatively favorable height values for black Brazilians, especially in the 1840/50s, can probably not be explained genetically, as the black people born in Africa were actually much shorter than those born in the feijoada environment in Brazil: The black people of African birth were on average 161.7 cm (N=151), those born in Brazil were 164.9 cm (N=921), which is a statistically significant difference.[11] Black slaves in the United States were actually quite tall in comparison with Brazilian slaves. According to Margo and Steckel (1982), the mean height of U.S. slaves was around 170.5 cm (25-39 year-olds, 1790s-1840s), i.e. 4 cm taller than Brazilian slaves (adding the slave coefficient from the constant in Col. 2, Table 4). But the white population in the U.S. was also quite a bit taller than that of Brazil (around 173 cm during the 1800s-1830s, then falling to 169.1 cm in the 1890s, i.e. on average they might have been one centimeter taller than the U.S. slaves (see Costa and Steckel, 1997). Fogel and Engerman (1974, 1995), Steckel (1986) and recently Rees et al. (2003) have argued that slave owners in the U.S. provided quite good nutrition to slaves after they survived childhood mortality hazards, and this mechanism might have worked in Latin America as well. Especially in a situation when importing slaves became more and more difficult and expensive, slave-owners often provided nutritious diets to their slaves, including, for example, offal and other

[11] Our results are in line with the arguments that Eltis (1982) has provided against strong height selectivity in the slave-trade. For example, he argues that if traders put a significant premium on taller slaves, prices and volumes of slaves traded in those areas with taller populations would have been higher, which does not appear to have happened in the nineteenth century. Second, by the 19th century, physically strong (and tall) Africans were also demanded by Africa's plantations and farms. 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.

varieties of cheap protein. Moreover, in Brazil the social differences between the white elite (such as the professionals and large land-owners) and the rest of the white Brazilians might have been larger than in the U.S., hence the difference between white and black does not appear as clear as in the case of the United States.

4. Conclusion

Brazil has been described as an economy which did not grow much between 1820 and 1913, when incomes were still not far from the lowest values ever measured in global comparison (Maddison 2001, see also Goldsmith 1986 for the post-1850 period). We find that the biological standard of living, which is proxied by height development, did not increase much in Brazil during the period of the 1810s-1860s. However, between the 1860s and 1880s, Brazilian heights increased substantially among the non-farm population that is covered by our sample. Hence we have to modify the initial hypothesis about Brazilian welfare based on Maddison's GDP guesstimates. Brazil's welfare development between 1820 and 1850 was not modestly positive, but stagnant or slightly declining. This lasted until the 1860s; however the biological components of the standard of living improved considerably for the population we are able to study between the 1860s and 1880s.

Apart from those main hypotheses about welfare trends, we also assessed regional and social differences. Regional heights in Brazil were higher in the inland and Southern cattle and grain producing regions, and in the booming coffee area, whereas Brazilian prisoners born in the other plantation regions were shorter, which would support the result that plantation economies in Latin America lead to lower height, unless they are as booming as coffee in Brazil of the 1870s and 1880s.

The social height differences in Brazil of the birth decades 1810s-1880s were visible mainly between a small elite of professionals and the remaining population, which included both lower and middle-class types of occupations.

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Tables and Figures

Table 1: GDP per capita in selected Latin American economies (Source: Maddison 2001)

year	1820	1850	1870	1890	1900	1910	1913	2001
Argentina			1,311	2,152	2,756	3,822	3,797	8,137
Brazil	646	686	713	794	678	769	811	5,570
Peru					817	975	1,037	3,630
Uruguay			2,181	2,147	2,219	3,136	3,310	7,557
Total Latin America	692		681		1,109		1,481	5,811

Table 2: Number of cases by birth decade

Birth decade	Number of cases	Raw average height	Standard deviation
1810	75	164.3	7.38
1820	323	164.3	7.30
1830	705	164.8	7.04
1840	1265	164.6	6.85
1850	1604	164.5	6.71
1860	1740	165.0	6.77
1870	887	166.5	6.53
1880	172	166.1	7.38
total	**6771**		

Table 3: Occupational classification using the farmer-augmented Armstrong scheme (selected occupations)

Unskilled				
Day-laborer	Gardener	Loader	Servant	Worker
Semi-Skilled				
Barber	Coachman	Cook	Guard	
Painter	Sailor			
Farmer				
Agriculturist	Cattle owner	Farmer		
Skilled				
Blacksmith	Cabinet maker	Carpenter	Confectioner	
Mason	Printer	Shop assistant	Tin smith	
Semi-Professionals				
Clerk	Merchant	Pharmacist	Stenographer	
Telegrapher				
Professionals				
Doctor	Engineer	Entrepreneur	Industrial	
Lawyer	Professor	School teacher	Veterinarian	

Table 4: Occupational and social structure, and skin color of Brazil in 1872 and in the prison sample (for the measurement cohort of the 1870s).

	Brazil Census share 1872	Brazil sample share 1870s
Occupational group		
No occupation	n.a.	3.1
Unskilled	33.9	35.9
Farmers	n.a.	1.7
Semi-skilled	26.5	34.5
Skilled	20.6	21.1
Semi-professionals	13.5	3.0
Professionals	5.5	0.7
Slaves		
free	84.29	82.88
slave	15.71	17.12
Skin colour		
White	38.5	41.6
Mestizo	41.5	30.4
Black	20.0	28.0

Notes: without considering farmers and persons without occupation.

Table 5: Regressions of heights

	(1)	(2)	(3)
	Brazil (all)	**Brazil (all)**	**Brazil (slaves)**
Semi-skilled	0.73***	0.52**	n.a.
	(0.00)	(0.01)	
Skilled	0.87***	0.82***	n.a.
	(0.00)	(0.00)	
Semi-professional	0.94**	0.74*	n.a.
	(0.00)	(0.08)	
Professional	3.19***	3.21***	n.a.
	(0.00)	(0.00)	
Farmer	-1.29*	-1.41*	n.a.
	(0.064)	(0.05)	
Round age	-0.77***	-0.77***	-0.97
	(0.00)	(0.00)	(0.35)
Migrant	0.17		
	(0.45)		
Black	0.21	ref.cat.	
	(0.40)		
White	-0.20	-0.65**	
	(0.41)	(0.04)	
Brown	ref. cat.	-0.40	
		(0.13)	
Slave		-0.99**	n.a.
		(0.02)	
France		0.49	n.a.
		(0.62)	
Germany		3.71***	n.a.
		(0.00)	
UK		3.48***	n.a.

		(0.00)	
North America		3.24***	n.a.
		(0.00)	
Spain		0.18	n.a.
		(0.70)	
Portugal		-0.13	n.a.
		(0.63)	
Italy		0.26	n.a.
		(0.57)	
Other migrant		1.56***	n.a.
		(0.01)	
Africa			-3.59***
			(0.00)
Birth decades			
1810	-2.75***	-2.42*	n.a.
	(0.00)	(0.05)	()
1820	-2.79***	-2.06***	0.20
	(0.00)	(0.01)	(0.92)
1830	-2.30***	-2.41***	-1.50
	(0.00)	(0.00)	(0.46)
1840	-2.46***	-2.45***	-2.04
	(0.00)	(0.00)	(0.36)
1850	-2.54***	-2.48***	-2.47
	(0.00)	(0.00)	(0.26)
1860	-1.80***	-1.81***	-2.74
	(0.00)	(0.00)	(0.32)
1870	-0.24	-0.25	n.a.
	(0.66)	(0.65)	
1880	ref.cat.	ref.cat.	ref.cat.
Age 19	-1.93***	-1.89***	-2.38
	(0.00)	(0.00)	(0.34)
Age 20	-1.05***	-1.00***	0.04
	(0.01)	(0.01)	(0.98)
Age 21	-0.73*	-0.66	-1.69
	(0.07)	(0.11)	(0.54)
Age 22	-0.51	-0.48	-0.03
	(0.15)	(0.18)	(0.98)
Age 51-60	-0.14	n.a.	n.a.
	(0.75)		
Constant	166.91***	167.36***	166.53***
	(0.00)	(0.00)	(0.00)
Observations	**6771**	**6491**	**430**
R-squared	**0.02**	**0.03**	**0.03**

The constants in 1 and 2 refer to a criminal unskilled free male of brown (Col. 1) or black (Col. 2) skin color aged 23-50, born in Brazil in the 1880s. The constant in 3 refers to a slave born in Brazil in the 1880s. P-Values in brackets.

Figure 1: Height development in Brazil

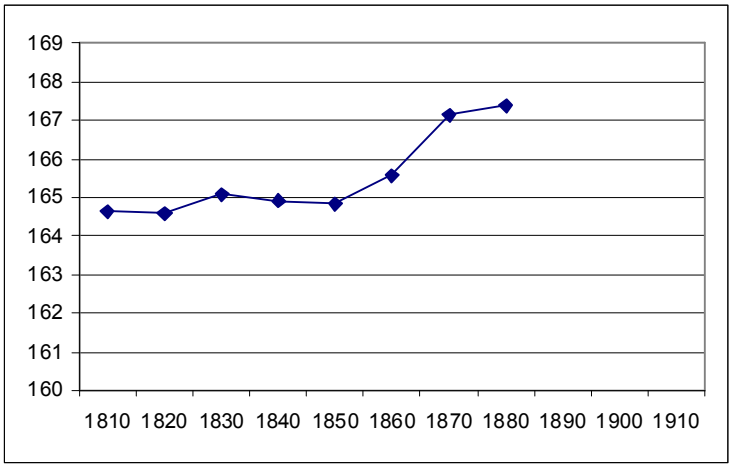
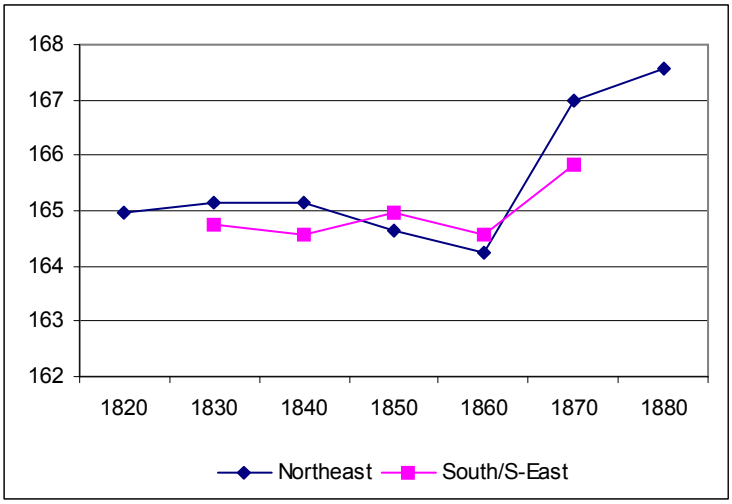


Figure 2: Height development in Northeast and Southeast/South Brazil



Notes: "Northeast" is Pernambuco, Bahia, Sergipe, Alagoas, Paraíba, Rio Grande do Norte, Ceará, Piaui, Maranhao. "Southeast" is Rio de Janeiro, Sao Paulo, Minas Gerais, Espirito Santo, Paraná, Santa Caterina and Rio Grande do Sul. We included only birth decades with at least 50 observations, and only adult males aged 23-60.

Figure 3: Height differences by skin color in Brazil

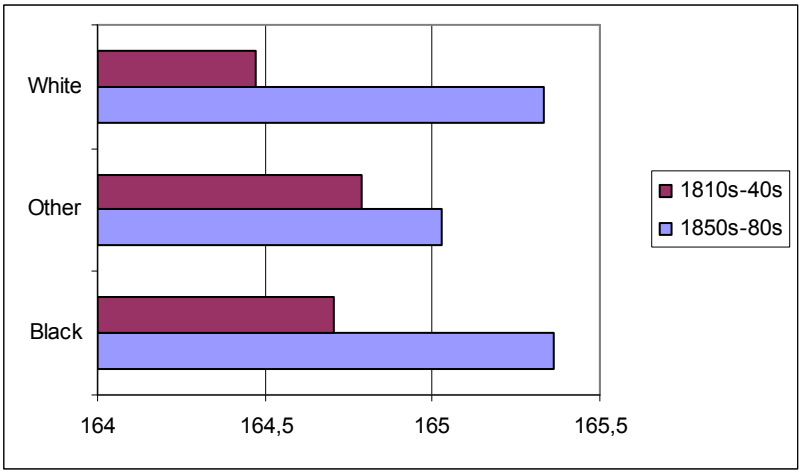


Figure 4: Number of cases by Brazilian provinces and average height by province
Line pattern indicates less than 30 observatinos