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Altura y nivel de vida en Puerto Rico, 1770-1924

Height and standard of living in Puerto Rico 1770-1924

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Javier Moreno-Lázaro [a]

Palabras clave
Antropometría
Puerto Rico
España
Estados Unidos
Colonialismo
Nivel de vida

Resumen

En este texto defiendo la hipótesis de que la especialización en la producción azucarera desde finales del siglo XVIII hasta mediados del siglo XIX tuvo como consecuencia la caída persistente del bienestar de la población portorriqueña más humilde debido a la necesidad de abaratar los costes de producción. Por otra parte, las carencias educativas, las condiciones de hábitat y la enfermedad, especialmente la anemia, fueron determinantes. Sólo entre 1860 y 1880 la situación gracias a los cambios en el mercado mundial de azúcar y la política social del gobierno colonial español mejoró la situación. Por el contrario, la anexión en 1898 por Estados Unidos no supuso un incremento en el bienestar de la población en el corto plazo. Para demostrar estas afirmaciones, he hecho uso de la talla de los presos nacidos en el período, de testimonios contemporáneos y de los contrastes econométricos habituales en Antropometría.

Key words
Anthropometry
Puerto Rico,
Spain
United States
Colonialism
Standard of living

Abstract

This text defends the hypothesis that the specialisation in sugar production from the end of the 18th century to the middle of the 19th century led to a persistent decline in the welfare of the poorest Puerto Rican population due to the need to reduce production costs. On the other hand, educational deficiencies, housing conditions and disease, especially anaemia, were also determining factors. Only between 1860 and 1880 did the situation improve thanks to changes in the world sugar market and the social policy of the Spanish colonial government. In contrast, the annexation in 1898 by the United States did not lead to an increase in the welfare of the population in the short term. To demonstrate these assertions, use has been made of the height of prisoners born in the period, of contemporary testimonies and of the usual econometric contrasts in anthropometry.

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a University of Valladolid (Spain). Javier.moreno.lazaro@uva.es

1. INTRODUCTION

The study of population height in a historical perspective sheds light on the evolution of the material well-being of a society in a precise manner, as it is the effect of income, the supply of public goods in terms of education and health, the natural environment, and housing conditions, to name but a few determinants (Steckel and Floud; 1997; Steckel, 1995 and 2009; Komlos, 1985; Komlos and Baten, 2004). In addition, it allows us to research the social and territorial inequality of the group.

In backward agrarian economies, anthropometric calculations are more useful in the measurement of living standards because of the less widespread use of formal labour contracts and cash wages. In these areas, real wages, the most commonly used micro-economic indicator, loses plausibility especially in slave societies. In such countries, height must be taken into account for an accurate estimation of material welfare and wealth distribution effects. This is the case of Puerto Rico. The Caribbean island has an additional factor of interest since it is the only country in Latin America that went from being part of a declining Spanish empire to an US colony in 1898, so it is possible to assess the welfare impact of that change.

This article presents the series of inmates' heights from the last quarter of the eighteenth century to the mid-1920s. It supports the hypothesis that Puerto Rico's insertion in the world market thanks to its sugar specialisation led to a deterioration of material welfare in the long run that lasted at least until around 1925. The reforms introduced by the Enlightenment governments at the end of the 18th century and by the liberals from 1870 onwards contributed to a significant improvement in living standards, but this was undone by changes in the world market. This deterioration persisted into the first decades of colonial rule by the United States after the occupation of the island in 1898. Godoy et al. (2007) thesis is confirmed: that the occupation by the United States did not, according to anthropometric calculations, lead to an increase in the standard of living of the population in the medium term

To demonstrate these hypotheses, a qualitative analysis has been made in which documentary evidence is compiled and interpreted - much of it unpublished - on the evolution of material wealth, nutrition, housing, education and health of Puerto Ricans, with the econometric contrast of the determinants of stature extracted and the source used here. In other words, this work goes beyond the mere statistical verification of the hypotheses. Attention must be drawn in this sense to the extraordinary richness of the printed sources published before 1898, both in Spain and in Puerto Rico, apart from the sample with which we work here.

This essay is divided into three parts: The first part studies the bibliographical contributions on the subject and the sample used and presents preliminary results. Then econometric contrasts are offered in order to validate and identify the socioeconomic factors on the definition of height. Finally, a conjunctural analysis is carried out to interpret the evolution of height as experienced in each period, taking into account the changes in the conditioning factors obtained.

2. PREVIOUS STUDIES, THE SAMPLE AND FIRST RESULTS

The evolution of the height of Puerto Ricans attracted academic interest relatively early on. It was precisely aimed at showing the racial superiority of the new colonizing power that Fleage (1917) studied the height of university students. Anthropologist Franz Boas (1920) did the same for the school children in Utuado and the military personnel in San Juan, although this was tainted with that purpose and excessive importance attributed to indigenous genetic inheritance.

The truth is that these studies, at least in their historical aspect, were not continued. It was only in 1948 that the administration regained interest in anthropometry with the help of Thieme (1959), with very unsatisfactory results on the effects of health policies. The author sharply defined Puerto Rico as a "*Paradise of problems*" due to "*the most tragic aspect of what is the constant and inescapable undercurrent of human privation and misery which pervades the island*" (Thieme, 1959:2).

Almost five decades later, Godoy et al. (2007) insisted on the tragic effects of this poverty on the physical development of Puerto Ricans and the harmful consequences of the US occupation in 1898. This assessment was disputed by Marein (2020) and Marein and Devereaux (2024), who argues just the opposite. For him, the US occupation was little less than a blessing, but his bibliographical shortcomings (even disregarding Boas (1920) pioneering work on the height of school children), his lack of knowledge on the health and hygiene policies during the Spanish domination, the poverty of his sample and his determinism (Sanabria and Torres, 2020), almost childish in our view, detract from the validity of his contributions. He does not work with unpublished data (they are those of the Puerto Rico Heart Health Program collected between 1965 and 1980, already used by Godoy et al. (2007)), he does not adjust the height of those measured to their age (which in some cases reach 79 years of age), does not provide the essential statistics for this type of study (the frequency distribution or the standard deviation of the means), considers only six localities in the vicinity of San Juan and evaluates the material standard of living of Puerto Ricans born between 1886 and 1895 with 81 observations, which is oddly absurd. His work, in reality a puerile and uncritical exaltation of the US administration, ignores the very statistical precautions formulated by Okun (1961) and lacks any reliability in measuring the height of the island's citizens over the last two decades of the 19th century.

In the present article new calculations are offered with a much broader time projection using prisoner data, a group whose study has provided valuable results in other Latin American countries (Frank, 2006; Salvatore, 2019). Specifically, the records of admission to all the prisons on the island from 1800 to 1950 are used, which are kept in the *Archivo General de la Nación* (The Nation's General Archives). The height was listed, expressed in *pies* (feet), *pulgadas* (inches) and French *líneas* (lines) (those used in Spain and its dominions) or in the metric decimal system since 1860. It also details the place of birth, age, profession, race, religious creed, level of education and, obviously, the offence. In order to avoid ageing effects, only prisoners aged between 19 and 52

were included, following the methodology of Soltz, Baten and Reis (2013), excluding those with a height below 1,400 millimetres (18 statistically irrelevant observations). Just over 6,000 records were obtained for males with an average age of 28 and three months. This is a significant sample, according to the postulates of the central limit theorem, equivalent to one third of the prisoners whose personnel files have been kept. The sample is not strictly speaking a normal sample, as Jarque-Bera test indicates, but according to the centrality statistics and its frequency distribution it is close to N(0,1) (Table 1 and Figure 1).

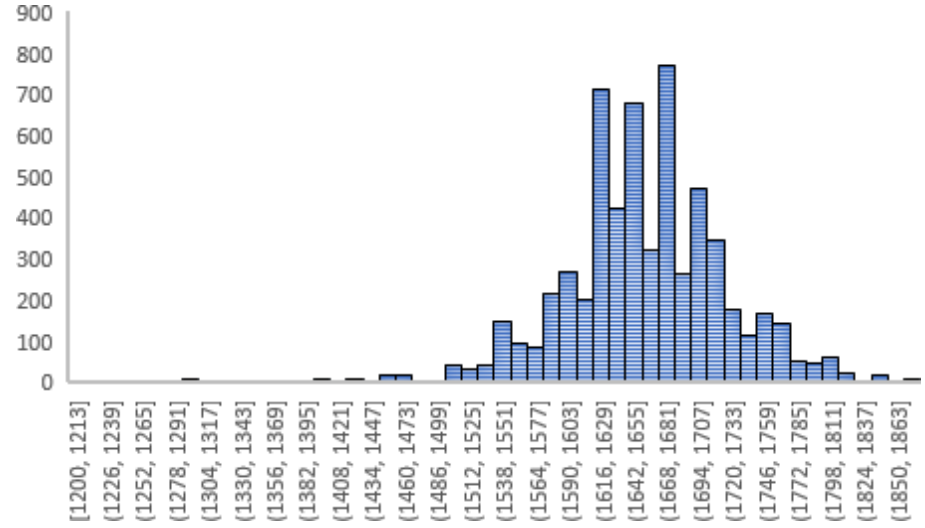
Tabla 1
Sample statistics and normality tests for the sample

Statistics	***Value***
Mean	1658.2
Median	1651.0
Standard deviation	64.45
Coefficient of variation	-0.03
Asymmetry	-0.57
5% percentile	1550.0
95% percentile	1760.0
Jarque-Bera contrast	1630.6

Source: Archivo General de Puerto Rico, Prisons, prisoner files and own elaboration.

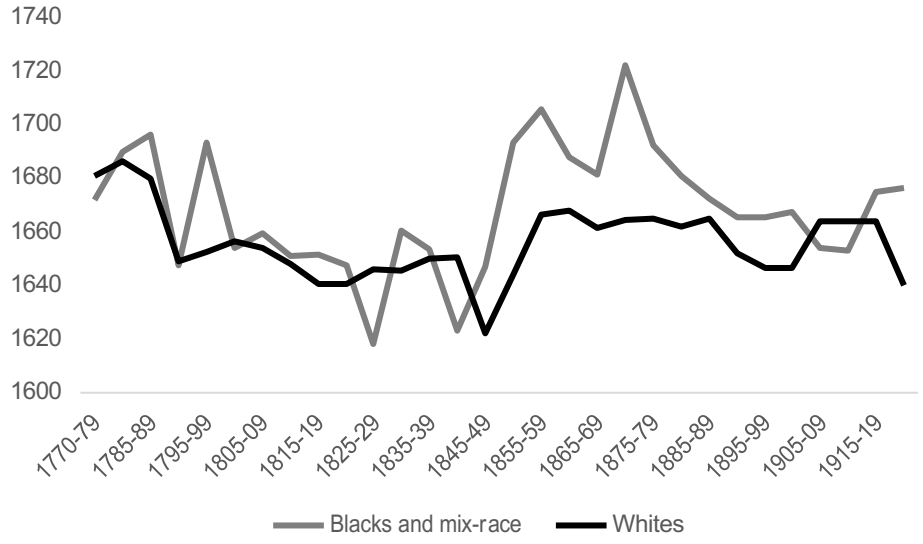
Figure 2 shows the results by race of calculations in five-year averages dated by the year of birth, a period which will be used as a reference in assessments, under the consideration that the material conditions enjoyed by the convicts at the beginning of their lives were decisive in their adult stature. It therefore seems convenient to represent a second series exclusively with those born in Puerto Rico (figure 3).

Figure 1
Frequency distribution of the sample



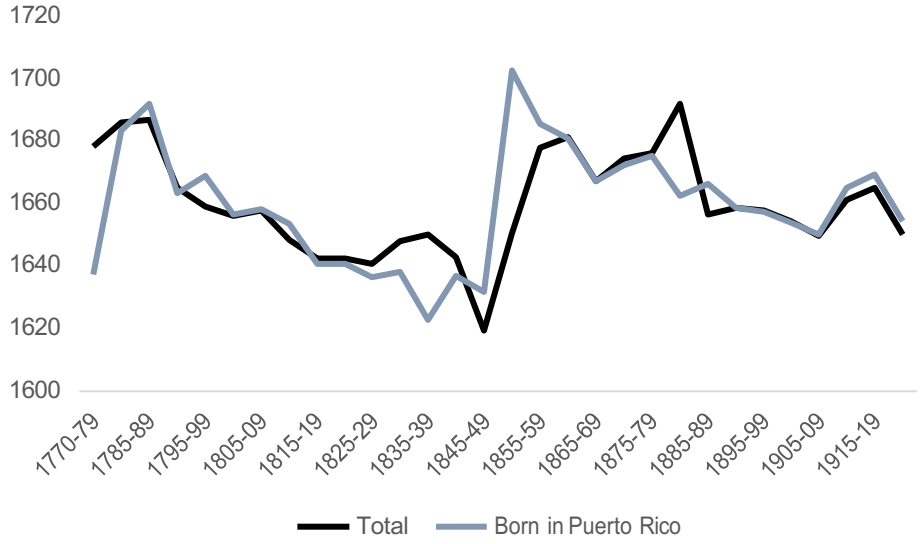
Source: *Archivo General de Puerto Rico*, Prisons, prisoner files and own elaboration.

Figure 2
Evolution of the height of prisoners in Puerto Rico according to race and year of birth (in five-year averages and millimetres)



Source: *Archivo General de Puerto Rico*, Prisons, prisoner files and own elaboration

Figure 3
Change in height of Puerto Rican prisoners by origin and year of birth (in five-year averages and millimetres)



Source: Same as figure 2.

Some remarks should be made about the significance of the sample. The relative weight of salaried prisoners was higher than that of labourers in the overall employed population, as has been found in Brazil (Baten, Perlger and Twrdek, 2009). It therefore presents the bias inherent to the consideration of such specific population samples (Bodenhorn, Guinnane and Mroz 2019). However, Moreno Lázaro (2023) has confirmed the suitability of this data, comparing the numeracy test obtained from it with that of the censuses.

It is therefore appropriate to carry out new comparisons between the sample and the population as a whole in order to identify and refute this validity. This is certainly not an easy task. The data from the 1860 Spanish census, conducted for tax purposes, is difficult to compare with that obtained from prison records due to the very imprecise professional categories it uses. The following published censuses (those of 1877 and 1887) do not provide quantitative information on the labour market. The 1899 census conducted by the US authorities was much more rigorous and detailed, although it is not very explicit in terms of labour information either. However, workers were grouped by broad sectors (agriculture, industry and commerce) without further detail. Comparisons between census data and prisoner data must be made with great caution.

Having made these preliminary remarks, in 1860, farm labourers accounted 20 percentage points more than in the sample and *Hacendados* 11 percentage points more than business prisoners. In contrast, the figures for day labourers in the 1899 census were closer to those in the sample (Table 1 and appendix). Interestingly, the weight of the white population was also much higher than that provided by the censuses (Table 3). The data have a certain downward bias for this reason, although it does not affect the trend in height.

Table 2
Sample composition (in percentages)

	1770-1814	*1815-1874*	*1875-1899*	*1900-24*	*1770-1924*
Race	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
White	80.3	75.3	61.8	61.1	68.6
Chinese	0.2	1.0	0	0.2	0.3
Indigenous	0.2	0.3	0	0	0.1
Mixed race	8.8	13.0	24.4	28.4	19.3
Black	10.5	10.4	13.8	10.3	11.7
Nationality	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Puerto rican	48.3	69.6	99.3	98.6	82.2
Spanish	44.9	27.8	0.2	0.3	14.5
Other nationalities	6.8	2.5	0.4	0.4	0.4
Education	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Literate	1.9	23.0	34.1	42.3	36.6
Illiterate	98.1	77.0	65.9	57.7	63.4
Occupation	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Day labourer	68.2	69.3	62.0	62.6	65.3
Landlords	0.1	4.2	2.6	2.1	3.7
Entrepreneurs	0.2	2.8	6.2	2.1	4.1
Sailors and fishermen	1.1	1.5	1.1	0.6	1.3
Officials	5.5	2.6	3.3	2.3	3.6
Employees in commerce and industry	24.7	20.0	24.9	29.2	21.7
Unemployed	0.2	0.4	0.1	0.4	0.3

Source: Same as table 1.

Table 3
Evolution of the Puerto Rican population, 1777-1920

Year	*Whites*	*% Total*	*Blacks*	*% Total*	*Total*
1775	30,709	43.7	31,909	56.3	70,212
1787	45,756	44.4	46,756	56.3	103,051
1802	78,281	48.0	71,578	52.0	163,192
1812	85,662	46.8	79,806	53.2	183,014
1820	102,432	44.4	106,46	55.6	230,622
1827	150,32	49.7	120,847	50.4	302,672
1830	162,311	49.8	127,287	49.6	325,838
1834	188,869	42.6	128,140	38.4	443,139
1846	216,083	37.1	175,791	37.3	583,181
1860	300,406	51.5	241,037	41.3	583,181
1877	411,712	56.3	319,936	43.7	731,648
1887	474,933	59.5	323,632	40.5	798,565
1897	570,187	63.8	315,632	35.3	894,302
1910	732,555	65.5	351,052	34.5	1118,012
1920	948,709	73.0	385,337	27.0	1299,809

Source: Vázquez Calzada, 1964, p. 2; Hunt and Grongan, 1921, p. 2.

3. IDENTIFYING THE DETERMINANTS OF HEIGHT

This this section presents different economic models with the purpose of identifying the determinants of height by means of time series and cross-section analysis.

As pointed out in the introduction, the first hypothesis is that the of the price of sugar strongly influenced the evolution of height. It is necessary to measure and contrast this incidence. To do so, several lin-lin and lin-log models have been used in which coffee traffic has also been considered. In the table results of those that have passed the following conditions are presented: 1) At least one of the coefficients is significant; 2) all of them have values greater than 0.009; 3) the F-statistic is greater than 4; and 4) there are no problems of autocorrelation, multicolinearity or heterostedasticity. These are not spurious models. Height is a non-stationary autoregressive process of order 1 and the rest of order 2.

All three models are quite robust, especially the third one. Their results would corroborate the thesis that there was an inverse relationship between height and sugar exports and a direct relationship between height and it price (Table 4). In the case of coffee, both magnitudes and height moved in the same direction. Since Puerto Rican

coffee enjoyed a captive market, the Spanish one, and it was impossible to compete with Brazilian coffee in the US and even the work conditions in the *cafetales* (coffe plantettions) were specially hard (Begard, 1983), producers were not obliged to reduce wages, unlike sugar *hacendados*.

Table 4
The influence of sugar and coffee exports on height of Puerto Rico inmates bon between 1770 and 1924

	(1)	*(2)*	*(3)*
Constant	1634.45(***)	1565.50(***)	1542.47(***)
	(6.18)	(21.59)	33.89
Sugar exports	-0.01		
	(0.01)		
Sugar price	0.02		
	(0.05)		
Coffee exports	0.04 (*)		
	(0.2)		
Coffee price	0.75 (***)		
	(0.37)		
Log sugar exports		-0.33	-5.41(*)
		(2.63)	3.06
Log sugar price		1.44(*)	15.85(**)
		(3.37)	(5.65)
Log coffee exports		7.48(***)	14.15(***)
		3.66	4.62
Log coffee price		16.01	
		5.64	
R2	0.48	0.53	0.37

Source: The same as Table 1 and Figure 4.

Asterisks denote significance as follows: * ** p-value ≤ 0.01; * * 0.01 < p-value ≤ 0.05; * 0.05 < p-value ≤ 0.10.

Following on from this a cross-section analysis was made using all the observations in the sample (Table 5). The same statistical requirements have been considered for the calculated models, although control variables have not been used so as not to obtain artificially high significance levels inherent to their use.

Firstly, the influence of the work the prisoner was engaged in was taken into account. To measure the incidence of this determinant, instrumental variables were not used, but rather the wage received in 1914, which ranged from $1.15 a day for *jornaleros*

(day labourers) to $4.7 for lawyers (Rogers, 1917). For businessmen a daily income of $5 was estimated. Model 1 shows a significant direct relationship between wages and height. However, there is a problem with this contrast: it is built on the assumption that the wage differentials between every group remained constant, which is hard to believe. Additionally, the extent of payments in kind and currency substitutes discourages its choice. It seemed more appropriate thus to examine the marginal status of day labourers instead. In that sense, their state was showed by using dummies, taking the value of 1 for day labourers and 0 otherwise. The results are conclusive in terms of the poverty they suffered (Table 5).

Table 5
Econometric height determination tests

	(1)	*(2)*	*(3)*
Constant	1656.37(***)	1659.62(***)	1659.25 (***)
	(6.43)	(2.73)	2.72
Wage	1.73		
	(3.14)		
Day labourer	-6.97(**)	-6.91 (***)	-7.83(***)
	(3.30)	(2.57)	(2.51)
White		-1.14	
		(2.24)	
Literate	3.96 (*)	3.59 (*)	3.97 (*)
	(2.08)	(2.08)	(2.07)
Urban birth	3.58(*)	3.20	3.58
	(2.01)	(1.97)	
Hurricane	-3.27(*)	-3.00	2.014 (*)
	(1.84)	(1.79)	(2.01)
R2	0.04	0.05	0.05

Source: The same as table 1 and Figure 4.

Secondly, the influence of education was examined. The data does not tell us very much since sources only indicate whether the prisoner could read or write, but it is enough to measure the effects of human capital on height. Dummy variables were also used here: 1 if the prisoner was literate and 0 if illiterate. The calculations confirm the incidence of education in the Puerto Ricans stature.

The conditioning factor of where the prisoner grew up is also difficult to measure because of the unclear distinction between rural and urban in Puerto Rico. Here San Juan and its metropolitan area, Ponce, Utuado, Huamacao, Arecibio and Mayagüez, were clas-

sified as cities. In the case of those braided in Spain, there is no major problem. Provincial capitals and the most populated localities were considered urban. Dummy variables were used once again, with a value of 1 assigned to rural areas and 0 to urban areas.

The result is very revealing: In Puerto Rico, the inhabitants of rural areas in the country's midlands, who were more exposed to poverty and anaemia, were severely penalised. On the other hand, those who lived in the cities were able to access public services, less available in the villages. In other words, just the opposite of what happened in developed Europe was the case here, which attracted the attention of Puerto Rican contemporary scholars (Valle, 1885: 80). However, place of residence in adulthood (i.e. at the time of imprisonment) did not have a statistically significant influence on height, which confirms the significance of one's childhood environment as hypothesised earlier.

An effort was made to measure the effects of hurricanes, to which a lot of importance has been attributed in this interpretation, taking into account the findings of Baten (2001 and 2002) on the incidence of climate variables, omitted by Marein, 2020 in his study about Puerto Rico. I considered that children borned during the first 60 months after the hurricane sufered its effects. Its influence on height was as decisive as that of *El Niño* in Mexico (Challú, 2010).

With respect to race, the models reflect the inferiority in height of the white population, but according to the Chow test applied to model 3 of table 5 (which has higher significance levels), it cannot be rejected that the coefficients of the variables were different for one and the other (the test result is F(5.4154=1.538 and p=0.172).

4. THE LONG-TERM EVOLUTION OF HEIGHT AND WELFARE

The effects of Enlightenment policies and sugar specialization

Around 1780, the inhabitants of Puerto Rico enjoyed a standard of living similar to that of Europeans, as was the case in other Spanish colonies in the Americas (Dobado and Garcia 2014; Challú, 2010; Llorca et al, 2018; Salvatore and Baten, 1998). However, from the mid-1780s onwards, Puerto Ricans suffered a severe deterioration of their physical condition (Figures 2 and 3). This was the social cost of Puerto Rico's insertion into the world market after the liberalisation of sugar exports in 1813.

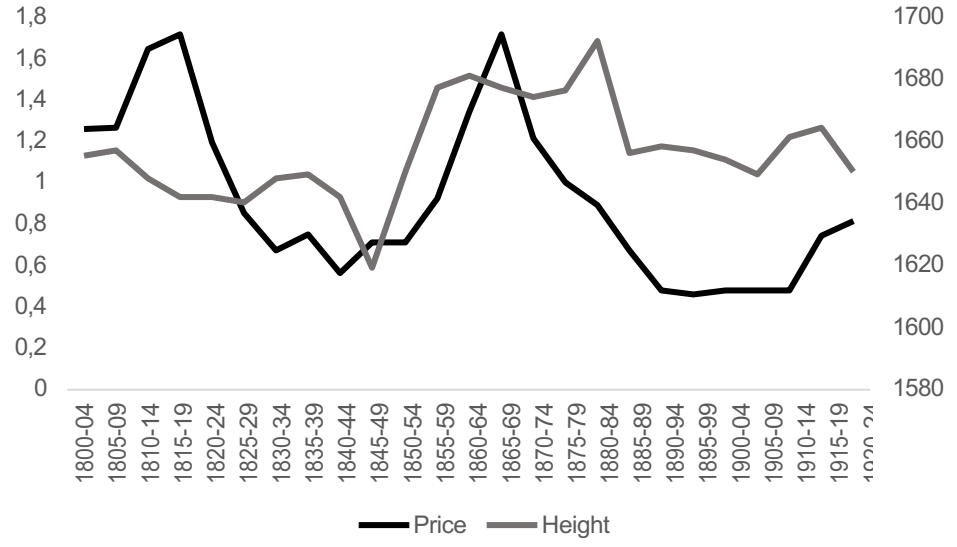
The loss of welfare particularly affected farm workers due to Puerto Rico's adoption of a labour-intensive model of sugar cultivation (Acosta, 1884). The reasons were the lack of labour availability after the abolition of the slave trade in 1817 and the failure of measures to encourage Spanish emigration (González, 1978; Viñas, 1856; Flinter, 1834:4-5; Brau, 1889: 17-18; Gómez and Sendrás, 1891).

The *hacendados* therefore used credit as an extremely coercive mechanism to attract and retain labour to solve this problem. During periods of inactivity in the fields, they

lent money to smaller landowners and day labourers for their subsistence. The landlords forced them to repay these loans by having all the members of the family, including the children, work for him without receiving wages until the debt was considered repaid. Since most of the labourers were illiterate, they signed contracts with abusive and usurious clauses (Brau, 1889: 37; García 1989; Gómez, 1970; Picó, 1982). This gave rise to the social condition of the *agregado* (saherecropper), also known as *alquilado* (rented) or *arrimado* (sponger), in practice, a white slave. He was not strictly speaking a free man. In fact, they did not appear as such in censuses and registries (Brau, 1889:12-13). In 1830 their number (38,407) exceeded that of slaves (29,929) (Córdoba, 1832). There is no similar case in European colonial history of the exploitation of workers coming from or originating in the metropolis itself.

Day labourers and *agregados* received a miserable wage, half in kind and the other half in *macuquinas* (cobs), a non-convertible hard currency that was legal tender only on the island and whose purchasing power decreased over time (Santiago, 1989). The *hacendados* were forced to lower wages, due to the fall in the price of sugar on the US market and in the productivity of labour (Figure 4) (Cordero, 1951: 27). They imposed as well the price of the sugar to the *colonos* (small land owners), most of the *agregados* themselves (Alemán,2018). Evidently, the material situation of the slaves was worse, even though in 1826 some of them- the *coartados*(alibis)- were able to do some lucrative work (Díaz, 1953).

Figura 4
Rthe height of Puerto Rican prisoners and the price of sugar in New York, 1800-1934 (in five-year averages, centimetres and dollars per pound)



Source: The same as Figure 2 and US Department of Commerce, 1975: 206-207.

Habitat conditions were extremely precarious for all of them. The free whites lived in huts made up of two rooms, one of them outside called *soberado* (a kind of porch) with a wooden floor and walls reinforced with a climbing plant *bejuco*) and a palm roof

(*yagua*). The kitchen was located in an adjoining building. The free blacks and those of mixed race lived in *bohíos* (cabins), literally cages made of reeds without any lighting. Both had no furniture other than hammocks. They had no latrine or cistern. Cabins and houses were distributed on the *hacienda* (ranch) in small settlements scattered around a larger one, known as *población* (village), through which slaves and *agregados* were forbidden to pass (Flinter, 1834: 7-78; Córdoba, 1832:2). They lived in overcrowded huts next to the *ingenios* (sugar mills), lacking any minimum comfort. They were authentic "*casas de reclusion"* (confinement houses) for all of them (Brau, 1885: 26).

Their diet was reduced to the products they could collect or grow around their miserable dwellings (maize, bananas, rice) and fish. The expansion of sugar cultivation led to a decline in meat and milk consumption (Figure 5). Occasionally they consumed *tasajo*, seasoned or jerked meat imported from Argentina and Uruguay. They made their own bread, not from wheat flour, but from the flour obtained by grinding cassava, an indigenous plant. They rarely ate more than once a day, and never breakfast (Valle, 1885:28; Brau, 1889:48).

Figure 5
Cattle farming in Puerto Rico, 1828-1864 (in thousands of heads)



Source: Acosta, 1866.

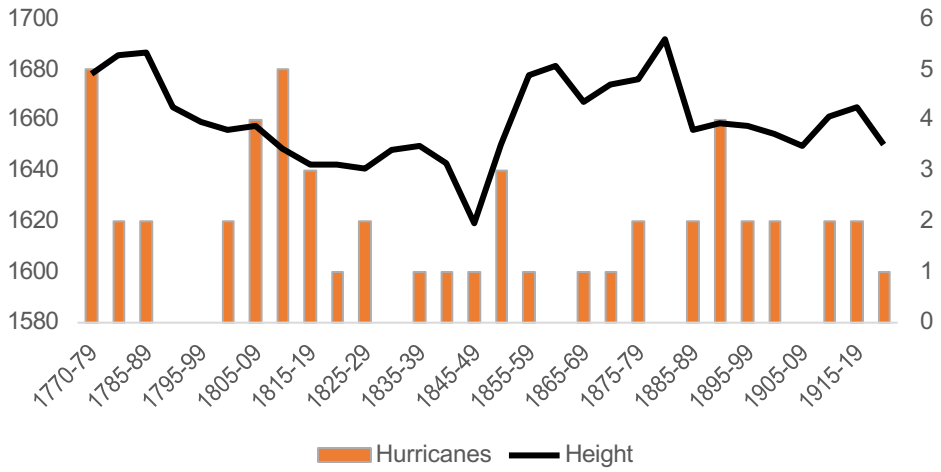
Hygiene was very poor due to the lack of bathing areas, soap and cleanliness habits (Valle, 1885:92). They could hardly develop them at school, which was attended only by white children from San Juan, the capital city of the colony. Health services also left much to be desired. In fact, in the interior, the so-called *curiosos* (quacks), supplanted the doctors, despite persecution by the authorities.

Merchant traffic facilitated the spread of epidemics. Cholera, plague and smallpox visited the island all too frequently. Malaria, marsh fever, typhoid, tuberculosis, yellow fever and even leprosy became endemic illnesses (Valle, 1885; Rigau, 1991).

But the disease that hit the Puerto Rican population hardest was anaemia caused by uncinariasis. It was due to a parasite known as *gusano gancho* (hookworm), which attached itself to the walls of the intestines. Labourers and slaves walked barefoot on roads contaminated by their own excrements and by irrigation with water drawn from cesspools (Valle, 1885: 22). The simple contact of feet with the worm was enough for contagion. Poor eating habits also led to anaemia and poor physical growth, in particular the abuse of alcohol, coffee and tobacco to mitigate the sensation of hunger (Valle, 1885: 51).

Finally, hurricanes wreaked recurrent havoc on this island in the eastern Caribbean (figure 6). In addition to the heavy loss of human life, there was also the loss of crops, which led to ruin and starvation and the spread of epidemics among a population that lived in the open after the destruction of their homes (Valle,1885, p.51).

Figure 6
Height of prisoners and hurricanes suffered in Puerto Rico, 1779-1924 (in five-year averages and number)



Source: Ramírez, 1932 and the same as figure 2.

All these reasons led to the small stature of the Puerto Rican farm workers, the so-called *jíbaros* (peasants), which so impressed foreigners visiting the island (Valle, 1885: 48). Even the Catholic Church denounced the "*flaqueza del cuerpo*" (frailty of the body) of the island population (Alonso, 1849: 148).

A new model should be run in this period in order to detect and measure these changes. The estimates meet the requirements listed above. In all of them precise statistical observations were used for all municipalities on the island (a total of 70). Data compiled by the *Secretario de Gobernación* (Governing Secretariat) since 1824 (Córdoba, 1832) has been used. The quantitative information corresponding to their place of birth has been attributed to those born in that time span (a total of 227 inmates).

With this data it is possible to measure the effect of the determinants detected in the previous contrast (Table 6). As pointed out earlier, access to education (measured in

number of teachers per thousand inhabitants), housing type and legal status conditioned the physical growth of Puerto Rican males. It also allows us to assess the effects of their agrarian specialization (measured by fiscal indicators).

Table 6
Ecomometric contrasts of height determinants for puerto rico inmates born between 1824 and 1832

Constant	1739.1(***)
	(120.08)
Teachers per thousand inhabitants	28.5(*)
	(89.28)
Territorial wealth per capita	-0.388(*)
	(0.31)
Slaves	-4.31
	(2.68)
Agregados	-7.78
	(5.61)
Inhabitants per house	4.9(*)
	2.32
Inhabitants per hut	-2.81(*)
	(3.61)
R2	0.05

Asterisks denote significance as follows: * ** p-value ≤ 0.01; * * 0.01 < p-value ≤ 0.05; * 0.05 < p-value ≤ 0.10.

Source: The same as Table 1 and Córdoba (1832).

The Spanish authorities were by no means insensitive or entirely negligent in the face of these calamities. From 1765 onwards they designed a reformist policy inspired by the French Enlightenment. But the wars against England in the Caribbean prevented these educational, sanitary and urban improvements from being implemented in their entirety until 1813, when Alejandro Ramírez, an economist and follower of Adam Smith, took them up again after being appointed *Intendente* (the highest civil authority in the colony) (Santamaría, 2005; Gutiérrez, 1953; Galvin, 1979). Ramírez then promoted the construction of a hospital for the poor in San Juan, the training of doctors, commissioned investigations into the causes of yellow fever in the midlands and regulated the conditions of rubbish collection and water supply in the capital city (Acosta, 1866; Flinter, 1834:40; Fernández, 1923, pp. 186-90). His work was continued from 1823 by the new *Intendente*, the Venezuelan physician and humanist José Domingo Díaz, appointed by *Capitán General* (Captain General) Miguel de la Torre. He was responsible for the first vaccination campaigns against smallpox (the effects of which are known (Voth and Leunig, 1996) and for the sanitary inspection of the ports. All this led to a slight increase in height, despite the scourge of smallpox between 1830 and 1834 (Figures 2 and 3).

New forms of labour exploitation and physical decay (1834-1872)

However, these improvements were limited in time and space. Only Puerto Ricans living in San Juan enjoyed them (Flinter, 1834:39). Despite its commendable results, this health policy.-proprely the first applied in the colony- encourage segregation, as it excluded, in fact, white women and black people from medical benefits (Salcedo, 2020).

Even more, this health policy as not maintained. After Miguel de la Torre's dismissal in 1837, what was called "*el régimen de la desconfianza*" (the regime of distrust) began, characterised by the loss of rights for Puerto Ricans (Gómez and Sendrás, 1891: 53-58). The new Captain Generals were not involved in health issues. They also neglected education because of their conviction that literacy would bring about revolution (Sardá, 1888:19). There were hardly any schools in the middle of the country. At best, the children of day labourers attended school for three hours a day in order to be able to work (Alonso, 1849:184; Sardá, 1885:15). The teachers taught, but didn't educate. Students only memorised the information the teacher provided orally, not learning to read or write (Fernández, 1923: 644).

Additionally, day labourers and slavesuffered an even greater deterioration in their material well-being and legal status. In order to reduce absenteeism, Captain General López de Baños ordered in 1838 that all workers, vagrants, transients and women register at the colonial offices. Once identified and located, Spanish civil servants would assign them to an *hacienda* where they would be forced to work in exchange for an imposed salary. Juan de la Pezuela went even further in 1849 with the introduction of the *régimen de la libreta* (the Notebook Regime) (Picó, 1982; Brau, 1889:51-53; García, 1989), during which the day labourer had to carry a notebook in which the owner would write down mishaps, penalties and daily work performance to be accountable to his *amo* (master). The situation got even worse for slaves in 1848, with the passing of a code exclusively for them. Not only did they lose a good part of the rights won in 1826, but from then on they were subjected to military jurisdiction that did not penalise the punishment, mistreatment and exploitation of slaves (Carlo, 2009; Negrón and Mayo, 2007).

Fortunately, the downward pressure on wages eased off, thanks to the rising price of sugar from the early 1850s until the end of the US Civil War in 1865, leading to considerable growth in height, despite the hurricanes of 1851 and 1852 (Figures 2 and 3). Additionally, after the cholera epidemic of 1855, which caused 30,000 deaths (Carroll, 1899:10), the Madrid government became aware of the need to prevent epidemics through prophylactic measures, ordered by the *Junta Superior de Sanidad* (The Superior Health Board). That same year, it prohibited the extraction of cattle from the island to improve the diet of the needy (Fernández, 1923:193) (Figure 5).

The government also tried to put an end to labour abuse. The new 1862 *Instrucción sobre jornaleros* (instruction on day labourers) sanctioned wage exploitation and the arbitrary extension of the working day. In 1865, Cánovas del Castillo, then *Ministro de Ultramar* (Minister of Overseas Territories), ordered the construction of schools in all the island's towns, aqueducts in the largest population centres, the withdrawal of the cobs as currency and the obligation to pay in cash (Valle, 1885). But the most impor-

tant measures came after the 1867 hurricane as well as the independence uprising in September 1868. The time had come to establish liberal capitalist labour relations and to address the "*cuestión social*" (social question). Otherwise, there would be a risk that discontent would provoke a war like in Cuba between 1868 and 1878.

The Acosta (1866) data, along with those of the population censuses, allow us to contrast the incidence of these determinants in the central years of the 19th century. A total of 155 observations have been used in the same way as in the previous contrast, (Table 7). Puerto Rico maintained its wealth at the expense of the poor. Where day labour and slave labour predominated, height was smaller. Commercial strength, on the other hand, ensured greater prosperity. The level of access to education and decent housing conditioned the magnitude of the detected growth in height after the abolition of slavery and the "*régimen de la libreta*".

Table 7
Ecomometric contrasts of size determinants for puerto rico inmates born between 1859 and 1865

Constant	1704.3(*)
	(26.56)
Rustic wealth per capita	-0.04
	(0.91)
Slaves (% black population)	-1,62(*)
	(1.12)
Day labourers (% free population)	-0.22(*)
	(1.25)
Traders (% free population)	1.77(*)
	(3.57)
Literate	0.28(*)
	(1.40)
R2	0.03

Source: The same as table 1 and Acosta (1866).

The abolition of slavery and the dignification of the day laborer (1873-1897)

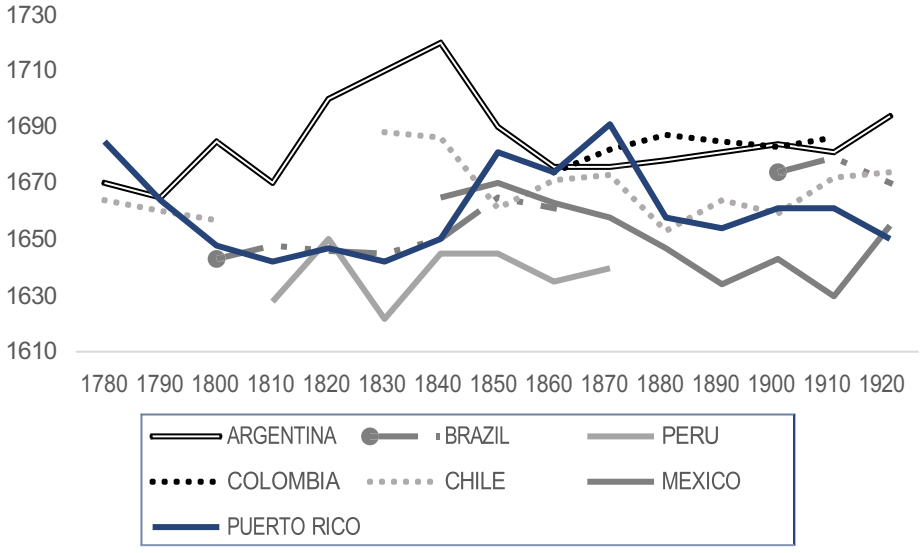
In 1873 the Spanish Parliament approved the abolition of the *régimen de la libreta* and the slavery, after seven years of debate and consultation. In the new 1876 Constitution, the rights of Puerto Ricans were set on a par with those of Spaniards. They were able to benefit from the health and education regulations that had been in force in Spain since the mid-1850s. Cánovas del Castillo, now Prime Minister, implemented a comprehensive improvement of health, education, irrigation canals and the provision of public goods

in the cities (Fernández, 1923: 311; Sardá, 1885: 15). Puerto Rican doctors and hygienists also made remarkable progress in the fight against epidemic diseases (Corchado, 1885; Valle, 1885).

All these reforms contributed to a substantial improvement in living standards in Puerto Rico, unknown in its magnitude prior to then (Figures 2 and 3). It's required at this point explore the hypothetical structural change caused by this firts milestone (the labour market reforms in 1873) in the period that to a greater extent could have caused sudden variations in the standard of living: using the Chow test in model 3 of table 5. The results confirm the findings mentioned earlier. Indeed, that structural change did come following the abolition of slavery and the "*régimen de la libreta*" can be affirmed at a confidence level of .90, in accordance with to the test statistic obtained (F(5,4169)=3.1 and p= 0.060).

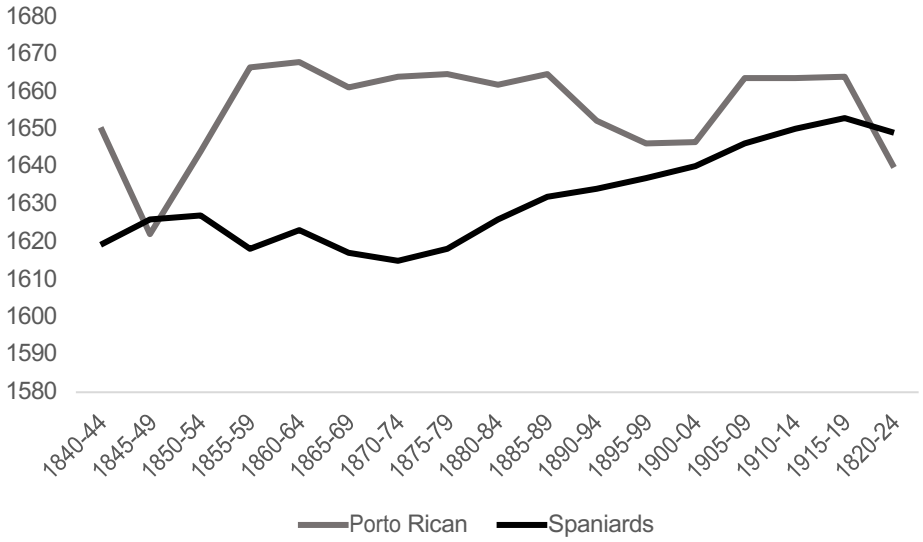
This time the great beneficiaries were blacks and those of mixed race, who now became free men and wage earners, unlike what happened in the United States in the same period (Meloney and Carson, 2008: 243). In the 1870s, height in Puerto Rico approached that of the more populous Latin American countries, although the data in the figure must be considered with extreme caution because of the differences in the groups studied, the racial disparities and the chronological period of measurement (Figure 7). Moreover, the height of whites born in Puerto Rico is 5 centimetres taller than that of Spaniards (Figure 8).

Figure 7
Average ale height in Latin America, 1780-1920 (in millimetres)



Source: Baten, Pelger and Twerdek, 2009; Lloca-Jana et al 2018. 2019 and 2021; Fran, K, 2006; Montero Monasteiro, 2013; Challú, 2010; López-Alonso, 2010; Salvatore, 2007 and 2019; Salvatore and Baten, 1998; Meisel and Vega, 2010; Llorca-Jana, Martínerz-Carrión and Salvatotre2025, and the same as Figure 2.

Figure 8
Average height of Spanish recruits and Puerto Rican white prisoners (in five-year averages and millimetres) (1840-1824)



Cámara et al, 2019 and the same as Figure 2.

In any case, improvements did not reach other determinants of biological well-being. Such was the case of housing. The data reproduced in Table 8, based on 152 observations, shed light on the persistence of the punishment of those who lived in the *bohíos*.

Table 8
Ecometric contrasts of size determinants for puerto rico inmates born in 1877 and 1878

Constante	1719(*)
	(28.12)
Territorial waelth per capita	1.60(*)
	(1.10)
Bohíos	2.10(*)
	(1.00)
Houses	0.10(*)
	(0.41)
R2	0.04

Source: The same as table 1 and Úbeda (1878).

In addition, this improvement in welfare was not sustained. In 1879, sugar specialisation lost its vigour due to the spread of cane disease, the 1876 US-Hawaii trade agreement and the end of the war in Cuba, its great competitor, in 1878. On the other hand,

the late and limited implementation of the *centrales* (the new production complexes that transformed sugar cane on a large scale), and poor railway communications (only available from 1880) reduced the competitiveness of sugar against Cuban and the obtained from beet in the US (Ramos, 1981). In a context of a sharp fall in price, landlords were only able to maintain a minimal market share through the decline in wages, that then led to a decrease in height (Figures 2, 3 and 4). The maximum wage for a farm labourer in 1885 (no more than 40 cents) was equivalent to half the income required to provide sufficient food for a family of six members (Valle, 1885: 87). The liberalisation and the cattle foreign trade presumably reduced consumption in Puerto Rico (there are no available data to confirm this) (Jimeno, 1890: 49). The drop of exports and sugar prices throughout the 1890s aggravated the situation. As wages in the mills were adjusted to prices, their fall meant a huge deterioration in the diet of day labourers (Figures 2, 3 and 4).

In order to compare the determinants of height at the end of Spanish rule, two exceptional documents have been used: the compilation of the results of the 1897 census and the one drawn up by the new authorities in the United States in 1899 (Table 9). The last of the Spanish decennial censuses was not published. However, previous local records have been preserved, from which invaluable information has been collected.

Using a new simple consisting of 644 prisoners, it is possible to make the most diverse and plausible contrasts in the identification of the determinants of height. In this respect, the technical change in sugar manufacturing had no major effect on the welfare of day labourers. Since it was not transferred to cultivation, wage exploitation was still accurate The schooling of those from wealthier families ensured harmonious growth. The model shed statistically significant light on the influence of housing conditions on height. The lack of latrines is shown to be responsible for the decrease in height due to the spread of anaemia as described previously, a spread that the supply of drinking water would limit, according to the results of the estimates (Table 9).

Table 9
Ecometric contrast of height determinants for Puerto Rico inmates born between 1894 and 1899

Constant	1701,0(*)
	(35.00)
Rustic wealth per capita	0.22(***)
	(0.76)
Agricultural labour force (%)	-0,31(*)
	(0.58)
Mortality	-0.20(*)
	(0.56)
Literate (%)	1.01
	(0.82)
	(1.55)
Houses without latrine (% of total)	-0.5(**)
	(0.28)
Water supply by tanker	0.48
	(0.30)
R2	0.15

Asterisks denote significance as follows: * ** p-value ≤ 0.01; * * 0.01 < p-value ≤ 0.05; * 0.05 < p-value ≤ 0.10.

The welfare effects of the US occupation (1898-1924)

When US troops forcibly occupied Puerto Rico on 12 May 1898, they found the island devastated by the latest hurricanes (Figure 6). The US government immediately appointed Major John Van R. Hoff as head of the implementation of the *Puerto Rico Relief Programme*. To this end, he commissioned a report on the socio-economic situation of the Puerto Ricans, with alarming results regarding their food and health (Van R. Hoff; 1901a and 1901b; Carroll, 1899). Colonel Bailey Kelly Ashford, after living for several weeks with day labourers from different parts of the country, was very accurate in his diagnosis. The labourers got up between 4am and 6am and breakfast was exclusively coffee. At 11 am, they would take a two-hour break for lunch but their meal was just a piece of cod and bananas. Their working day lasted until 5 o'clock, then having rice and beans for dinner. If they were lucky, they'd have a piece of butter a day. For those 9 to 11 hours a day, they earned 35 cents (five cents less than in 1880), much of which was spent buying tobacco and rum. "*Bad food and bad hygiene are responsible for much of its power of evil*," Ashford concluded.

The report found that, in many respects, the health services in place were acceptable. The irrigation programmes were also praised. Observers emphasised, however,

the need to invest in sewerage, the installation of household latrines (three out of four houses lacked them), the supply of water (only one in 17 inhabitants received it through an aqueduct), and the fight against illiteracy, infant mortality, anaemia and particularly prostitution (Sanger, 1899:114).

But the 1899 hurricane, a few months after the effective incorporation of Puerto Rico into US sovereignty, in which 3,000 people lost their lives, took with it the hope of an increase in the standard of living under the new administration, which soon forgot its promises. There are no interventions worth mentioning in solving the educational and residential problems in the early years of domination.

At least, the authorities were even more concerned about the ravages of anaemia (Rigau, 2009-10). In 1899, the new *Asamblea Popular* (the parliament) and Governor Beekman Withrop created a commission whose members were Dr. Pedro Gutiérrez Igarubide, Dr. Walter King and the aforementioned Colonel Bailey K. Ashford to report on the incidence of this disease. After examining 18,000 people, they concluded that most of the population had this illness, given that 85% of Puerto Ricans walked barefoot (Gutierrez, King & Ashford, 1906). Asfhord set up a total of seven *Servicio de Dispensarios de la Anemia* (Anaemia Health Centres), staffed by nurses and teachers trained by him to disseminate hygienic measures among the population. Ashford even discovered a new tropical disease mistaken for it: sprue (Ashford, 1946). But without improvements in wages and food, the struggle was futile. Those cured systematically got it again (Crosby, 1987). In 1908 the Governor suspended the programme despite protests from doctors and nurses (Governor of Puerto Rico, 1909, p. 25). At that time, the leprosy epidemic of 1912 also revealed the enormous shortcomings of Puerto Rico's health system.

The adverse consequences of the health policy implement since 1898 on Puerto Rico's poorer population have been convincingly revealed by the historiography (Mulligan, 2014; Díaz, 2022; González, 2025). The measures adopted by the US administration, unequivocally elitist, increased the social segregation and the inequality in access to medical services, stigmatized the *jíbaro* by blaming him for his own adversity on moral grounds, and worsened the deterioration of *jornaleros*' physical and material well-being.

The *colonos*, on the other hand, suffered the consequences of the change in the monetary system. Instead of applying with the introduction of the dollar the one-for-one exchange rate that had been in force until then, they devalued the *peso* by 20%, which reduced their wealth by the same percentage, as well as that of savers (Enamorado, 1975; Alemán, 2018).

The five-fold increase in exports of sugar to the United States, once the tariffs were lifted, demanded further sacrifices from the wage earners. Day labourers were paid with *fichas* (tokens) to be used in the supermarkets of the mill itself. The owners managed the wages as they wished only by raising prices at the supermarkets (Crist, 1948). On the other hand, Puerto Rican coffee lost the Cuban and Spanish markets without gaining the US one, due to the maintenance of tariffs (unlike sugar) (Pumarada, 1990). The devaluation of the currency and of wages drove labourers and *colonos* to the point of destitution (Alemán, 2018).

However, aside from purely circumstantial issues, it is clear that the US government neglected its obligations to improve the material well-being of the population of the new colony, as its officials were overwhelmed by the effects of the hurricane and unable to adapt to an environment they were completely unfamiliar with. All that remained of the initial good intentions was propaganda. Asfhord's reporting of this inaction were ignored.

With the US joining World War I in April 1917, the Washington government was forced to meet the social demands of the inhabitants of an island whose young men were losing their lives on the battlefield in Europe fighting in its army. The Jones Act that year granted citizenship to the Puerto RicansIn 1919, the government again became concerned about the hookworm disease. It set up the Office of Unciniarisis Control, which promoted the construction of latrines. But with the fall in sugar prices following the 1921 crisis, hardship and misery returned (figures 2 and 3).

In short, during the first five lustra of island rule, there was no substantial increase in the standard of living. According with the results of Chow ($F(5,4169)=1.11$ and $p=0.341$), US rule did not bring about any change, at least during its first two decades.

Neither did the Spanish rulers do so badly, nor did the new authorities have the experience, knowledge, instruments and resources to do much better, as they expressly acknowledged (Governor of Puerto Rico, 1909:23). The evolution in the height of the population raises incontrovertible conclusions about the absence of tangible improvements in welfare (figures 2 and 3), in contrast to what happened in other Latin American countries and in Spain itself (figures 7 and 8).

Despite the caution with which the results must be taken due to the small sample size (larger, in any case, than that considered by Marein (2020), it is inferred from the data that, at best, height stagnated in Puerto Rico over the first two decades of U.S. occupation. In other words, data here corroborates Godoy et al. (2007) hypothesis and refute Marein (2020). Vázquez Calzada (1984), a prominent Puerto Rican scholar and pioneer in population censuses analysis, whose work Marein (2020) ignored, demonstrated in an unquestionable way, that high levels of mortality persisted significantly throughout the first third of the 20th century without significant variation.

The determinants of height did not change substantially after annexation by the United States (Table 10, obtained with 384 obsevations). Continued agrarian specialisation, illiteracy and overcrowding continued to hinder the growth of Puerto Rican males. The first of these factors was then considered using the production of different goods, which shows coffee production as having the most welfare-damaging effect due to the bitter consequences of the loss of the Spanish market. Although the data is poorer (especially for housing), its econometric analysis reveals two aspects not discussed so far. The results emphasise the importance of education in physical growth. The contrasts show that parents adjusted the number of children to the available resources. Hence there is a direct positive relationship between height and family size (Carson, 2012), an issue not addressed so far. Although data was not available on the hygienic facilities of homes, it was possible to measure the material welfare costs of overcrowding.

Table 10
Ecometric contrast of height determinants for Puerto Rico inmates born between 1905 and 1910

Constant	1675.1 (***)
	(41.12)
Coffee production per capita	-1.31(*)
	(0.66)
Tobacco production per capita	0.58
	(1.00)
Sugar production per capita	-0.11(*)
	(0.14)
Illiterate population	-1.35(**)
	(0.51)
Average household size	35.8 (***)
	(7.55)
Inhabitants per dwelling	-20.0(***)
	(6.23)
R2	0.12

Asterisks denote significance as follows: * ** p-value ≤ 0.01; * * 0.01 < p-value ≤ 0.05; * 0.05 < p-value ≤ 0.10.

Source: The same as table 1 and Hunt and Grongan, 1921

CONCLUSION

The series on the height of male prisoners in Puerto Rico is very useful to shed light on the development of the welfare of the so-called "*plantation economies*". In this case, the excessive dependence of the whole economy on the evolution of exports of sugar and the competitive strategies of the *hacendados* forced an exploitation of the labour force, a wage restraint, which hindered the growth of welfare experienced in other countries, common at the birth and spread of mono-export agrarian capitalism. Puerto Rico suffered what Challú, 2010 acutely called "*the great decline*". This is demonstrated by the evolution of height. In other words, in times of growth in this type of economy, biological well-being would fall, as it did in more prosperous societies, but over a much longer period of time, and not only in the first phases of industrialisation, as was the case in the more prosperous ones (Margo and Steckel1, 1983; Baten and Komlos, 1998; Komlos and Coclanis,1997). As has been studied, this model of economic growth led to a deterioration in living standards also seen in other Latin American countries. In Puerto Rico this was caused by institutional and climate factors.

The former concerns the organisation of labour relations. Although their agriculture was fully integrated into the world market, pre-industrial practices of labour recruitment continued on the labour market. The obscene continuity of slavery, its extension, in practice, to the white population, and the imposition of the wages led to the misery of agricultural workers, which the evolution of height confirms.

It is worth stressing the tremendous damage to well-being caused by slavery and the absolute subjugation of farm workers, whether white or black. Apart from their harsh legal status and labour exploitation, they had very limited, if not zero, access to food resources, whether plant or animal, which were however freely available to free men and women.

With respect to the latter factors, tropical climatology, especially hurricanes, caused recurrent damage to crops and infrastructures, with a high cost in terms of welfare.

Poor housing conditions, lack of hygiene and educational deficiencies further reduced well-being. Puerto Ricans were small in height because they ate little and poorly, were paid low wages and suffered from anaemia caused by parasites.

The Spanish colonial administration was aware of these evils but it reacted late. Only in the middle decades of the 19th century did the government liberalise the labour market and put an end to worker abuse, extend schooling to the inner areas of the island, improve sanitation, launch vaccination campaigns and provide drinking water to urban dwellers, among other merits. But intensifying competition in the world sugar market and climate misfortunes undermined these achievements.

Things did not change after US occupation. Good intentions ran up against the same two constraints. In addition, there was a complete lack of knowledge of the area. Biological standards of living did not rise after annexation. After the change of sovereignty, civil rights improved but welfare did not. In fact, it took a long time to do so in any appreciable and significant way. It is true that the debate on this issue is far from closed with a conclusive answer (Ayala and Begard, 2020), but this anthropometric approach offers incontrovertible results, at least for the poorest population in the early years of US sovereignty.

US administrations was as well extremely negligent in the provision of educational services. Its grandiose announcements of literacy came to nothing, as they were more concerned (and not excessively so) with religious and identity indoctrination or the spread of English. Puerto Ricans were condemned by both sides to illiteracy and, with it, to a complete lack of knowledge of hygiene practices and healthy behaviour.

Nor did the US dominium lead to an improvement in equity, from the perspective of the biological well-being of the inhabitants of Puerto Rico. Only the wealthiest residents of the cities enjoyed an adequate provision of public goods. The rest of the island, where poverty, disease, environmental degradation and segregation reigned, was not reached by the actions of an absent state. Plans to improve medical services in rural areas had disappointing results, widening the gap in access to healthcare between rich and poor

that had begun around 1830. The high mortality rate on the island was not so much due to epidemics that knew no social distinction, but to anaemia, which exclusively affected agricultural workers.

During the two colonial periods, apart from the factors mentioned above, the population of Puerto Rico paid a high price for its hyper-specialisation in sugar, whether through the work of the old Spanish sugar mills or the modern refineries owned by large US companies. Sugar cane was an alien, corrosive plant that destroyed the soil, limited the production of native fruit, reduced the area available for livestock and made the territory much more vulnerable to hurricanes due to the changes it caused to the terrain, as happened in a much more intense and lasting way in Haiti. It was precisely the specialisation in agriculture that made it more vulnerable to these meteorological phenomena due to the transformations in the soil and the type of settlement that were inherent to it.The environmental damage caused by the sugar option had tragic effects on well-being, which would be even greater if we included rice and tobacco in the equation.

Thus, whichever of the two colonial experiences we study, both reveal the difficulty the State encountered in counteracting the slow-down in the improvement of living standards in tropical agricultural-export economies.

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APPENDIX

Employed male labour force in puerto rico (percentages)

1860

Ocupation	***%***
Soldiers, civil servants and clerics	11.5
Lanlords	12.1
Wage eaners	49.3
Slaves and agregados	22.7
Bussines men	4.4
TOTAL	100.0

1899

Sector	***%***
Agriculture, fishing and mining	73.3
Industry	7.5
Trade and Transport	8.3
Profesional services	10.9
TOTAL	100.0

Source: Departamento de la Guerra (1899): 32 and 98.

Average height of male prisones in Puerto Rico by race (mm)

Year of birth	*Total*	*Whites*	*Black and mix-race*
1770-79	1678	1680	1672
1780-84	1632	1686	1686
1785-89	1691	1670	1680
1790-94	1663	1648	1649
1795-99	1659	1652	1693
1800-04	1656	1656	1656
1805-09	1658	1653	1659
1810-14	1653	1648	1650
1815-19	1640	1640	1651
1820-24	1640	1640	1647
1825-29	1640	1646	1618
1830-34	1648	1645	1660
1835-39	1650	1650	1653
1840-44	1642	1650	1623
1845-49	1619	1622	1647
1850-54	1650	1644	1693
1855-59	1677	1666	1705
1860-64	1680	1668	1668
1865-69	1667	1661	1681
1870-74	1672	1664	1722
1875-79	1675	1664	1692
1880-84	1691	1661	1680
1885-89	1656	1664	1672
1890-94	1658	1692	1665
1895-99	1657	1646	1665
1900-04	1653	1656	1667
1905-09	1649	1663	1663
1910-14	1665	1663	1652
1915-19	1668	1664	1674
1920-24	1654	1640	1676