

On the Height of Spanish Recruits During the Early Phases of Modern Economic Growth*

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I. Introduction

This paper is part of a larger project that investigates long-run changes in the biological standard of living of Spaniards during the 19th-20th centuries. Data collected focus on physical stature at the onset of modern economic growth. We will analyze whether there is any evidence of the historical divergence between the trends in heights and income, as observed for many now-developed countries in the nineteenth century. The existence and nature of the phenomenon referred to as the mystery of the "early industrial growth puzzle" or the "antebellum puzzle" in the American context, has been the subject of discussion and debate in North America and Europe¹.

We construct a height series on the basis of records of 127,310 conscripts born between 1837 and 1913 in nine towns of Southeastern Spain and examine the relationship between height and GDP per capita. Data show that physical stature declined between the 1850s and 1870s. From these results, we derive implications about the biological standard of living at the beginning of Spain's modern economic growth. Finally, the height trends are placed in an international context.

II. Anthropometric history in Spain

The beginning of anthropometry in Spain is associated with the so called "health debate" initiated by military and hygienist physicians, including Monlau whose, *Remedios del pauperismo* (1845), marked the beginning of this debate². In view of "the moral and physical decline of the population", as some put it, reports on physical stature were published and the causes of the "physiological degeneration of civilised countries"³ explored. The Spanish response to the pioneering work of Villermé and Quetelet in epidemiological auxology appeared from the 1860s onwards⁴. The issue was first left in the hands of military physicians, but by the turn of the twentieth century it was also being discussed by anthropologists, who warned about the disparity of "races" and the existence of inequalities across social groups. The military physi-

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- 1 J. Komlos, Shrinking in a growing economy? The mystery of physical stature during the Industrial Revolution, in: *Journal of Economic History* 58, 1998, pp. 779-802.
- 2 The first study was by the physician G. Andrés-España, *Consideraciones sobre las variedades de estatura e influencia que ejercen en la salud*. Discurso leído en el acto de investidura de Doctor, Facultad de Medicina y Cirugía, Universidad Central Madrid, 1854.
- 3 M. Tschouriloff, Estudio sobre la degeneración fisiológica de los pueblos civilizados (causas de la degeneración), in: *La Gaceta de Sanidad Militar* III, 1877, pp. 45-52, 109-115, 192-199, 276-283, 301-05, 363-66, 384-92.
- 4 F. Bona, Estadística física de las tallas y de los defectos físicos, in: *Revista General de Estadística* II, 1863, pp. 305-321. A. Chinchilla, Estadística de Sanidad Militar, in: *Revista General de Estadística* III, 1864, pp. 1-31.

cian Gregorio Andrés-Espala pointed out that "a direct relationship exists between height and the welfare, strength and energy of a nation", and that "in poor and decaying countries, short stature prevails, whereas the opposite is the case in prosperous, flourishing ones"⁵. Some decades later, the works of the anthropologists Telesforo Aranzadi and Luis de Hoyos-Sainz revealed regional differences in height and explained them by variations in the "environment in its broadest sense"⁶. The works of other authors⁷, were also supported by the Reales Academias de Ciencias Políticas y Morales y de Medicina, by the Comisión de Reformas Sociales, and the Congreso Internacional de Higiene y Demografía held in Madrid in 1898. The social issue from an anthropometric point of view, thus did not escape the notice of Spanish scholars in the nineteenth century.

Now, a century later, studies in anthropometric history have unveiled considerable evidence on the trends and cycles of heights from the beginning of the industrial revolution. Hand in hand with economic history, anthropometry has reinvigorated the debate on the standard of living during industrialisation. The incorporation of hundreds of thousands of data to the study of height and weight in different countries has allowed the debate to extend to broad areas of the world and to cover virtually all social groups. Thus, the most general issue may now be approached: that of welfare during the various stages of economic growth⁸.

This new "anthropometric history", as John Komlos and more recently Richard H. Steckel⁹ have come to call it, has also found an echo in Spain. Height data have for some years been explored using various sources and methods¹⁰. Given the limitations posed by some conventional indicators of welfare, the possibilities opened up by anthropometric studies are wide-ranging, and relevant to the economic and social history of contemporary Spain. The anthropometric

5 G. Andrés-Espala, Reflexiones sobre la talla, peso y perímetro torácico, in: Gaceta de Sanidad Militar III, 1877, pp. 2-3.

6 T. Aranzadi/L. Hoyos-Sainz, Lecciones de antropología, Madrid 1893.

7 L. Figuerola, La talla de los mozos para el servicio militar sorteados y medidos en las quintas de 1858 a 1867, in: Memorias de la Real Academia de Ciencias Políticas y Morales, tomo VII, 1893, pp. 305-311; F. Olóriz-Aguilera, Discursos leídos en la Real Academia de Medicina, Madrid 1896; L. Sánchez-Fernández, El hombre español útil para el servicio de las armas y para el trabajo. Sus características antropológicas a los 20 años de edad, Asociación Española para el Progreso de las Ciencias, Madrid 1913; P. Suárez-Inclán, El problema del reclutamiento en España, Madrid 1905.

8 C. Floud/K.W. Wachter/A.S. Gregory, Height, health and history: nutritional status in Britain 1750-1980, Cambridge 1990; J. Komlos, Nutrition and economic development in the eighteenth-century Habsburg monarchy. An anthropometric history, Princeton 1989; J. Komlos (ed.), Stature, living standard, and economic development. Essays in anthropometric history, Chicago 1994; J. Komlos (ed.), The biological standard of living on three continents. Further explorations in anthropometric history, Boulder 1995; J. Komlos/J. Baten (eds.), Studies on the biological standard of living in comparative perspective, Stuttgart 1998; J. Komlos/T. Cuff, Classics in Anthropometric History, 1998 R.H. Steckel/R.C. Floud (eds.), Health and welfare during industrialization, Chicago 1997.

9 R. Steckel, Strategic ideas in the rise of the new anthropometric history and their implications for interdisciplinary research, in: Journal of Economic History 58/3, 1998, pp. 803-820.

10 A. Gómez-Mendoza/V. Pérez-Moreda, Heights and welfare in Spain 1900-1930, in: Komlos, The biological standard of living, pp. 81-91; J.M. Martínez-Carrión, Niveles de vida y desarrollo económico en la España contemporánea. Una visión antropométrica, in: Revista de Historia Económica XII, 1994, pp. 685-716; J.M. Martínez-Carrión, Stature, welfare and economic growth in nineteenth century Spain: the case of Murcia, in: Komlos, Stature, p. 76-89; J.M. Martínez-Carrión/J.J. Pérez-Castejón, Height and standard of living during the industrialisation of Spain: the case of Elche, in: European Review of Economic History II/2, 1998, pp. 201-230; J.M. Martínez-Carrión/J.J. Pérez-Castejón, Height and standard of living in Spain 1860-1969: evidence from the southeastern region, in: Komlos/Baten, pp. 31-46; G. Quiroga, Height evolution in Spain, 1893-1954. An analysis by regions and professions, in: Komlos/Baten, pp. 359-383.

data used so far in Spain have come from military records. These data are easier to process than many other historical economic data¹¹.

III. Data and reconstruction of a height series

Table 1: The heights of conscripts by birth quinquennium, nine municipalities in South-eastern Spain

Quinquennium of birth	Total number of conscripts	Number of conscripts measured	% of conscripts measured	Mean Height (cm.)	Age
1837-1840	3,361	3,076	91.5	161.4	20
1841-1845	6,365	6,162	96.8	161.2	
1846-1850	5,190	4,580	88.2	162.1	
1851-1855	2,797	2,052	73.4	161.7	
1856-1860	10,811	8,937	82.7	161.0	
1861-1865	10,748	9,365	87.1	161.4	19
1866-1870	12,482	12,160	97.4	161.0	
1871-1875	13,052	12,823	98.2	160.7	
1876-1880	11,986	11,648	97.2	161.0	
1881-1885	12,622	12,037	95.4	162.5	20
1886-1890	14,378	13,862	96.4	163.3	21
1891-1895	11,715	10,153	86.7	163.3	
1896-1900	8,483	6,357	74.9	163.6	
1901-1905	7,568	6,037	79.8	164.0	
1906-1910	7,205	5,505	76.4	164.6	
1911-1913	3,148	2,556	81.2	165.0	
TOTAL	141,911	127,310	89.7		

Source: *Archivos municipales*, Actas and expedientes de reemplazo; see Appendix.

Aggregate annual height series can be constructed for Spain from the 1850s onwards. Earlier data are both scarce and fragmentary, and almost non-existent for the end of the eighteenth century. This study begins with the 1857 draft and presents data on cohorts born between 1837 and 1913, a period when GDP per capita was increasing¹². The series pertains to nine municipalities of Southeastern Spain: Elche, Orihuela, (the south of Valencia), Murcia, Cartagena, Torre Pacheco, Totana, Cieza, Yecla (in Murcia), and Vera (in east Andalusia). Because of its economic and environmental characteristics, the geographic area considered is representative of the Spanish economy of the nineteenth century¹³. We have a sample of the height of 127,310 conscripts out of a total of 141,911 men (89.7 per cent) called up for service (Table 1). The rest – 10.3 per cent – were either deserters, emigrants or missing men.

We used the following criteria in the selection of municipalities: (1) availability of long enough anthropometric series, (2) reliability of data, (3) socio-economic characteristics of the

11 *J.M. Martínez-Carrión*, Los niveles de vida del campesinado en la España contemporánea. Algunas reflexiones, in: *Noticiario de Historia Agraria* 14, 1994, pp. 25-57.

12 *L. Prados de la Escosura*, Spain's Gross Domestic Product, 1850-1990. A New Series. Documento de Trabajo, Madrid 1993. *A. Carreras*, Industrialización española: estudios de historia cuantitativa, Madrid 1990.

13 A series based on six of the nine municipalities between 1837 and 1948, in: *Martínez Carrión/Pérez Castejón*, Height.

populations considered – either agricultural or industrial –, (4) areas defined both geographically and environmentally, and (5) availability of demographic and socio-economic information supporting an anthropometric interpretation. The towns of Cartagena and Vera were characterised by a large percentage of mining population; Cartagena, Murcia, Orihuela, and Elche were important urban centres; Cartagena and, notably, Elche experienced industrial development particularly in metallurgy and shoe-making. In general, the surroundings of all the towns had a large share of their rural population engaged in farming activities. They experienced processes of agricultural specialisation: Totana (orange), Cieza (fruit, *esparto*), Yecla (wine), Torre Pacheco (cereals) beginning in the second half of the nineteenth century. The height series in some towns do have some gaps, particularly at the end of the 'six-year revolutionary period' (1868-1874) in 1873, as a result of the riots and popular revolts against the "Quintas" (compulsory conscription)¹⁴.

The main problems in height series may be posed by the introduction of changes affecting conscription age and by the rounding of height data. The biases associated with a truncated height distribution are not present in this study, because of universal conscription established in the "Ordenanza para el Remplazo del Ejército" (Ordinance on Military Drafts)¹⁵. The reliability of the data has been ascertained using the Kolmogorov-Smirnow and χ^2 tests (See Figures 1 and 2 for a comparison between sample and theoretical distribution for some years in Elche). Only after 1970 are we able to find marked irregularities and a more widespread use of rounding due to the implementation of the new National Service Law of 1968.

IV. The results

Figure 3 shows the trend of the Spanish heights at the onset of modern economic growth. The results obtained, using three-year moving averages, point to the existence of two marked trends: a decline in the reign of Isabel II and the Revolutionary Period, and an increase during the Restoration. Annual data are presented in Table 2. It is immediately apparent, that heights of 20-years-olds born between 1838 and 1865 declined by 0,8 cm. Between 1848 and 1860 the decline was still bigger: some 1,6 cm. This pattern suggests an initial worsening of welfare measured in net nutritional terms as in a number of other countries including the United States¹⁶. Secondly, a recovery is evident among those born after 1876. The increase in physical stature became decisive by the 1890s. Between 1865 and 1885 the average heights increased by some 1,2 cm; thus, the losses of the 1840s and 1850s were made up entirely: those born after the late 1880s tended to be taller than their mid-century counterparts. The height of 21-years-olds increased between 1886 and 1905 by 1,3 cm. Hence, biological living standards improved considerably for young men born at the end of the 19th and the beginning of the 20th century. By WWI Spanish military recruits were on average 165 cm tall.

To assess the degree of consistency between height and other welfare indicators, we compare *per capita* income with the height series even though the former refers to the nation-wide average, whereas the latter is regionally restricted. *Per capita* income refers to the year when the recruit was measured (Figure 4). The results reveal no relationship between both series un-

14 A. Feijóo-Gómez, *Quintas y protesta social en el siglo XIX*, Madrid 1996.

15 Martínez-Carrión/Pérez Castejón, *Height*.

16 Komlos, *Shrinking*, p. 779.

Figure 1: Gaussian distribution vs. sample distribution. Elche: 1970

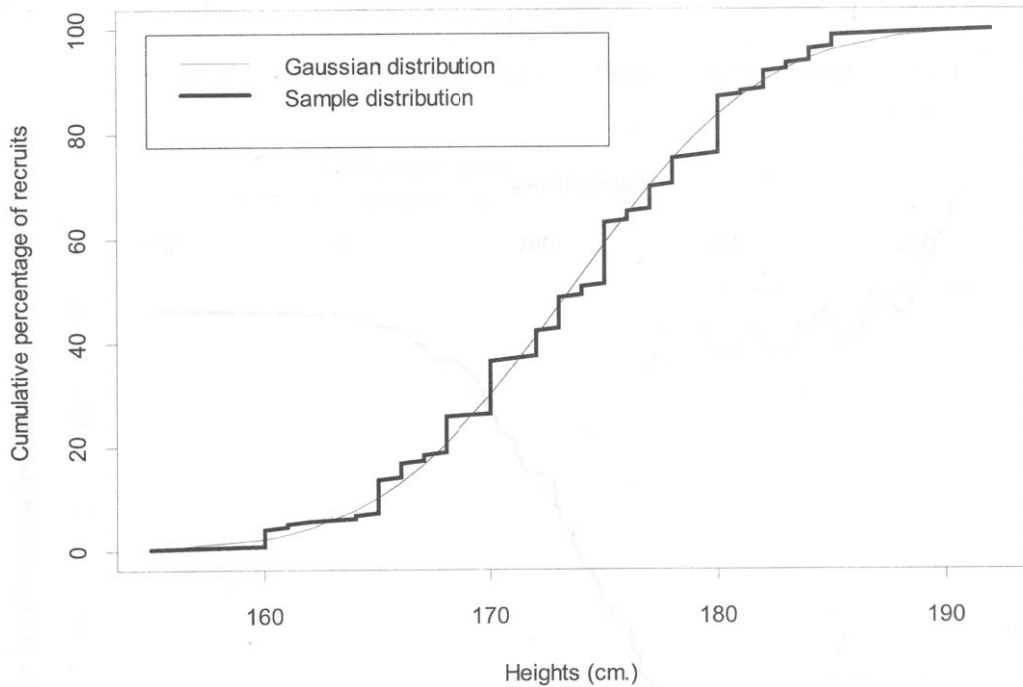


Figure 2: Gaussian distribution vs. sample distribution. Elche: 1870

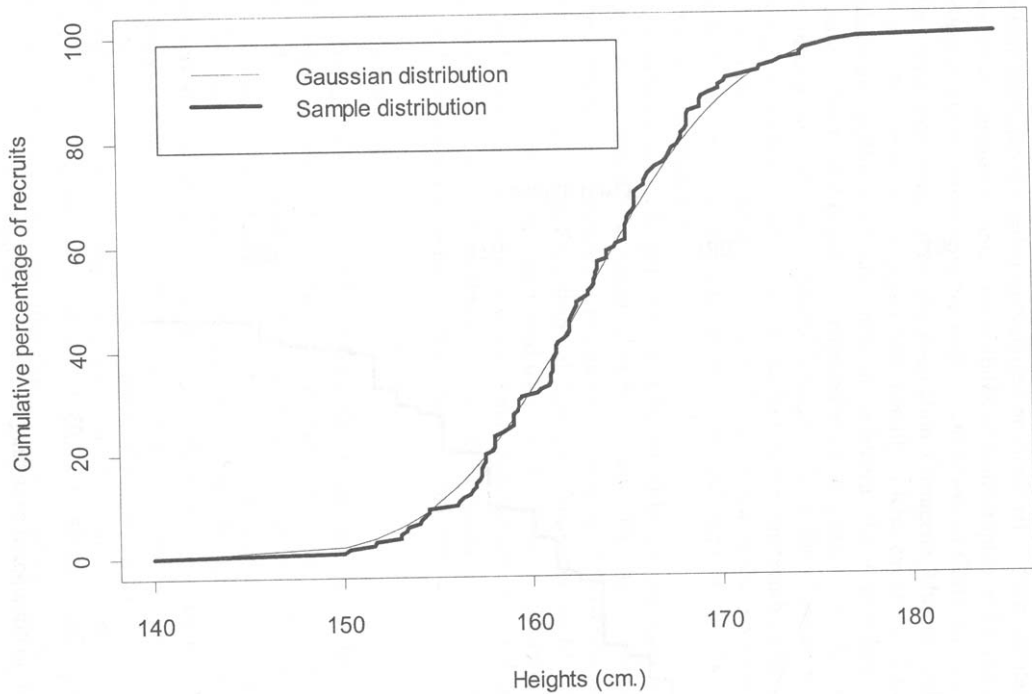


Figure 3: Trend of height in Spain

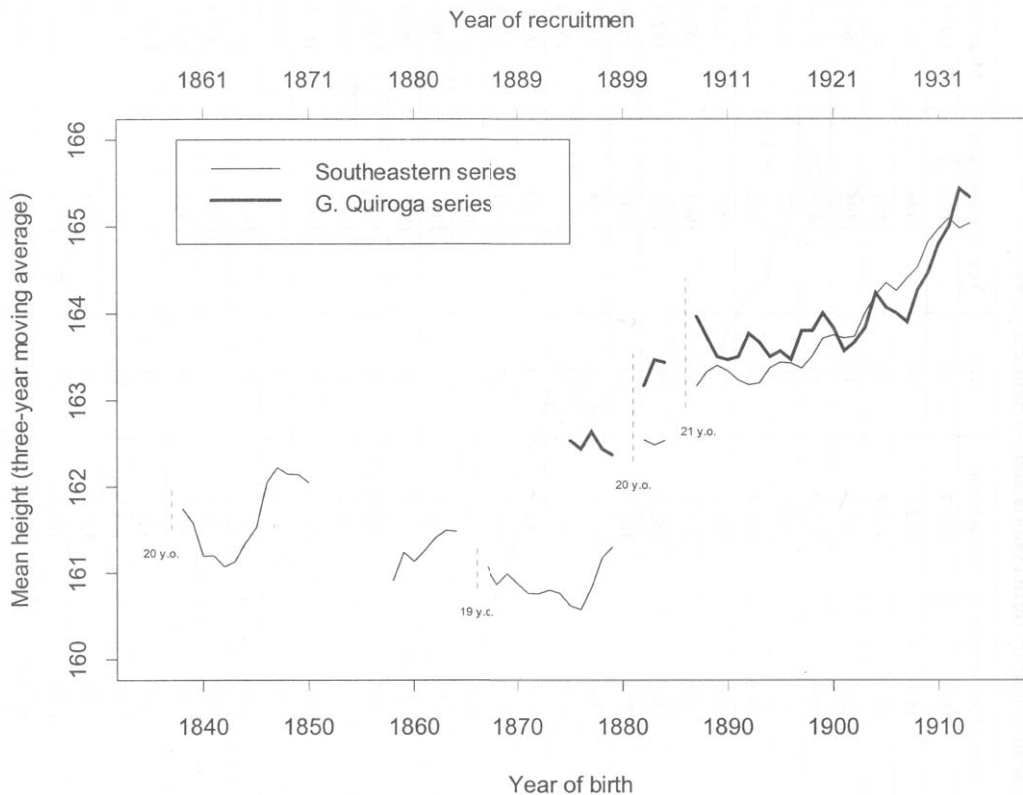


Table 2: Mean height by birth cohorts and recruitment years

Age	Year of recruitment	Mean height	Age	Year of recruitment	Mean height
20	1858	162,3	19	1895	160,5
20	1859	162,1	19	1896	160,8
20	1860	160,8	19	1897	161,2
20	1861	161,8	19	1898	161,5
20	1862	161,0	19	1899	161,2
20	1863	160,8	20	1901	162,6
20	1864	161,4	20	1902	162,5
20	1865	161,2	20	1903	162,5
20	1866	161,4	20	1904	162,4
20	1867	162,0	20	1905	162,7
20	1868	162,7	21	1907	163,0
20	1869	162,0	21	1908	163,1
20	1870	161,7	21	1909	163,4
20	1871	162,7	21	1910	163,5
20	1872	161,7	21	1911	163,4
20	1873	n.d.	21	1912	163,2
22	1875 (*)	160,7	21	1913	163,2
21	1875 (*)	161,5	21	1914	163,2
20	1875	162,5	21	1915	163,2
19	1875 (*)	161,1	21	1916	163,7
20	1877	160,2	21	1917	163,4
20	1878	161,4	21	1918	163,2
20	1879	161,1	21	1919	163,5
20	1880	161,1	21	1920	163,8
20	1881	161,1	21	1921	163,8
20	1882	161,5	21	1922	163,6
20	1883	161,6	21	1923	163,7
20	1884	161,4	21	1924	163,9
20	1885	161,5	21	1925	164,4
19	1885 (*)	161,6	21	1926	164,3
19	1886	160,5	21	1927	164,3
19	1887	161,1	21	1928	164,2
19	1888	160,9	21	1929	164,8
19	1889	160,9	21	1930	164,7
19	1890	160,8	21	1931	165,0
19	1891	160,6	21	1932	165,2
19	1892	160,9	21	1933	165,0
19	1893	160,9	21	1934	164,7
19	1894	160,5			

(*) Extraordinary Draft /Conscription.

Source: Archivos Municipales, Expedientes de reclutamiento y reemplazo.

Figure 4: Mean height of recruits and GDP per capita at recruitment year

