Biological Welfare During the Economic Development of the Basque Country: Biscay, 1850-2000*

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Introduction

From the 1880s, the industrialisation of the Cantabrian Coast (Basque Country, Cantabria and Asturias) and particularly the province of Biscay form a remarkable part of the Spanish industrialisation process.[1] From the mid-nineteenth century, northern Spain had been immersed in an industrialisation process which had begun in the eighteenth century with the iron and steel sector, arms manufacturing, naval construction and other traditional industries. At the same time, a trading bourgeoisie emerged among the international markets which, with new capital and technical knowledge, initiated a tentative industrial stage after the First Carlist War (1833-1840). This process was principally led by the Lordship of Biscay, and gained momentum after the Third Carlist War (1872-1876). The most notable sectors were mining, iron and steel, and ship building. From the end of the 1870s, the Basque Country constituted one of the Spanish regions with the greatest economic growth. Between 1900 and 1930, in relative terms, the region stood out for its standard of living, its wealth and economic prosperity, measured by income per capita and the principle welfare standards, of which its human capital accumulation (education and health) was particularly outstanding. The highest

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1. Over the last 30 years the bibliography corresponding to the industrialisation of Biscay has been extensive. Some representative studies include: Fernández de Pinedo (1984, 1986, 1998, 2001, 2006), Fernández de Pinedo & Hernández Marco (1988), and Escudero (1998).

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business indices in Spain also corresponded to this region and were maintained throughout the twentieth century.[2]

How did the advanced development of industrialisation and the modern economic growth in Biscay affect biological standards of living? There has been recent interest in this issue. which connects with the strong tradition of research in the field of standards of living in the Basque Country.[3] The social consequences of Basque industrialisation and the impact of this process on the welfare of the population has been evaluated by historians using conventional indicators of the standard of living, such as income, real wages, consumption, and death rates for several decades.[4] Somewhat later, and with very few studies of the Basque case, research on biological standards of living have begun to emerge.[5] The interest in height as a proxy for welfare in recent years is due to the significant influence of the new anthropometric history in economic and social history research, particularly in the field of standards of living based on quality of life and nutrition.[6]

The use of height, weight and body mass constitute excellent indicators of biological welfare. The most popular is height, used by economic historians to analyse how the industrial revolution and economic growth processes have influenced human bodies over the very long term.[7] The study of average height by social class and population groups at certain ages is widening the perspective offered by conventional indicators and provides a better knowledge of the inequality and levels of welfare in a broader sense.[8]

The main objective of this article is to explore the impact that the industrialisation and economic growth of Biscay had on height in the very long term. To do this, anthropometric evidence from the early stages of industrialisation and throughout the whole modern economic growth process of the Basque Country has been gathered. The study has used anthropometric data,

2. With respect to human development indices see Escudero & Pérez-Castroviejo (2010), and Escudero & Simón (2012); for business indices see Valdaliso (2010).

3. Perez-Castroviejo (1992), Fernández de Pinedo (1992), Arbaiza (1997), Escudero (1997), among others.

4. For the Spanish context, see Escudero (2002). For the British perspective see Voth (2004), and Berg (2004).

5. Pérez-Castroviejo (2006), Escudero & Pérez-Castroviejo (2010), and González Portilla & Urrutikoetxea (2012). Data on the Basque Country in the national context have been analysed by González Portilla (1998 and 2001), Quiroga (2001), Martínez-Carrión (2005), Martínez-Carrión, Pérez-Castroviejo, Puche-Gil & Ramon-Muñoz (2014), and Martínez-Carrión & Cámara (2015).

6. An excellent summary of the progress made in anthropometric history in the western world can be found in Floud, Fogel, Harris & Hong (2011). On the new anthropometric history see Heyberger (2011).

7. Steckel (1995, 2009).

8. Anthropometric historiography has highlighted the use of average height in the study of biological welfare and inequality; see Komlos (1994), Martínez-Carrión (2012), and Blum & Baten (2012).

the height and weight of the military recruits between 1877 and 1969 and the cohorts born between 1857 and 1948. Considering that historically Biscay has been one of the most prosperous provinces of Spain since the end of the nineteenth century and forms part of one of the country's most dynamic regions, with a high level of economic development throughout the twentieth century, this article seeks to determine whether the evolution of height, or the *secular trend* (a term used by physical anthropologists),[9] is related to the processes of industrial development and the relative economic prosperity. In other words, it analyses whether there is a relationship between economic welfare and biological welfare.

After this introduction, the study is divided into six sections. The first describes the sources of the study around which the research, methodology and criteria for selecting the municipalities which constitute the sample for constructing the average height series of Biscay are developed. The second section explores the trends in height and the different stages of biological welfare in the province. The third part establishes the links between height and the main quality of life indicators including purchasing power, highlighting the components of human development, death rates and life expectancy. These variables were influenced by urban development, which was expanding considerably, and the availability of health services and the supply and treatment of water, which determined the level of hygiene and healthiness of the area. The fourth part refers to the evolution of the body mass index (BMI) in different years. The BMI is an indicator of the degree of robustness and nutritional health as it incorporates weight and height at a certain age. Section five compares the averages of the series used to estimate a trend of the average height in Biscay in comparison with the other regions in Spain, correlating the social and economic developments and highlighting how the height of the Biscay recruits was clearly taller. Finally, we draw some conclusions.

Sources, Data and Methodology

Studies on the standard of living in Biscay during the industrialisation process have explored numerous indicators such as real wages, death rates and life expectancy.[10] In recent years, height has been incorporated into these economic welfare and health variables as an indicator of biological welfare. In Spain, the anthropometric data may be traced back to different military

9. Rebato, Susanne & Chiarelli (2005).

10. For bio health factors such as morbidity and mortality see González Ugarte (1994), Arbaiza, Guerrero & Pareja (1996), and Pérez-Castroviejo (2005).

sources,[11] but in our case, the documentation used has been drawn from two sources: first, the local councils which were directly responsible for the recruitment process; and second, the provincial council which gathered valuable information about the height of the recruits until the 1920s.

From 1859, all young men of military service age were measured in the town halls of the municipalities where they lived. The exceptions were young Basque and Navarre men who were exempt from military service in virtue of the local laws, the so-called *fueros*. This exemption from being called up disappeared in these regions by way of the Law of 21 July 1876, which established the duty of all Spanish men to undertake military service.[12] In general, the Basque local councils conserve the documents related to the draftees or recruits of each year since 1877. The data referring to height which have been used in this study are drawn from the *Actas de Clasificación y Declaración de Soldados* (Classification and Declaration Records of Soldiers) and sometimes from the *Expedientes Individuales* (Individual Dossiers), which recorded the whole recruitment process. For the period 1877-1924 the heights recorded in the *Expedientes Generales de Reemplazo* (General Recruitment Dossiers) have also been used. This is a similar source to the municipal records but produced by the Provincial Council of Biscay.

Despite the high quality of these sources, there are some disadvantages inherent in the *Actas de Clasificación y Declaración de Soldados*, as they are not centralised in a single file. Furthermore, the information that they provide is not aggregated, requiring the collection of data for each individual recruit. The task of measuring the height in all the municipalities of a region or province would be materially impossible due to the huge amount of work, time and cost that it would imply. Furthermore, measuring all the elements which form part of the recruitment sources increases their complexity. We have overcome these disadvantages by selecting a sample of municipalities which we considered to be representative. The use of samples which contain a selection of populations is becoming frequent in anthropometric history. In the case of Spain, regional or provincial anthropometric studies are only able to cover a small number of towns; unfortunately, there is no other option. The sample must be distinctive and representative of the area being studied in accordance with the quality of the data and the socioeconomic characterisation.

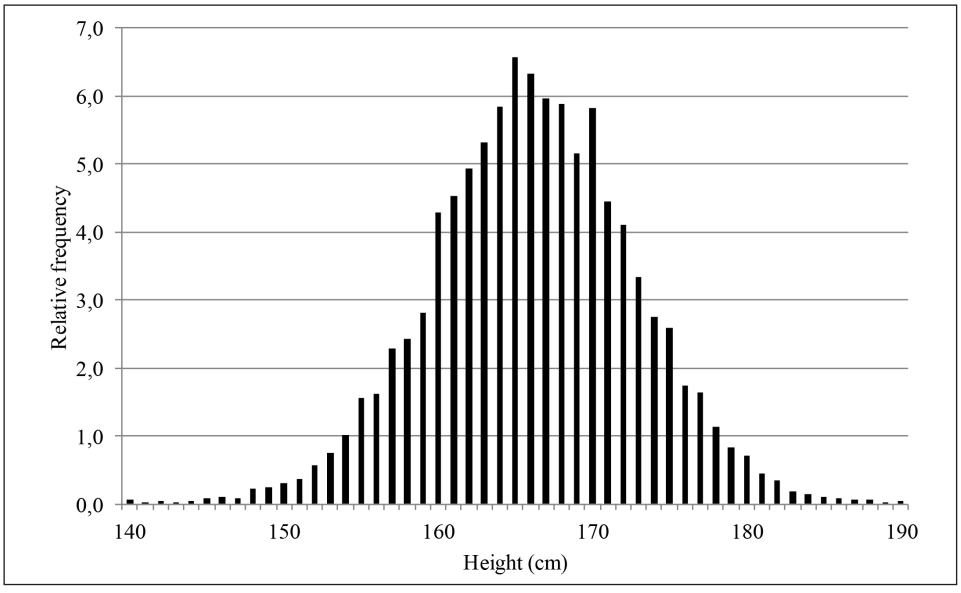
11. Some authors have worked with the height data contained in the Military Archive of Guadalajara, which confirms that all of those called up ended up doing military service. There is also information to this respect in the *Anuarios Estadísticos de España* (Statistics Yearbooks of Spain).

12. Articles 1 and 2 exhaustively describe this obligation: "as from the publication of this Law, in the case of ordinary and extraordinary draftees or recruits, the three provinces (Biscay, Guipúzcoa and Álava) are obliged to provide the quota of men that corresponds to them in accordance with the laws". See Vicario (1905), p. 67.

As in other parts of Spain, the data meet the requirements of statistical normality, as they are "universal" masculine populations and have no problems in the tail distribution. The sample does not exhibit truncation (see Figure 1) and the degree of normality of the distributions is fairly acceptable despite the typical rounding in the years ending in 0, particularly visible in the heights of 1600 to 1700 millimetres. The fact that the heights of the Spanish recruits were measured in millimetres renders the reconstructed series more reliable. Figure 1 shows that there was no left tail truncation as is the case in the military data, which do not include the heights of the call-ups who were too short to enlist. In general, the results reveal a fairly typical Gaussian distribution.

With respect to the representativeness of the sample of the municipalities analysed, their socioeconomic characterisation reflects a significantly typical part of the Biscay population. The height series that is presented in this study is made up of six population nuclei from both rural and urban areas in the province of Biscay. Nevertheless, the results of the research should be considered as a preliminary approach to the anthropometric study of the masculine population of Biscay among the recruits between 1877 and 1969. We hope that this study serves to stimulate the production of more studies which will

FIGURE 1 ▪ *Distribution of the heights of the Biscay recruits. Draftees from 1877 to 1969*



Source: Own work based on the *Actas de Clasificación y Declaración de Soldados* and the *Expedientes Generales de Reemplazo* of the municipalities forming part of the sample.

help to increase the scale of the sample and will enable a more detailed analysis of the results obtained.

The municipalities selected exhibit environmental and socioeconomic features that are considered as characteristic of the Basque province under study. The final series contains three municipalities characterised by a strong presence of the primary sector, which we could classify as rural, and another three characterised by a greater urban and industrial presence in which the secondary and tertiary sectors are dominant. In the coastal area there is an agricultural and fishing municipality: Bermeo; inland, there are two places that belong to the *comarcas* (areas) of the Arratia Valley and Duranguesado, which were engaged in agricultural and fishing activities and small industry: Dima and Amorebieta; finally, of the towns with the greatest weight and which are clearly industrial, we can highlight Sestao, Portugalete and San Salvador del Valle, located on the Estuary of Bilbao. In 1900, these three latter towns had just above 5,000 inhabitants; 30 years later they formed part of the most populated urban area of the Basque Country. The effects of industrialisation spread inland and to the coast of the province, and extended the processes of urban development and production specialisation mainly in consumables such as meat, fish and milk.

The scope of the Biscay series begins with the first Basque recruit in 1877 and ends with the recruits of 1969. Therefore, it includes those born between 1857 and 1948. The series is composed of a total of 32,766 registrations, made up of all of the young men of the six municipalities, of which, 75 per cent provided information about their height. The rest included those who had deceased, deserted and individuals who, at the moment of the call up were not in the municipality for different reasons and whose absence was sometimes explained by a direct family member.

It is necessary to say a few words about the methodology used for constructing the "Biscay" series and about how some of the problems arising from the information were resolved. With respect to the first point, there has been no statistical manipulation in the construction of the series, not even of the local series which make up the sample of Biscay. In creating this series, all of the height data of the recruits residing in the reference municipalities have been considered. The series of annual average heights that has been estimated is fairly complete in terms of time. There are hardly any data gaps and, as we have already said, practically all of the young men are of measuring age ("universal recruitment"). The height averages calculated in annual averages and five-year moving averages are presented in birth cohorts as the final height reached at age 20-21 years, which includes the impact of the "nutritional status" from the early years of life. The final average height at 20 years of age would reflect both the environmental impact of the early years of life and the pubertal or late adolescent growth spurt. This is important as child labour could be relevant in

some towns, as revealed by some studies,[13] and it could influence, together with illnesses experienced in childhood and youth, the delay in height growth. The specialised biological anthropology literature considers not only the environment in the early years of life, or childhood, which is important for the final average adult height, but also the environment of the adolescent growth spurt years, or puberty. Therefore, the first three years of life are as decisive as the adolescent years during which a strong growth spurt is experienced between the ages of 13 and 17.[14] Height is an indicator which is highly sensitive to living conditions and a persistent environment during the growth years.

Throughout history, the age for being called up for military service changed in accordance with the needs of the Spanish army.[15] These alterations in the recruitment age create problems when interpreting the data. To resolve this situation, the heights have been standardised at the age of 21. The standard heights of three generations of youths measured at different ages have been calculated. Table 1 presents the results of the fiftieth percentile of young men born between 1876 and 1880, measured at 19 years of age, those born between 1881 and 1885 measured at 20 years of age, and those born between 1886 and 1889 recruited at 21 years of age. The resulting value represents the standard height of each of these ages, revealing the variations, enabling us to adjust them to the heights at 21 years of age.[16]

TABLE 1 ▪ *Increase in height of the recruits measured in the province of Biscay between 1895 and 1911*

Age	Five-Year Period of Birth	Five-Year Period of Call-Up	Men Measured	50th P cm	Age Interval	cm
19 years	1876-80	1895-99	962	163.50	From 19 to 20	0.70
20 years	1881-85	1901-05	1,122	164.20	From 20 to 21	0.80
21 years	1886-90	1907-11	1,056	165.00	From 19 to 21	1.50

Source: Own elaboration based on the *Actas de Clasificación y Declaración de Soldados* and the *Expedientes Generales de Reemplazo* of the municipalities which make up the sample.

13. For child labour in the south-west of the peninsula see, Martínez-Carrión, Puche & Cañabate (2013), and Pérez de Perceval, Martínez Soto & Sánchez Picón (2013). Child labour in the Basque Country, while being relevant, was not as prevalent as in other parts of Spain; Pérez-Castroviejo (2013), and Pérez-Fuentes & Pareja (2013).

14. Bogin (2001); Rebato, Susanne & Chiarelli (2003).

15. From the first group of recruits in 1877 to that of 1885 (first call-up) the young Basque men were measured at 20 years of age; from 1885 (second call-up) to 1899 they were measured at 19; from 1901 to 1905 at 20 years old again and from 1907 at 21. On the military recruitment system and its evolution see Feijóo Gómez (1996), Jiménez Guerrero (2001), and Frieyro de Lara (2004).

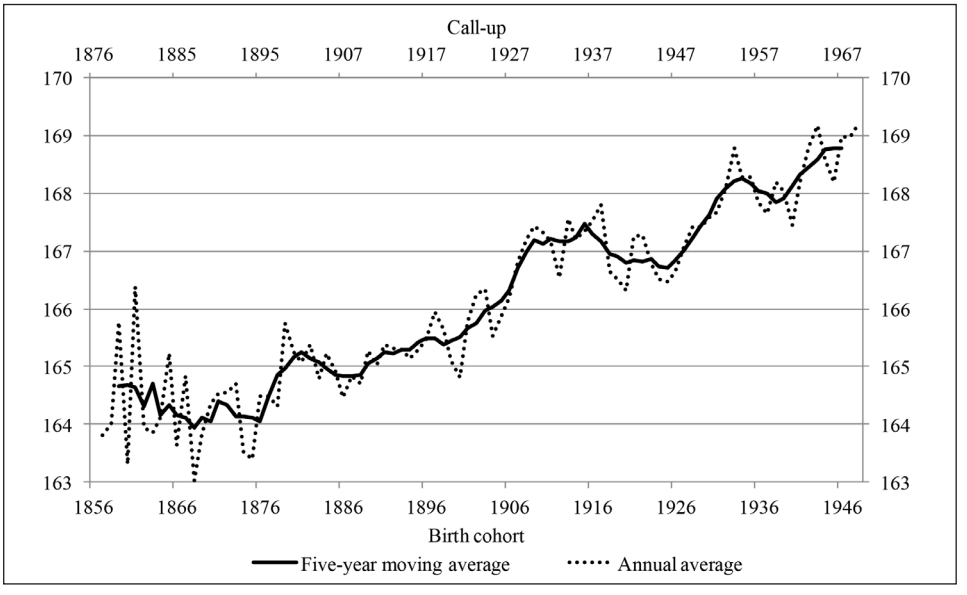
16. For more on this procedure see Ramon-Muñoz (2009 and 2011).

The Evolution of Height in Biscay: Secular Trend and Stages

Figure 2 shows the long-term evolution of the average height of the Biscay recruits born between 1857 and 1948 (recruits of 1877-1969). In this period, the gains in physical height reached 4.5 centimetres. The average height increased from the 164.5 cm of the cohorts of 1857-59 (recruits of 1877-79) to 169 cm at the end of the period analysed, being that of the cohorts born in 1846-48 (recruits of 1967-69). However, the trend was not unidirectional, as can be observed at certain stages. But first two aspects revealed by the estimated height averages for the whole of the sample must be highlighted:

1. The male populations of Biscay were among the tallest in Spain from the end of the nineteenth century. The height data of Biscay men reveals that the biological standards of living were relatively more prosperous or advantageous than those in the rest of Spain, which has also been observed in the data estimated for the Basque Country. Let us consider some figures. The average height of Spanish males recruited in 1858 and born in 1838 has been estimated at 160.93 cm, and the recruits of 1913 and 1917, born in 1892 and 1896 respectively, at 162.4 cm and 162 cm. We do not have any data for the Basque Country with which to compare that of the first Spanish draft, but

FIGURE 2 ▪ *Evolution of the standardised average height in Biscay. Birth cohorts (Annual averages and five-year moving averages)*



Source: Own work based on the *Actas de Clasificación y Declaración de Soldados* and the *Expedientes Generales de Reemplazo* of the municipalities included in the sample.

we do have data for the last two drafts. From this data we can observe that the average height of Spanish males was three centimetres shorter in 1913 and 1917 than that estimated for the whole of the Biscay sample.[17]

From the mid-nineteenth century a series of Spanish height data of the recruits before their twenty-first birthday is available based on the data provided by the statistical yearbooks with information from the Ministry of Defence. Therefore, in the call-up of 1955 (born in 1934), Spaniards reached an average height of 165.5 cm, while the sample for Biscay is estimated at 168.3 cm and the average height in the Basque Country was 168.2 cm.[18] Therefore, the difference remains the same: at around three centimetres. At the end of the period, in the call-up of 1969 (born in 1948) the estimated average height of Spanish males is 167.6 cm; that of the Biscay sample is 169.2 cm, and that of the Basque Country 169.9 cm (Figure 3).

2. A strong parallel can be observed between the evolution of the average height of the sample for Biscay and the averages estimated for the Basque Country as a whole (Figure 3). Different studies that use fragmentary data until 1955, and which provide average heights of the Basque Country, reveal concordance between the two series. In the recruitment process of 1915-16, the estimated average height of the Biscay series is 165.2 cm, four millimetres shorter than that of the Basque Country at 165.6 cm. Among the recruits of 1920, the average height of the Biscay series is lower by five millimetres and among the 1924 recruits by one millimetre, while that of 1955 is the same.[19] After this, the differences widen and reach almost one centimetre at the end of the period. Naturally, the sample constructed for Biscay does not have to follow the same trend as the average height of the Basque population, given the characteristics of the Biscay populations. But the scarce differences found between the average heights of the sample and the Basque Country reinforce the quality of the series presented in the article in a first attempt to explore the height trends and cycles of the Biscay men with local data.

Based on the series constructed (Figures 2 and 3), the stages that we can identify are as follows:

a) First, it is worth pointing out that the early years were characterised by poor biological welfare in relative terms when compared with the averages of the more advanced European countries.[20] However, it is not so poor when

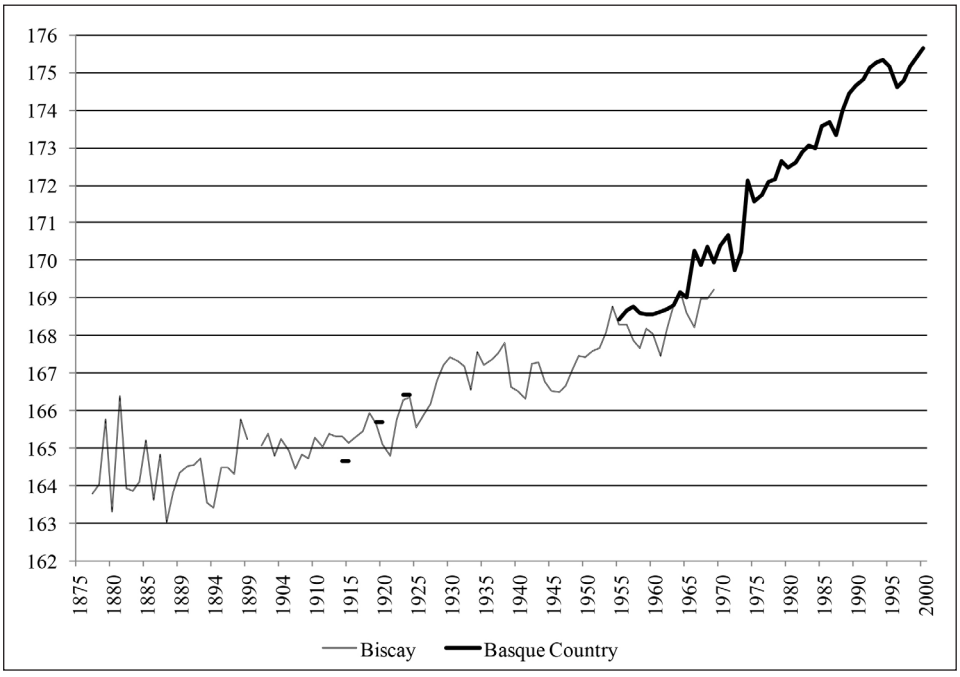
17. Gómez Mendoza & Pérez Moreda (1995), p. 87. Data of the Basque Country and Spain in González Portilla (1998, 2001), Quiroga (2001), Gómez Mendoza & Pérez Moreda (1985), and Martínez-Carrión (2001, 2005).

18. Martínez-Carrión (2005).

19. For 1915-16 see 1920 and 1924, González Portilla (2001), p. 195 and 198; for 1935 see Martínez-Carrión (2005), p. 216.

20. See Martínez-Carrión (2012).

FIGURE 3 ▪ *Evolution of the average height in Biscay and the Basque Country according to the recruits between 1877 and 2000*



Source: Biscay: The *Actas de Clasificación y Declaración de Soldados* and *Expedientes Generales de Reemplazo* of the municipalities included in the sample. Basque Country: Recruitment Statistics of the Ministry of Defence (1955-2000). For 1915-16, 1920 and 1924 see González Portilla (2001), p. 195.

compared with the average height for Spain. As we have already mentioned, the Biscay men born in the mid-nineteenth century were among the tallest in Spain. The genetic component of the population of the province, still not subjected to environmental pressure and immigration, could constitute the origin of the differences found between the average height of the Biscay men and that of Spaniards.

b) The deterioration in biological standard of living is visible among the cohorts of the third quarter of the nineteenth century. A slight fall in the height reached at the age of 20 is observed among the cohorts between 1860 and 1875. The fall in biological welfare is greater among the recruits of the 1880s until 1894, whose height fell by half a centimetre. These young men were children during the years of shortages and epidemics at the end of the 1860s, the Third Carlist War (1872-1876) and the start of the industrialisation process in the 1880s, coinciding with the second stage of childhood and adolescence for most of the recruits.

c) The recovery began with the cohorts of 1878, and although this stopped in the 1880s, it resumed with significant growth among the cohorts of 1895-

96 and 1909-10. Between the start and end of this stage, the increase in height was almost three centimetres. The increment observed among the cohorts of the first decade of the twentieth century, from 1900 to 1909, is particularly remarkable, placing the Biscay men among the tallest in Spain and with height averages closer to those of western Europe than those of southern Europe. The height of the recruits continued to rise in the 1920s, although, in general, it could be claimed that the height of recruits grew throughout the first third of the twentieth century. The recruitment processes of the second and third decades of the twentieth century provide the best height records until then. The tallest average height of this long growth period was reached in the recruitment process of 1938 (cohort of 1917), with 167.8 cm.

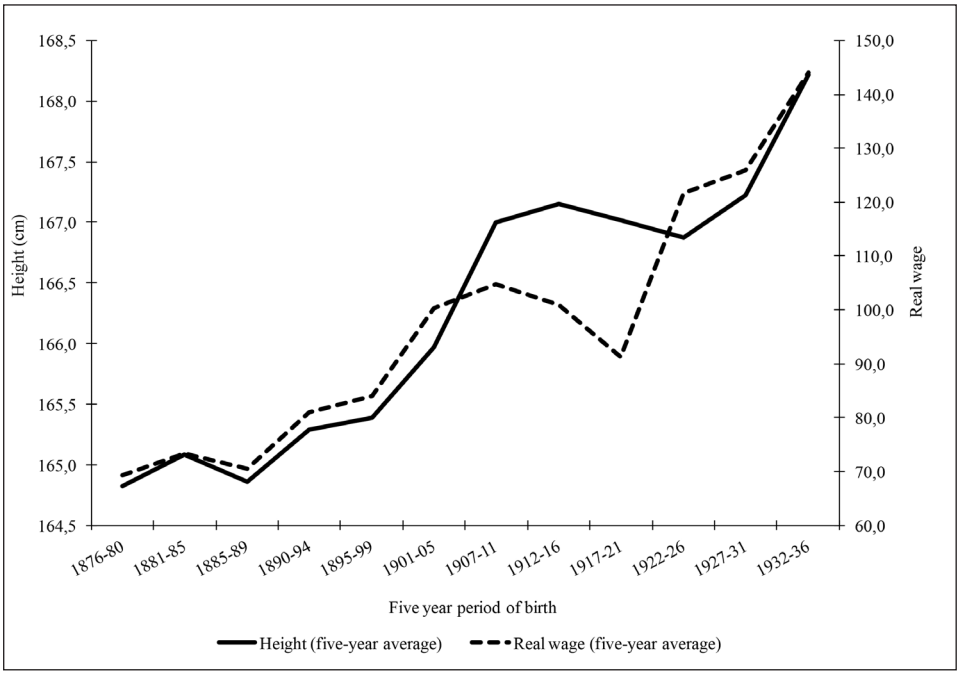
d) We can observe a new deterioration in height among the cohorts of 1918 and 1925. The fall in height affected the men born in the final stages of the First World War and those measured during the Spanish Civil War and the long post-war period. There was a drop in height among the recruits of 1938 and 1942 of approximately 1.5 cm. The slump continued until the call-up of 1945 and the fall from 1938 is estimated at 1.3 cm. The data suggest that the "years of hunger" took their toll on the final average height just when these men were experiencing their adolescent growth spurt, affecting their growth in the years before they were called up to be measured. Food deprivation or shortages suffered by the majority of teenagers in the "years of hunger" could have slowed their growth. This is fairly feasible given the intensity of the fall in height among the recruits in the 1940s. The average height of the recruits of 1938 was not recovered until 1954. Thus, the slump in biological welfare lasted almost fifteen years.

e) The recovery phase at the end of the period studied affected firstly the cohorts of the second half of the 1920s and continued until 1948, with the exception of those born during the Civil War and the immediate post-war period. We can observe that those born during the years of the conflict and those measured in these dates suffered a clear reduction in height. This situation reveals the seriousness of the food problems and the deterioration of nutritional health in the 1940s. Strictly speaking, the fall in height is observed among the cohorts of 1933 and 1940, and again in 1945. Except for these episodes that were critical for nutritional status, in general we can determine that from the cohorts of 1925 to those of 1948 there was a growth phase in the biological standard of living that affected the welfare of the young men who were adolescents in the 1950s and 1960s. Apart from the years of the Spanish Civil War and the post-war period until 1945, those born between 1925 and 1948 grew by almost three centimetres. During the 1960s, when Spain's economic growth was in full swing, the Basque recruits were the tallest in Spain (Figures 2 and 3).

The Determinants of Height

As well as genetics, which accounts for 80 per cent of the evolution of height, there are also environmental and socioeconomic factors that come into play, such as diet, nutrients, labour intensity and illness.[21] The standardisation of a balanced diet and of an appropriate energy and nutrient intake determined the height of the Biscay men. The relationship between real wages and height by date of birth is interesting to highlight the importance of the environment in childhood and even during the foetal period, as pointed out by some biomedical research projects. The 1880s and 1920-21 were times of extreme shortages and a high cost of living, whereas other periods, such as that between the third decade of the twentieth century and the Civil War, were less severe and height exceeded previous levels. A positive relationship is observed between the height of Basque men and the real wage throughout almost the whole period (Figure 4). This reveals the decisive importance of

FIGURE 4 ▪ *Average height in Biscay (standardised at 21 years of age) and the real wage index in Biscay, 1876-1936 (Five-year averages)*



Source: Own work based on Figure 2 and Pérez-Castroviejo (2006).

21. Martínez-Carrión (2012), Nicolau & Puyol-Andreu (2006), Puyol-Andreu & Cussó (2014), and Collantes (2014).

the purchasing power of families when accessing a certain level of nutrient intake.

As well as nutrient intake and nutritional sufficiency, nutritional status can be affected by health and the impact of illness. Now we will consider the alterations in morbidity and mortality due to environmental changes, the increasing population and the first urban development process in order to assess to what extent these factors contributed to the evolution of height.

The development of the industrialisation process in Biscay gave rise to changes in the density and growth rate of the population. In some municipalities, particularly those in the area of the Bilbao Estuary and the mining area, the population increased at such a rapid rate that there was insufficient time to generate an urban infrastructure capable of housing the resident population in acceptable conditions. Other towns outside of this area also experienced significant transformations, although less intensely. Amorebieta and Bermeo, for example, which were traditionally agricultural, developed economic activities related to the industrialisation process and their resident populations in the central districts grew rapidly, with problems similar to those of the truly industrial area.

The immediate consequences of the deficient and unsuccessful urban development gave rise to serious health problems, which mainly affected the welfare of the workers residing in the industrial towns of the Lordship of Biscay during the last quarter of the nineteenth century. The principal illnesses were contagious and transmitted by water, food and air. This group of illnesses became less virulent at the start of the twentieth century.[22] Taking into account that medical treatment to cure these diseases was not available until the development of antibiotics in the 1940s, it is reasonable to assume that their reduced prevalence was due to diet, improvements in personal hygiene, and the public health system (water supply and treatment). During the 1920s and during the Civil War and the immediate post-war period, some of these diseases appeared or reappeared. One of these illnesses, which was widespread in the poorest areas, was pulmonary tuberculosis. It was highly prevalent in Biscay, and then attenuated between 1920 and 1936. It reappeared during the years of conflict and post-war period before abating at the end of the 1940s.[23]

Morbidity is a reliable reflection of the state of a population's health, but as we do not have access to information about its impact we have examined

22. González Ugarte (1994), p. 50, and Arbaiza (1998), pp. 128 and 145-9.

23. The arrival of antibiotics was significant for the treatment of all types of infections. Although penicillin proved to be ineffective against tuberculosis, in 1943-44 a new antibiotic was developed, streptomycin, which contributed to eradicating this disease. Subsequently, throughout the 1950s, the discovery of tuberculostatic medicines and isonicotinic acid hydrazide contributed to a drastic fall in morbidity and mortality due to tuberculosis. With respect to the death rate due to pulmonary tuberculosis, see *Reseña Estadística de la Provincia de Vizcaya* (1951), pp. 126 and 169.

the relationships between health and height based on death rates. We studied a series of annual average values of two variables related to the biological standard of living: the overall death rate and child mortality. Figures 5 and 6 show the evolution of these demographic variables together with that of height. The progressive reduction of overall mortality in both the rural and urban environments of Biscay began at the beginning of the nineteenth century.[24] Research has revealed that the beginning of the industrialisation process and the boom in urban development gave rise to an increase in death rates that lasted for a good part of the last quarter of the nineteenth century.[25] It has been shown that mining towns such as San Salvador del Valle and Abanto y Ciérvana, or industrial towns such as Barakaldo and Sestao, reached overall death rates higher than 40 per 1,000 during these years. In rural towns, such as Larrabezúa, Munguía and Morga, death rates stood at 20-30 per 1,000.[26] The child death rate was also higher in the industrial cities, peaking in the 1880s and descending from the end of the nineteenth century.[27]

During the 1880s, a strong increase in the overall death rate and child mortality was recorded, which coincided with a fall in height in the second half of this decade and slower growth in the following decade (Figures 5 and 6). In addition to the negative effects caused by lower purchasing power, which gave rise to nutritional stress, food deprival and poverty prevailed. Furthermore, we should highlight that during this phase of industrial development of the province there was a high incidence of deficient environmental conditions of housing. The need to share homes gave rise to overcrowding at a time characterised by a scarcity of urban facilities,[28] particularly those related to water infrastructure.[29] The proliferation of public fountains and the non-existence of a sewerage system contributed to poor personal hygiene, leading to an increased mortality rate, particularly among children.

24. Arbaiza, Guerrero & Pareja (1996), p. 37.

25. The source used for monitoring mortality rates was drawn from the Basque Institute of Statistics (EUSTAT) but has the disadvantage of a data gap during the critical phase of the industrialisation process of Biscay. In any event, the high overall and child mortality rate during this period is well documented, as is the beginning of the change in the evolution of these variables in the last few years of the nineteenth century. In this respect, see González Ugarte (1994), and Arbaiza, Guerrero & Pareja (1996).

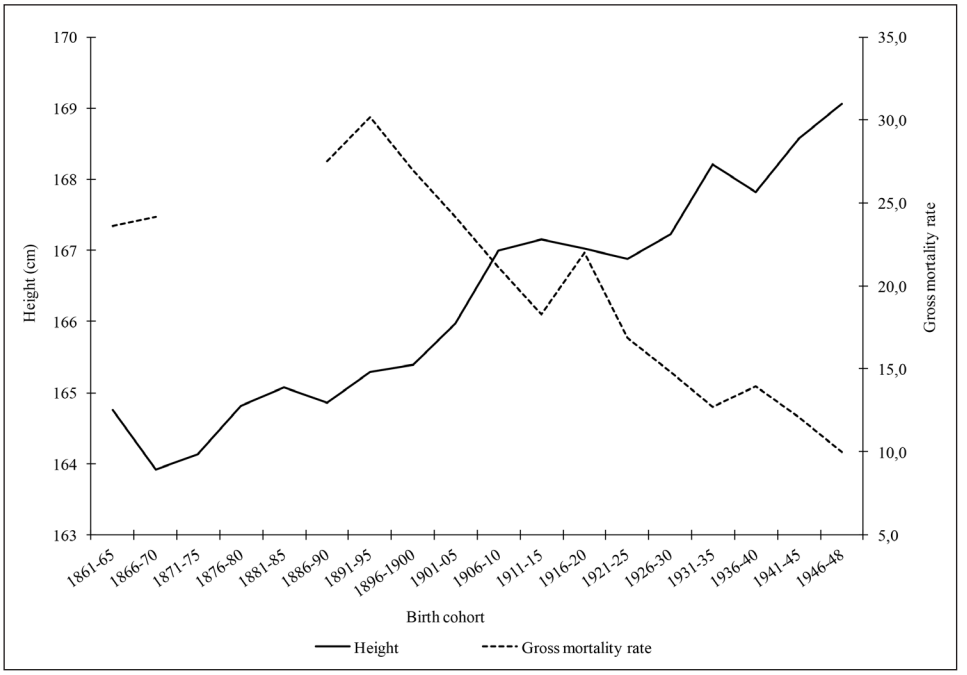
26. See González Ugarte (1994), p. 40, and Pérez-Castroviejo (2005), pp. 80-81.

27. González Ugarte (1994), p. 45.

28. This process was not exclusive to the towns on the Estuary of Bilbao. In the village of Bermeo, for example, the lack of urban space and the agglomeration of its inhabitants gave rise to slums, poor hygiene and an accumulation of rubbish. See Delgado (1998), p. 270.

29. The local fountains situated at different points of the towns were incapable of supplying the whole population. It was necessary to resort to other springs, some far from the town centres. But while, little by little, solutions were sought for supply, sanitation was not even addressed. The construction of a modern sewerage system was considered too expensive and difficult to carry out in an area with a scattered population. See Pérez-Castroviejo (2005), p. 94.

FIGURE 5 ▪ *Overall mortality rate and heights in Biscay (Five-year averages)*

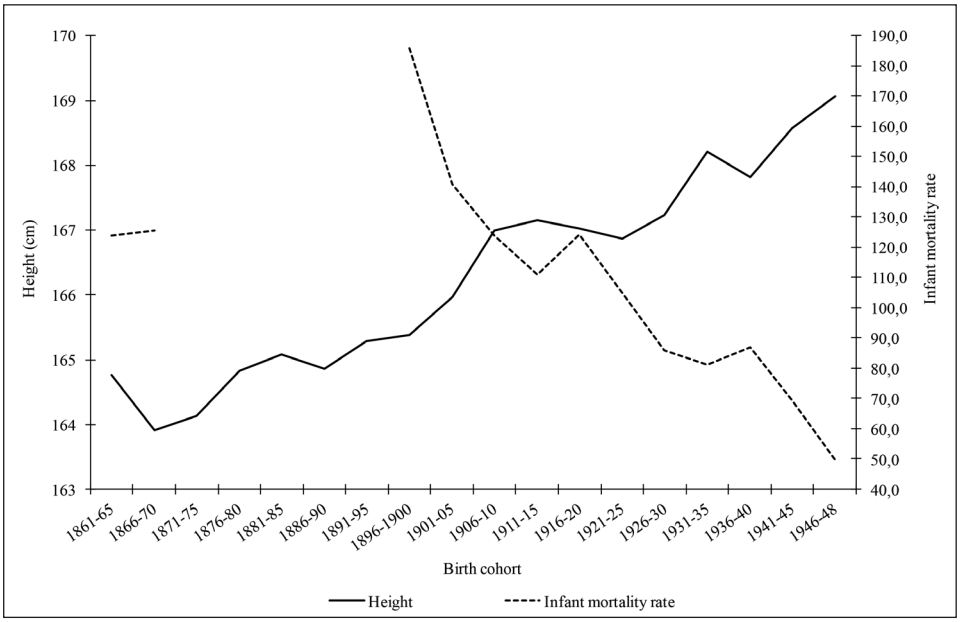


Source: Eustat and author's own work.

During the last decade of the nineteenth century the overall death rate began to fall, while child mortality started to decrease later, in the first decade of the new century. The sharp fall in mortality during the first half of the twentieth century was marked by two relevant exceptions; the upturn due to the influenza epidemic of 1918, and another increase during the Civil War. There is an evident correspondence between this variable and height (see Figures 5 and 6). It should be pointed out that child mortality was relatively lower in the Basque Country than in the whole of Spain, knowing, as we do, that the height of this region was among the tallest in the country. The majority of the factors that would cause a fall in child mortality could be affecting the almost parallel increase in height. In addition to improved purchasing power, higher levels of consumption and dietary diversity, we can add the progress being made in the supply of drinking water, the construction of sewerage systems, the opening of new hospitals,[30] and a generalised vaccination pro-

30. To better attend the sick of Bilbao and the province, in 1908 the Hospital de Basurto was built. Located on the outskirts of the capital and close to the industrial towns, its main characteristic was its distribution over independent blocks to isolate sick people and avoid the unnecessary spreading of diseases.

FIGURE 6 ▪ *Infant mortality rate and heights in Biscay (Five-year averages)*



Source: Eustat and author's own work.

gramme. Advances in the urban development of the towns were taking shape with the implementation of town planning frameworks. The town councils gave special attention to water services, but on more than one occasion budgetary constraints prevented projects from being carried out. Over time, domestic water systems began to be installed, and, although with greater reluctance from the property owners, the installation of a pipe network was undertaken. In short, the adoption of public and private hygiene systems contributed to an improvement in quality of life and the remission or disappearance of some childhood illnesses.[31]

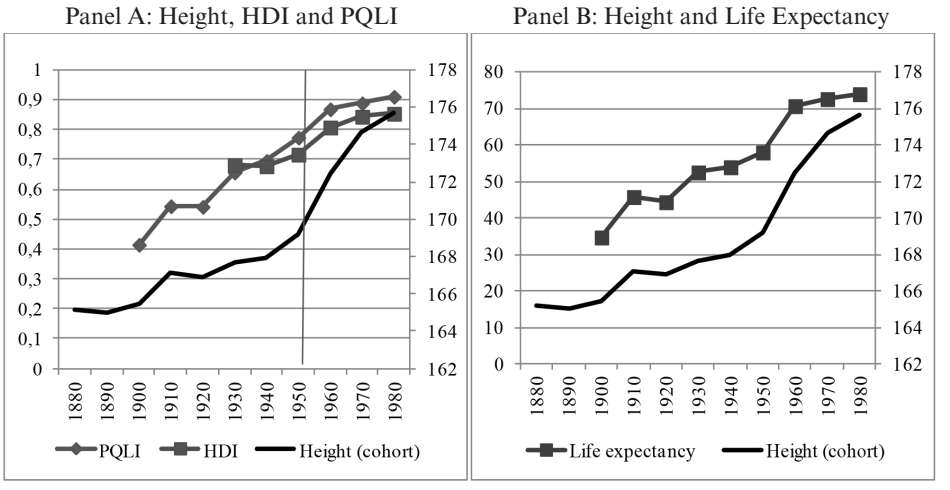
Health education policies and social and political advances, which were developed before the Civil War, also contributed to the biological welfare of the Biscay population. Although at the beginning of the Franco dictatorship the standard of living of the population weakened, the overall and child mortality rates continued to fall, with the latter standing at levels of 50 per 1,000, as opposed to the higher levels of Spain as a whole which were close to 80 per 1,000. During the difficult economic situation of the 1940s, the increase in the average height of the Basque recruits did not exceed one centimetre. The factors that contributed to maintaining the falling trend in death rates and the moderate increase in height in a context of economic difficulty

31. For the water service in Biscay see Pérez-Castroviejo (2005), pp. 94-98.

for working families are also related to the continuation of certain policies adapted to the new situation with its lack of freedom.[32] In 1942, the *Seguro Obligatorio de Enfermedad* (Statutory Sickness Insurance Scheme) was introduced, which gave health cover to workers with lower incomes, providing them with outpatient care and surgical and hospital care. This new insurance scheme extended the health infrastructure with the creation of a provincial hospital in Barakaldo in the 1950s called "Cruces", while the work of doctors progressed in terms of treatment for the first time thanks to the introduction of antibiotics.

Socioeconomic and nutritional progress was much more significant after the 1950s. Welfare indicators made a considerable leap forward during this decade. The progress observed in height occurred in parallel with spectacular improvements in life expectancy and the physical quality of life index (PQLI) and human development index (HDI), as shown in the panels of Figure 7.

FIGURE 7 ▪ *Indicators of human welfare and biological welfare in Biscay. Height by cohorts 1880-1980 (*)*



Source: (*) Until 1950, the estimated height data are taken from the sample, where 1950 is the year corresponding to those born in 1948. From 1960 to 1980 the data corresponds the height of the Basque Country. For the rest of the indicators provincial data have been used: HDI and PQLI, in Escudero & Simón (2012), and life expectancy the author's own work based on data drawn from the National Institute of Statistics (INE).

32. The most evident case was related to social insurance. The Franco regime superimposed the new system over the existing statutory social insurance which had arisen during republican rule: Labour Mutualism. The diffusion of this official mutualism consolidated the professional social insurance schemes in Spain at a time when universal social security systems were gaining ground in Europe. See Comín (2007), pp. 662-6.

Body Mass Index: An Indicator of Nutritional Health

An indicator which links environmental factors with physical or biological welfare at the time of measurement and which identifies possible inequalities is the body mass index (BMI). This index, also known as the Quetelet index, enables us to explore certain problems that affect nutritional health, such as obesity. This phenomenon is developing at an alarming rate both in advanced and more industrialised countries as well as in developing countries. The BMI is known to be an excellent indicator of possible illnesses and risk of death.[33] In our case, where populations from the nineteenth century until the beginning of the twentieth century suffered from deprival and shortages, the BMI can be useful to analyse the evolution of robustness and determine situations of scarcities or low weight. As we know, the index relates height with weight and is calculated by dividing weight in kilograms by the height in centimetres to the square. It is also known that as opposed to height, which constitutes a record of net nutritional status during the growing phase or the first 20 years of life, the BMI measures nutritional health at the moment of weighing, in our case at the time of measurement, therefore in the year of recruitment.

Tables 2 and 3 present the results of three years: 1912, 1956 and 1969 within the sample, the data of which has been organised on this occasion into the different environmental sections of residential areas, industrial areas, and ag-

TABLE 2 ▪ *Body mass index in 1912, 1956 and 1969 by areas in Biscay (%)*

Interval	Classification	1912		1956		1969	
		Urban	Rural	Urban	Rural	Urban	Rural
<16.00	Severe thinness						
16.00-16.99	Moderate thinness	1.38					
17.00-18.49	Mild thinness	4.86		2.22		1.59	
18.50-24.99	Normal range	89.58	82.27	82.27	74.76	77.29	68.57
25.00-29.99	Pre-obese	4.16	17.72	14.44	22.42	18.72	25.71
≥30.00	Moderately obese			0.55	2.8	2.39	5.71
AVERAGE BMI		21.38	23.09	22.73	24.24	23.26	24.03
Total		100	100	100	100	100	100

Source: Author's own work based on *Expedientes Generales de Reemplazo.*

1. Industrial area: 1912 – Portugalete, S. S. del Valle and Sestao; 1956 – Sestao and S. S. del Valle, and 1969 – Sestao.

2. Rural area: 1912 and 1956 – Amorebieta, Dima and Bermeo, and 1969 – Dima and Bermeo.

33. Fogel (2009), pp. 48-53.

TABLE 3 ▪ *Percentiles of the body mass index of the Biscay recruits*

	1912		1956		1969	
	Industrial	**Rural**	**Industrial**	**Rural**	**Industrial**	**Rural**
Extreme minimum value	16.38	18.58	17.13	20.07	18.13	18.52
P3 (0.03)	17.65	19.47	19.08	20.69	19.27	18.67
P5 (0.05)	18.16	19.98	19.44	20.92	20.00	19.95
P10 (0.1)	18.82	20.41	19.81	21.51	20.55	20.69
P20 (0.2)	19.73	21.09	20.69	22.38	21.00	21.96
P25 (0.25)	20.18	21.39	21.04	22.75	21.33	22.22
P50 (0.5)	21.28	22.82	22.38	24.14	22.90	23.46
P75 (0.75)	22.81	24.48	24.06	25.00	24.49	25.31
P80 (0.8)	23.03	24.83	24.54	25.29	25.02	25.62
P90 (0.9)	24.01	25.89	26.13	27.09	27.27	28.07
P95 (0.95)	24.63	26.64	27.12	28.21	27.96	29.96
P97 (0.97)	25.34	28.33	27.28	29.47	29.02	32.09
Extreme maximum value	27.55	28.96	30.55	34.03	35.59	34.15

Source: Author's own work based on *Expedientes Generales de Reemplazo.*

1. Industrial area: 1912 – Portugalete, S. S. del Valle and Sestao; 1956 – Sestao and S. S. del Valle, and 1969 – Sestao.

2. Rural area: 1912 and 1956 – Amorebieta, Dima and Bermeo, and 1969 – Dima and Bermeo.

ricultural areas. In Table 2 the percentage of recruits belonging to each of the BMI intervals established by the World Health Organisation (WHO) has been calculated, and in Table 3 the percentiles of the index are displayed. The result is absolutely normal, as the majority of recruits in both areas considered fall into the healthy weight section with a BMI of between 18.5 and 24.99. Moreover, the percentage of recruits with values of moderate excess weight with an index of between 25 and 29.99 increased from 1912, which is more evident in rural areas.

At the beginning of the 1920s, the young Basque men were particularly robust compared to the Spanish average, with a clear equilibrium between height and weight. The industrialisation process of the province progressed in parallel with a nutritional transition. The improvement in purchasing power during these years translated into an increase in the consumption of basic commodities and the addition of other products to the food basket which were known but not widely consumed. The degree of robustness increased slightly during 1956 and 1969. A survey on family budget carried out by Spain's National Institute of Statistics in 1958 revealed an average monthly

expenditure higher than that of other areas of the country.[34] Furthermore, the consumption of basic products — meat (beef, pork and lamb), fish, wine and oil — did not fall during this decade or the following one.[35] It is worth highlighting that the average BMI is higher on all three dates considered in the rural area. This reveals the existence of a better nutritional status in the countryside than in the industrial areas, due to the closeness of food sources (mainly meat and milk) to the rural population. However, Table 2 also shows a high percentage of young men residing in industrial towns with a normal BMI (healthy weight). This index would be due to greater work opportunities, the possibility of acquiring a wide range of food products more regularly, and being able to enjoy good quality municipal services.

Finally, those individuals whose profession has been recorded in 1912 and 1956[36] have a normal weight for their height and there are hardly any differences between areas or professions. The mine operators of San Salvador del Valle in 1912 and the factory workers in 1956 have a healthy weight with an index of 22. This was exceeded by barely one point by farmers and fisherman on the same dates. The specialised workers residing in both industrial towns and rural areas had an index of robustness which was very similar to that of their non-specialised counterparts, with a balance between weight and height within the parameters considered as normal by the WHO.

Height and Regional Inequality

In order to evaluate the importance of the environmental factors that affected biological welfare, we have compared the evolution of the average height of the Basque young men with that of other geographical contexts. Figure 8 includes several complete series of average height standardised at 21 years of age of a good national sample made up of different regions of Spain with different degrees of economic and social development.[37]

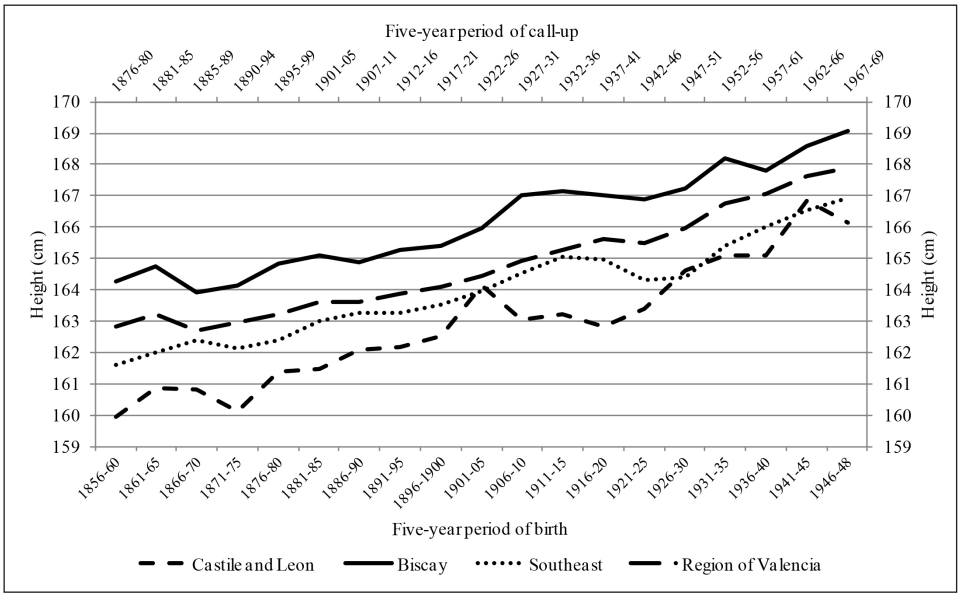
34. This random sample in Biscay included 84 families of which 46 resided in Bilbao, 38 in towns with more than 10,000 inhabitants and 11 in towns with a population of fewer than 10,000. The monthly expenditure per family was 5,000 pesetas, higher than the national average by 1,000. The comparison of Bilbao with the average of regional capitals revealed 500 pesetas more per family and that of the towns exceeds the other towns by more than 1,000 pesetas. See *Reseña Vizcaya* (1960), p. 455.

35. See *Reseña Vizcaya* (1960), pp. 440-449, and *Anuarios Estadísticos de España*, 1950-1969.

36. The year 1969 has not been considered as there is no information regarding profession in some of the towns of the sample for this year.

37. Comparative studies of this type can be found in González Portilla (1998 and 2001), Martínez-Carrión (2005), and, recently, on the height of Europeans in Martínez-Carrión (2012).

FIGURE 8 ▪ *Comparison of the evolution of the average heights of Biscay, the region of Valencia, the Southeast and Castile and Leon (Five-year averages)*



Source: Region of Valencia (Puche-Gil, 2011), Southeast (data provided by Martínez-Carrión), Castilla-Leon (Moreno & Martínez-Carrión, 2010), Biscay – data in text.

The tallest Spanish heights were found in the regions with higher levels of industrialisation, such as Biscay and Catalonia. The intermediate heights corresponded to, among others, the region of Valencia.[38] The shortest heights in Spain were recorded for the southern and central regions, such as Castile and Leon.[39] The trend of the average height among the cohorts born between 1856 and 1860 and between 1946 and 1948 increased in the cases considered and a slight inter-regional convergence can be observed at the end of the period, due to the progress made in the less developed areas. The most significant advances were made in the regions with the lowest heights. In Castile and Leon, the total increase was more than 6 cm, while the tallest recruits, in Biscay, grew by 4.5 cm. There is considerable disparity between the heights of the cohorts born in the mid-nineteenth century. In the period 1856-60, young Basque men were much taller than those from Castile and Leon, by more than 4 cm. They also exceeded those from the southeast by 2.6 cm and those from Valencia by 1.5 cm. The convergence of heights between the regions studied did not occur until the 1960s, sometimes with notable disparities. The last

38. For data on Catalonia see Ramon-Muñoz (2009 and 2011).
39. Some of the previously-mentioned studies also arrive at the same conclusions.

birth cohorts (1946-48), corresponding to the recruits of the late 1960s, exhibit these differences, with the Biscay recruits being the tallest, 3 cm taller than those from Castile and Leon and a little over 1 cm taller than those from Valencia. The inequalities were less pronounced in the case of the shortest heights corresponding to Castile and Leon and the southeast which, since 1930, had been very similar and are still increasing among the young men from Murcia. The disparity in height between the north and the south-eastern and central parts of the peninsula reflect the inequality in living or working conditions, the environment and health.

We can also observe behavioural differences at critical junctures. In general, we can see that the biological welfare of Spaniards born between the mid-nineteenth century and 1875 deteriorated with a fall in height, which can be seen in Figure 8. There was also a decline in biological welfare during the early phases of industrial development, coinciding with increases in overall death rates and particularly child and youth mortality. The fall in height was more pronounced in Castile and Leon and the Southeast and less so in Biscay and the region of Valencia. The tallest heights of the Basque and Catalonian men could be related to the fact that they grew up in geographical environments with lower levels of child mortality during the second half of the twentieth century.[40] In the case of Biscay, we can also consider a series of factors that favoured the standard of living. It has been suggested that these factors could include the implementation of measures against infectious diseases (preventive habits and smallpox vaccine), changes in agricultural economic structures (early disentailment and the introduction of potato crops), and finally, as a result of the abundance of cattle farming in the Basque region, a greater consumption of meat, which gave rise to a diet with more calories in the rural areas and in the towns.[41] The recovery of the average height in the following decades until the First World War clearly indicates the relative improvement in biological standards of living, which coincided with the beginning of the demographic transition.

The average height declined again among the generations born during the First World War and 1925. In this phase, critical moments were experienced during the earliest years of life, such as the Great War and the early 1920s, and before being measured, during adolescence — 1936 and 1947-51 — they suffered the Civil War and the difficult years of the long post-war period, known as the "years of hunger". In Figure 8, we can observe the decline in height which affected the adolescents (see call-up years) more than the children (birth cohorts). Recent studies have revealed the terrible consequences of the policies applied during the 1940s with respect to the economic welfare

40. Dopico (1987), and Dopico & Reher (1998).
41. Arbaiza, Guerrero & Pareja (1996), pp. 38-43.

of the Spanish population. The reduction in purchasing power and the resulting fall in consumption gave rise to diminished health, experienced mainly by workers.[42] Poverty, hunger, and the black market were the result of the Civil War and the implementation of the Franco Regime.[43] The negative effects of the dictatorship and even the Civil War varied between regions. The most pronounced downturn can be observed in the southeast and the regions least affected were the Basque Country and Valencia. However, in Castile and Leon, the crisis began earlier as a result of the deindustrialisation process which had begun at the beginning of the twentieth century, particularly throughout the second decade. In the late 1950s and during the 1960s there was a significant increase in height due to the positive effects of economic development and the opening up to the outside world. The improvements in standard of living indicators were also influential, especially in regions with industry, such as Biscay and the region of Valencia.

Conclusions

This article presents a first series of biological welfare for Biscay during the phases of industrialisation and economic modernisation. The series is constructed from height data and represents six towns that are well characterised in environmental and socioeconomic terms. With local data regarding height, the article explores the changes in the standard of living of young Basque men from the last quarter of the nineteenth century until the 1960s. The results reveal that there was an upward secular trend, showing the improvements in welfare, health and nutrition. Despite the advances made in long-term biological welfare, the evolution of height was discontinuous over time due to the influence of environmental and socioeconomic factors.

The cohorts prior to the industrial boom of the province experienced a reduction in average height, which lasted until the beginning of the industrialisation process in 1880. The economic and demographic transformations of the industrial area, urban growth, the scarcity of housing and high rents, together with the insufficient infrastructure related to sewerage systems and drinking water supply had highly negative effects, mainly on the industrial towns and, over time, on towns which experienced urban development without becoming industrialised. Diseases that were transmitted by air, water and

42. See Martínez-Carrion, Puche-Gil & Ramon-Muñoz (2012), González Portilla & Urrutikoetxea (2012), Martínez-Carrión & Cañabate (2013), Cussó & Garrabou (2007), and Nicolás (2011).

43. González Portilla & Urrutikoetxea (2012) highlight the importance of the black market and the fall in height of the recruits measured during the Civil War and the immediate post-war period.

food increased overall death rates, especially infant mortality until the beginning of the twentieth century. We have highlighted that low purchasing power determined nutritional status, and when it increased from the last decade of the century, biological standards of living improved.

The increase in average height was evident during the first decade of the new century, reaching 167 cm during the years preceding the First World War. The anthropometric data suggest that from the beginning of the twentieth century a significant proportion of the population had insufficient income in order to ensure their energy and basic caloric needs. The increase in height was due to a fall in the death rate resulting from urban improvements to the public health system, particularly infrastructure for the supply and treatment of water. However, the cohorts born after the First World War until 1925 exhibit significant decreases in average height. During their childhood, these young men had suffered the effects of losing purchasing power and the blows of some of the epidemics that could have increased the mortality rate, such as the influenza pandemic of 1918-20. These cohorts also suffered the consequences of the war and post-war period during their adolescence, which undoubtedly was a lot harder from a nutritional point of view than the difficult times suffered during their earliest years.

The data referring to height by year of recruitment are consistent with the effects of nutritional shortages during adolescence, which gave rise to delays in the final growth spurt in the 1940s. Inadequate calorie intake and the lower consumption of certain basic nutrients for physiological development (calcium, riboflavin, niacin, vitamins B6 B12, among others) in the years of the teenage growth spurt could have had serious consequences for the final height. The years of the Civil War and especially the post-war period have been dubbed the "years of hunger", when malnutrition could have extended beyond the poorest classes and the marginalised population groups. The recovery and growth in height took place as of the cohorts of the mid-1920s, with the exception of the Civil War and immediate post-war period. These recruits were adolescents who benefitted from the positive economic effects of the 1950s and 1960s and who experienced an overall improvement in standards of living, which is corroborated by the BMI calculations.

The critical phases with respect to the decline in height among the generations born between the mid-nineteenth century and 1875 and then between the First World War and 1925, were less relevant in Biscay than in other regions. The special economic conditions of the province helped the population to overcome the difficult economic situation in Spain, although not without considerable effort made by the Basque workers. The average height of Biscay and its evolution over time has been compared with that of other regions analysed in Spain, and the existence of marked regional imbalances has been found. Inter-regional economic inequality took its toll on heights. The tallest

heights corresponded to the regions with the highest levels of industrialisation, such as Biscay, and the shortest to the less economically-developed regions, such as the southeast and Castile and Leon. The study also finds that the most important advances were made in the less developed regions with shorter heights and that regional convergence only began very timidly with the cohorts of the end of the 1940s.

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Biological Welfare during the Economic Development of the Basque Country: Biscay, 1850-2000

ABSTRACT

This paper analyses the biological welfare in the context of industrialisation and economic growth in Biscay. It explores the changes in the welfare of young Basques from a sample of six towns, three of them agricultural and the other three industrial. Although the average height had a rising trend in the long term, its evolution was irregular due to the influence of environmental and socioeconomic factors. The decline of height is particularly evident at three stages: firstly, during the pre-industrial boom and once the process had been initiated in the 1880s; secondly, from the end of the First World War until 1925 and, finally, during the years of the Civil War and its aftermath. Moreover, this paper reveals a correlation between health, real wages and height, and it also pays special attention to body mass index (BMI) in order to assess the degree of robustness of the Basque recruits throughout the period under study.

KEYWORDS: biological welfare, human height, standard of living, Biscay

JEL CODES: I31, N33, N34

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El bienestar biológico durante el desarrollo económico del País Vasco: Vizcaya, 1850-2000

RESUMEN

Este trabajo analiza el bienestar biológico en el contexto de la industrialización y el crecimiento económico de Vizcaya. A partir de una muestra de seis localidades, tres industriales y tres agrarias, explora los cambios del bienestar de los jóvenes vascos. Aunque la tendencia de los promedios de estatura en el largo plazo fue ascendente, su evolución fue irregular debido a la influencia de factores medioambientales y socioeconómicos. El deterioro de la talla por cohortes de nacimiento se manifiesta especialmente en tres momentos: durante la fase previa al despegue industrial de la provincia e iniciado el proceso en la década de 1880, en la etapa final de la IGM hasta 1925, y en los años de la Guerra Civil y la posguerra. Se revela igualmente una correlación entre la salud, los salarios reales y la estatura, y se hace un especial seguimiento a lo largo del período del índice de masa corporal para apreciar el grado de robustez de los reclutas vascos.

PALABRAS CLAVE: bienestar biológico, estatura humana, nivel de vida, Vizcaya

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