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Height and standards of living during the industrialisation of Spain: The case of Elche

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The purpose of this article is to present new evidence on living standards during the Spanish industrialisation process by means of secular trends in height. The data pertain to Elche, a town in the Valencia region of south-eastern Spain that witnessed early and rapid industrial development in the context of Spain's delayed industrialisation and experienced strong immigration during the twentieth century. Thus, the relationship between biological standards of living and industrialisation and urbanisation is explored. The data suggest that the first stages of industrialisation in the late nineteenth century did not bring much improvement to workers' living conditions. The consequences to health and nutrition of Spain's Civil War and its aftermath are also examined. Finally, we comment on the process of general convergence in height that took place at the end of the period considered.

1. Introduction

Studies of changes in living standards during industrialisation and economic development have gained considerable attention in the last two decades. New sources of data have emerged and new methods of analysis have been applied, thus giving rise to new approaches to human health and welfare in modern times. Although the case of England remains the best-known of all, recent research on various other countries has contributed to the living standards debate and given the discussion a comparative international perspective. Besides the traditional indicators of welfare such as *per capita* income, real wages, education, life expectancy and child mortality, economic historians have now become familiar with anthropometric indicators (Floud *et al.* 1990, Ward 1993, Komlos 1994, 1995, Steckel 1995, Steckel and Floud 1997).

Of all the measures used, stature and the body mass index have attracted the most attention. According to biomedical researchers, stature and the

body mass index constitute two excellent indicators of human welfare and, in particular, of health and nutritional status. Thus, the study of the height of a subpopulation or social group allows us to explore aspects of its quality of life previously unrevealed by conventional indicators.

Obviously, there are many ways of approaching the issue of living standards, as has been shown for the working classes of England. This is why alternative indexes using different aggregation methods have been developed for purposes of comparison. Among the most widely accepted of these is the United Nations' Human Development Index (HDI), which has three components – income, longevity and literacy. This and similar indexes have opened up new approaches to a controversial issue, though they still leave unresolved the problem of weighting the variables used (Crafts 1997). At any rate, the progress made has given new insights into the problem of the effects that industrialisation had on health and nutritional status.

In Spain the living standards debate has always been present, but – unlike other fields of economic history – the number of publications on the subject has remained small (Martín-Aceña and Simpson 1995, Simpson 1997). In recent years, however, this weakness of Spanish historiography is being corrected, as shown by the specialised sessions devoted to the analysis of living standards at major conferences such as the Symposium on Economic Analysis (Barcelona 1990) and the SEHA (Salamanca 1997). The main approaches have focused on working conditions, real wages and the formation of industrial labour markets (Fernández de Pinedo 1992, Pérez Castroviejo 1992, Camps 1995, Simpson 1995a, Escudero 1997), and on the impact of urbanisation and industrialisation on health and disease. The fact that most Spaniards came from the rural milieu until well into the twentieth century explains why most studies have focused on the living standards of rural populations (Martínez Carrión 1997). Housing, diets and cost of living, child mortality, morbidity and causes of death, and stature have been some of the variables used for analysis.[1]

This article presents new evidence on the progress of living standards during Spanish industrialisation and explores the links established between economic and welfare cycles through the height of conscripts in three towns of south-eastern Spain. Our analysis, however, focuses on Elche, a town south of the Valencia region characterised by early industrial development in the context of Spain's late industrialisation process. The results for Elche are compared with those for Cieza and Murcia during the various periods for which data are available. Unlike Elche – which specialised in shoe-making

[1] For housing, see Pérez Castroviejo (1992); for diets, Simpson (1995b), table 13.2; Catalán (1994), table 12.6; Angulo *et al.* (1996); for cost of living, Ballesteros (1997); for child mortality and causes of death during the Basque Country's industrialisation, see Pérez-Fuentes (1993); González Ugarte (1994); and Arbaiza (1995); id. in rural Spain, see Reher *et al.* (1996). For height, Martínez Carrión (1994a) and Gómez Mendoza and Pérez Moreda (1995).

and whose industrialisation process started in the 1860s and 1870s – the economy of the other two towns remained basically agricultural in nature until the turn of the century. Thereafter, food and agriculture-related industries began to flourish. The height data for all three towns is compared to the available height data for all Spaniards.

The present article is divided into four sections. First, we describe Spain's economic development and industrialisation process and discuss Elche's representativeness in the context of the Spanish experience. Second, we point out statistical problems posed by Spanish anthropometric sources with reference to height data and the methods used to handle them. Third, we present the results of the secular trend of height for Elche's conscripts and compare them with those for other towns in south-eastern Spain. In addition, the data for Elche is arranged by rural or urban residence, mobility and origin, and the social and occupational status of conscripts. Finally, we discuss the findings, and place them in comparative international perspective in relation to the environmental and economic factors associated with height patterns.

2. Economic growth and welfare: the historical experience

2.1. The pattern of industrialisation and living standard indicators in Spain

The trajectory of Spain during the nineteenth and twentieth centuries reflects a continuous attempt to change its traditional agriculture-based socio-economic structure into a modern industrial one. This process has not been without its problems and painful interruptions. In the nineteenth century, Spain lost its American colonies and various civil wars broke out. In the twentieth century, the effects of the painful civil war of 1936–9 and the policy of the early Franco fascist regime brought economic isolation and worsened living standards for Spaniards. The opening of the economy to international markets in the 1960s, the advent of democracy in 1975, and the entry into the EEC in 1986 marked Spain's definitive liberalisation (Tortella 1994b, Martín-Aceña and Simpson 1995).

There is widespread agreement on the backwardness of the Spanish economy in the nineteenth century (Nadal 1973, Prados de la Escosura 1988, Molinas and Prados de la Escosura 1989, Carreras 1990). Recent estimates of industrial output show: (1) a dramatic decline from the end of the eighteenth century to the beginning of the second quarter of the nineteenth century; (2) a significant yearly increase of 4.6 per cent between 1830 and 1860; and (3) a progressive yearly decline of nearly 2 per cent until 1910. While in 1860 Spain found itself at the first industrial stage according to the Hoffman index, hand in hand with countries such as Belgium, France, Austria, Russia and Sweden, in 1910 it found itself only with Russia (Carreras 1995, Prados de la Escosura 1995). *Per capita* income as a percentage of that of western European countries dropped from 81 per cent

in 1820 to 56 per cent in 1913 (Tortella 1994a, Maddison 1995, Carreras 1995).

This relative weakness of Spain's international position was accompanied by a delay in structural change. On the eve of World War I, two thirds of the Spanish labour force were engaged in farming; however, they only accounted for one third of Spain's GDP. The composition of the Spanish labour force remained largely unchanged throughout the nineteenth century except for large cities and the industrial belts of Barcelona, Bilbao and Madrid in the last third of the century. The urban population in centres of over 100,000 inhabitants was very small in 1910 and those living in communities of more than 5,000 and 10,000 inhabitants accounted for 32.3 and 17.5 per cent, respectively, of the total Spanish population.

Living standards were low compared to western European countries. Some estimates of alternative living standard measures reveal that Spain occupied an unfavourable position in 1860, which does not seem to have improved by 1910 (Crafts 1997), as shown by the fact that the demographic transition had hardly begun to take place, except for areas such as Catalonia and the Balearic Islands. Crude mortality rates remained above the 30 per thousand level until they declined in the first decade of the twentieth century. Life expectancy at birth was 29 years in 1860, significantly lower than that of countries in north-western Europe. Even though it had increased to 41 years by 1910, it remained well below the western European norm and closer to the standards of eastern Europe. Child mortality was still nearly 200 per thousand in 1900. The number of illiterates fell from 73 per cent to 48 per cent between 1860 and 1910, yet the illiteracy rate continued to be one of the highest in Europe. There were also marked regional and local differences in welfare indicators.[2]

The economic and social circumstances changed during the course of the twentieth century. After World War I industrialisation extended to other Spanish areas and other manufacturing sectors. The Valencia region claimed a place beside the more traditional industrial areas such as Catalonia and the Basque country. Small local and county industries began to spread across Spain. The diversification and strengthening of Spanish industry had become a reality after the country's electrification. The process of industrial modernisation reached its maturity in the 1960s and 1970s (Nadal *et al.* 1987, Nadal and Carreras 1990, Nadal and Catalán 1994). During that period, Spain enjoyed the highest economic growth and industrial output rates in Europe. Following Hoffman's indexes, Spain entered the second stage in the 1920s and the third in the early 1960s. After 1950, traditional agricultural methods gave rise to more mechanised farming; a large share of the workforce shifted toward the industrial and service

[2] For urbanisation, see Gómez Mendoza and Luna (1986); for infant mortality, Gómez Redondo (1992); for life expectancy, Dopico (1987); for literacy, Núñez (1992).

sectors. Depopulated inner areas contrasted with intense demographic growth in the periphery and the capital. Urbanisation increased and expanded and, despite the strong emigration to other countries, the Spanish population as a whole grew faster than the European average as a direct result of the 'baby boom' and decreased mortality rates.

Welfare indicators exhibited a slight improvement at the end of this period but still revealed that in 1970 Spain continued to be economically and culturally backward by European standards. Comparison of Spain's real *per capita* GDP as a percentage of that of western European countries showed an increment of only nine points between 1913 and 1973. In 1973, the *per capita* income of Spaniards was two thirds that of Western Europeans, according to estimates made by Carreras on data provided by Prados de la Escosura and Maddison (1995).

The upward trend of economic growth and welfare in Spain during the twentieth century was abruptly interrupted by the outbreak of the 1936–9 Civil War and the disastrous policy of Franco's earlier governments. The rise in industrial output was halted during the late 1930s and it decreased in the 1940s. Male industrial activity froze at about 25 per cent. Male manufacturing activity dropped from 17.2 per cent in 1930 to 16.1 per cent in 1950. The most adversely affected sector was the manufacture of consumer goods, in particular food, tobacco and paper. Other economic activities were also negatively affected – there was a fall in agricultural output and a slackening of some energy sectors vital to the economy (Catalán 1993, 1994). As a result, the *per capita* income levels of 1929 were not regained until 1954 and all the other welfare indicators worsened (Prados de la Escosura 1995).

The 1930s and 1940s witnessed a decline of living standards in Spain. The level of real wages in 1935 was not seen again until 1956 (Fontana and Nadal 1976, Catalán 1993). Between 1936 and 1949 there were restrictions on basic foodstuffs, and health standards deteriorated. By the late 1950s, the average calorie intake of Spaniards was well below that of Italians or Greeks, in contrast with what happened in the mid-1930s. The gross schooling levels of 1935 would not be regained until 1964. Consequently, some Spanish scholars speak of a 'wasted generation' of Spaniards in terms of education (Tortella 1994b). Although no official data are available on the average stature of Spaniards, it is quite likely that height standards fell in response to impaired health and nutritional status in the 1940s.

2.2. Representativeness of Elche's case in the Spanish context

What was the role played by Elche and the Valencia region in this historical process? Was Elche's and the Valencia region's industrialisation representative of the 'average' Spanish industrialisation experience? The current state of research does not allow us to establish a representative place for Spain,

one that can qualify as a good proxy to trace the effects of industrialisation on Spanish society. Although there is widespread agreement on the fact that Spain's industrialisation was delayed until the second half of the twentieth century, recent research has pointed out the existence of early industrial development in places such as Tarrasa, Sabadell, and Igualada, in Catalonia; Baracaldo and Sestao, in the Basque country; Alcoy and Elche, in the Valencia region, as compared with a general delay of industrialisation in the rest of Spain. By 1900, the three above-mentioned regions were the most industrialised in Spain (Nadal 1987).

Although the dominant industries differed (textiles, iron and steel working, shoe-making), these towns underwent rapid urban development in the second half of the nineteenth century and played an important part in their respective regions from an industrial point of view. In 1900, the size of their populations ranged from 15,000 to 30,000, Elche being one of the most densely populated of all, also featuring a large percentage of rural population. Regardless of the type of industry involved, any of the above towns could well qualify as representative for Spanish industrialisation, judging from the success that each of them had achieved by the turn of the century.[3] In any event, regional variations and the general retardation of Spanish industrialisation make the question of its representativeness problematic.

Two facts seem to support Elche's representativeness: (1) the dynamic nature of the industry of the Valencia region during the second half of the nineteenth century, as shown in Table 1; and (2) the fact that Elche underwent a strong process of industrialisation and urbanisation in the twentieth century and was, between 1960–70, one of the most important centres of the shoe-making industry in Spain (see also Table 1). Data for 1911 clearly demonstrate Elche's degree of industrialisation. The number of males employed in shoe-making amounted to 4,640 and that of women to 5,585, more than two thirds of whom worked at home. Shoe-making employed 35 per cent of the female labour force and nearly two thirds of the male labour force, exclusive of farm labourers – who were also engaged in such activity on a part-time basis (Miranda 1991).

The case of Elche is peculiar, but it is not the only one in the industrialisation process of the Valencia region. The growth of the shoe-making industry focused on Vall d'Uixó in the province of Castellón, and above all in the valley of the Vinalopó river, in the province of Alicante, with Elda and Elche at the forefront. However, it was Elche's shoe-making industry that developed earlier. Also, in the province of Alicante, Alcoy stood out as one of the main woollen textiles producing centres in Spain during the second half of the nineteenth century. The food and agricultural industry also played an important role at the turn of the century promoted

[3] For Catalonia, see Camps (1995); for the Basque country, Arbaiza (1995) and González Ugarte (1994); for Valencia region, Miranda (1996).

Table 1. *Comparison of Spain's and Valencia's industries by sector, 1856–1973.*

Sectors	Spain			Valencia Region		
	1856	1900	1973	1856	1900	1973
Food	55.8	40.3	11.6	56.7	40.6	10.0
Textiles	23.7	26.7	7.3	24.1	14.4	7.9
Metal	3.2	8.1	38.7	1.2	7.0	24.2
Chemical	3.5	5.6	14.4	2.4	8.4	11.1
Paper	2.3	5.0	6.1	4.7	8.8	4.9
Ceramics, glass	5.3	4.0	6.0	7.8	6.0	8.5
Wood, cork	1.2	3.2	6.1	1.7	7.2	11.3
Shoe, leather	3.8	2.9	9.7	0.9	2.1	22.0
Other	1.1	4.1	–	0.8	5.6	–

Source: Nadal (1987), pp. 52–4.

by the French demand for the wines of Denia and the *Alto and Medio Vinalopó* (Miranda 1996). Finally, it should be made clear that the choice of Elche was not only due to its early industrial development in the context of south-eastern Spanish industrialisation. There are also excellent studies on Elche, and Elche's libraries preserve a rich documentation of data from the military draft extending from the mid-nineteenth century to the 1980s.

3. Sources, sample and methods

The main problem of anthropometric research so far has been the source of information used. In Spain, conscript data from the 1850s onwards is abundant and of good quality. Data on height are available from municipal records from as early as 1858, even earlier in some places. Weight began to be recorded systematically from 1955 onward. The introduction in 1835 of compulsory military service led to the measurement of the entire young male population. Since the process of recruitment (calling, classifying and declaring conscripts fit for service) was very strict, the information recorded is extremely reliable. Therefore, the universal character of the system guarantees the consistency of data.

The period studied covers the drafts from 1858 to 1986. The height data of conscripts have been analysed and related to data on profession, rural or urban residence, and migration (see Table 2). In order to analyse the sample population by occupation, we created subgroups reflecting income and the trajectory of the various economic sectors and industrial branches concerned. Thus, within the primary sector we distinguished between two categories: farmers and labourers. Farmers constitute a well-defined social category, characterised by their ownership of the means of production. Labourers, in the majority of cases, did not own land and were also often

engaged for short periods in activities other than farming itself. The probability that the labourers would also do some shoe and espadrille work at home on orders from manufacturers and workshops was quite high and persisted into the twentieth century (Miranda 1991). The group of industrial and factory workers and craftsmen was divided into: construction, shoe-manufacturing and skin-tanning, wood, textiles and metal craft. Finally we grouped the service sector: trade (shop assistants, transport) and professionals (including white-collar workers such as printers and lawyers) and students, regardless of their nature.

The most significant problems facing the literature are: (1) the changes in recruitment age, and (2) the minimum height requirements for military service. Comparing social groups, economic sectors and populations can solve the first problem (Martínez Carrión 1986). Because the changes in recruitment age affected all Spanish municipalities to the same extent, the consequences for cross-sectional comparative studies are not significant. Besides, these changes in compulsory recruitment age are known – 1856 (20 years), 1885 (19 years), 1901 (20 years), 1906 (21 years).[4] Taking a careful look at the series around those years, no spectacular changes in trend have been observed.

Another problem in Spain is that of selective biases from a truncated distribution of heights arising from the imposition of minimum height requirements for admission into the armed forces. However, this does not affect our analysis, given the universal character of measurement in Spain before any potential recruit could be declared fit.

The rounding to the nearest centimetres is another problem. Normality tests (the χ^2 goodness of fit and the Kolmogorov-Smirnov tests)[5] show anomalous results for those drafted after 1969. This is due to the practice of rounding brought about by the new *Ley del Servicio Militar* – National Service Law – of 1968 and its Regulations of 1969. Unlike the practice adopted in the period from 1857 to 1969, the new regulations ruled that data be recorded in centimetres rather than in millimetres. The data for the period 1857–1969 are therefore quite reliable as normality tests show. The disappearance of measurers also detracts from the credibility of anthropometric data from enrolment lists. This is why the height series presented here end with the 1969 drafts. The practice of data rounding off took some time to set in. Despite the fact that such rounding was also practised before the 1969 Regulations, its effects are hardly noticeable.[6]

The effects of the new Regulations on the data can be seen in Figures 1 and 2. They compare, for specific years, the cumulative sampling distribu-

[4] For Spain's conscript system, see Gómez Mendoza and Pérez Moreda (1985, 1995), Martínez Carrión (1986, 1994a, b).

[5] The software used was S-plus, version 3.3.

[6] Coll and Quiroga (1994), pp. 53–4 have also detected this problem, and point out that between 1950 and 1969 data was increasingly rounded off in many Spanish regions.

Table 2. *Sample distribution according to several characteristics, Elche.*

Decade of birth	Number of conscripts	Percentages
1837–50	1,978	3.4
1851–60	1,141	1.9
1861–70	2,533	4.3
1871–80	1,747	3.0
1881–90	2,862	4.9
1891–1900	3,866	6.6
1901–10	3,481	5.9
1911–20	2,955	5.0
1921–30	5,389	9.1
1931–40	6,203	10.5
1941–50	7,665	13.0
1951–60	8,874	15.0
1961–66	10,280	17.4
Total	58,974	100.0
Age of draftee		
18	227	0.4
19	11,957	20.3
20	30,902	52.4
21	15,849	26.9
Others	39	0.1
Residence		
Rural	10,458	17.7
Urban	25,393	43.1
Unknown	23,123	39.2
Place of birth		
Immigrants	11,897	20.2
Elche	41,775	70.8
Unknown	5,302	9.0
Profession		
Farmers	3,492	5.9
Labourers	5,235	8.9
Shoe industry	10,976	18.6
Construction	1,833	3.1
Textiles	510	0.9
Wood industry	568	1.0
Metal industry	2,001	3.4
Other industry	451	0.8
Trade	3,317	5.6
Professionals & students	6,319	10.7
None or unknown	24,272	41.2

Source: Archivo Municipal de Elche, Actas de reempl'azo.

tion of heights with the normal distribution. The information used refers to the municipality of Elche for 1960, when heights were still measured in millimetres, and 1970, when the 1969 Regulations had already come into force. The difference between sample data and theoretical distributions is clear.

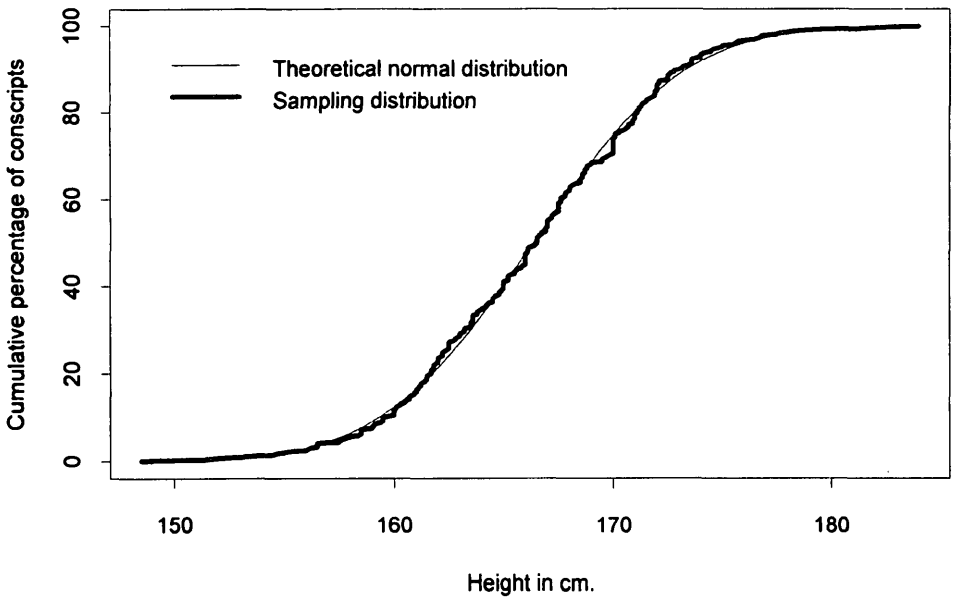

Figure 1. *Normal versus sampling distribution. Elche: 1960.*

By assigning the average height of conscripts of a particular draft to their year of birth, we have been able to build up the average height for that particular year. Although people born in two or more years were sometimes drafted, we have incorporated them into this study because their age at the time of measurement was known with accuracy. Average height series cover the birth years from 1837 to 1948. It was not possible, however, to calculate the average height by birth cohorts in 1847, 1853, 1855, 1857, 1878–80 and 1919. We have been forced to discard average height data from 1949 onwards for the reasons quoted earlier. The average height of conscripts classified according to the variables mentioned above were obtained using the same method. Because the data for some of the variables was not available for all conscripts, samples had to be grouped by five-year periods so that they always had a minimum size of 20 individuals.

Comparison is also made with the average height of conscripts in other recently studied towns of south-eastern Spain with a view to establishing the relationship between standards of living and the processes of economic growth and industrialisation. For the nineteenth century the comparison is made with Murcia (Martínez Carrión 1994a) during the years 1860–1911 (birth years 1839–90), while for the twentieth century it is made with Cieza

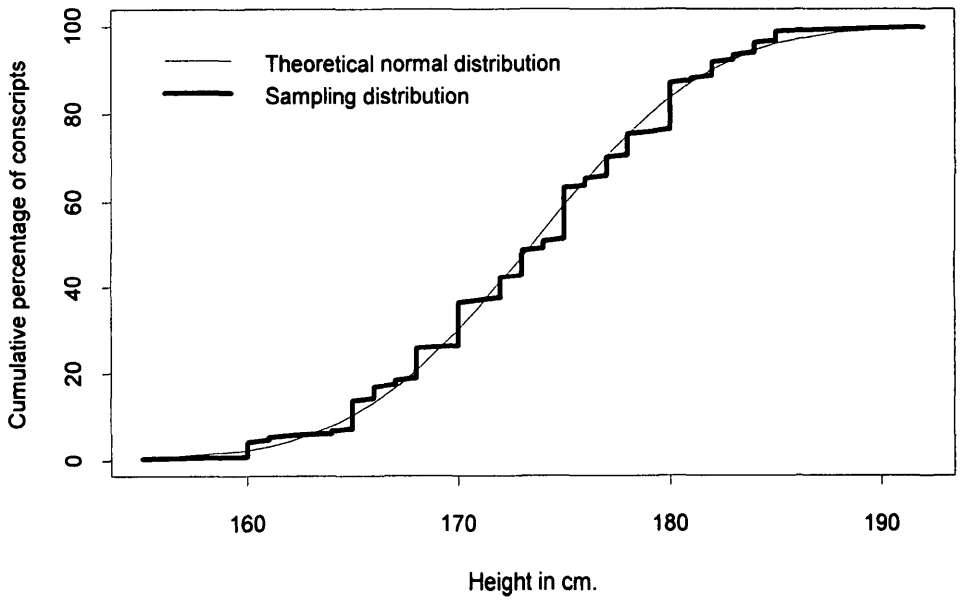

Figure 2. *Normal versus sampling distribution. Elche: 1970.*

(Martínez Carrión 1994b) between the years 1897–1969 (birth years 1878–1948), where the degree of industrialisation was relatively low. The number of conscripts for which height data was available was 31,293 in Elche, 35,191 in Murcia and 11,627 in Cieza. In all three municipalities, yearly average height series used in the comparisons are the result of applying five-year moving averages to the average height series obtained directly from the data. Our purpose is to reflect trends rather than short-term fluctuations.

4. The evidence

4.1. Demographic growth and urbanisation

Data on the size and growth of the populations under study are shown in Table 3. The demographic growth of Elche in the last third of the nineteenth century is associated with its industrial and urban development, whereas in Murcia and Cieza it was due to intensive agricultural production of vegetables in Murcia and fruit in Cieza. In the twentieth century the economic growth of the latter two relied on food, farming and agricultural industries (canned vegetables and paprika in Murcia, esparto in Cieza), whereas Elche was home to the largest shoe industry in Spain. The labour market was thus rather different, Elche featuring a percentage of industrial population far exceeding the others from the end of the nineteenth century.

Elche and Murcia had a large share of their rural populations distributed in small villages and farms scattered around the *huerta* (fertile irrigated land). The urban population in the municipal district of Elche was over 50 per cent, while in Murcia it hardly reached a third of the total. After 1900,

Table 3. *Populations of the municipal districts studied: 1860–1970.*

Year	Elche	Murcia	Cieza
	(a) Evolution of population (1860 = 100)		
1860	100.0	100.0	100.0
1877	104.8	104.5	113.9
1900	145.8	127.4	143.1
1930	212.9	180.8	187.4
1950	298.4	248.7	245.3
1970	655.7	277.6	266.3
	(b) Population size (in thousands)		
1860	18.7	87.8	9.5
1900	27.3	111.5	13.6
1930	38.0	158.7	17.8
1950	55.8	218.3	23.3
1970	122.6	243.7	25.3
	(c) Share of rural population (per cent)		
1857	47.0	69.9	16.1
1900	48.0	71.4	34.4
1930	39.1	66.7	21.1
1950	37.9	73.6	10.6
1970	17.4	58.0	9.6

Source: 'Censos de población' and 'Nomenclatores de población'.

the urbanisation process accelerated, and at a faster rate in Elche and Cieza. The halt of the process in the 1940s in certain places was a consequence of the Civil War and of the industrial crisis resulting from its aftermath (Table 3c). The case of Cieza, which increased its urban population well above the other towns in that decade, can be explained by the boom experienced in the esparto industry in the production of goods for the paper, textile and chemical industries resulting from Franco's autarchic economic policy.

The data on the occupations of conscripts in Table 4 shows the relative increase of both groups in the primary sector between 1900–20. This fact, however, might be misleading as not all the cases observed contain information on occupation. Such findings might be associated with the importance of the agrarian transformation and the need for agricultural labour in the early twentieth century. This period was characterised by the expansion of irrigation and the access of tenants to rented property; it is, however, quite likely that a large number of labourers classified under the primary sector were seasonally engaged in domestic production, producing orders placed by the shoe and espadrille industries (Gozálvez Pérez 1977, Miranda 1991). The data suggest that industrial activities increased in importance by the end of the nineteenth century and accelerated after 1940. From then on, rapid urbanisation took place (Table 3c) which affected a large number of

Table 4. *Distribution of Elche's draftees by economic sector and occupation: 1858–1986.*

Year of draft	1858–1900	1901–20	1921–40	1941–60	1961–80	1981–6
Industry	Percentages					
Primary	*64.5*	*71.5*	*61.6*	*24.9*	*5.9*	*3.0*
Farmers	7.4	18.2	19.6	22.3	5.2	2.4
Labourers	57.1	53.2	42.0	2.6	0.7	0.6
Secondary	*28.6*	*21.4*	*26.0*	*49.1*	*59.6*	*49.0*
Construction	1.9	1.0	2.0	7.9	6.9	4.5
Wood	1.1	0.8	0.9	2.5	1.8	1.4
Metal	1.4	0.6	2.0	5.8	7.7	8.8
Textile and Shoe	24.2	19.0	21.1	28.4	42.0	34.4
Other	0.1	0.0	0.0	4.5	1.2	0.0
Tertiary	*6.9*	*7.2*	*12.4*	*26.0*	*34.5*	*48.0*
Trade and services	4.6	3.6	4.4	11.6	11.4	11.9
Profes. and students	2.3	3.6	8.0	14.4	23.1	36.1
Not available	*50.9*	*26.3*	*91.5*	*48.3*	*10.8*	*53.3*
Total conscripts	7,399	6,728	6,436	11,592	16,539	10,280

Spanish cities. From the late 1950s onwards, Spain's farmers were forced to respond to a number of external pressures. Opportunities abroad and the attraction of jobs in industry and the service sector at home encouraged over two million Spaniards to leave the land in the 1960s (Harrison 1995). In the case of Elche, immigrants flocked from the rural areas of neighbouring regions, such as Murcia and Valencia, and from less developed regions such as Andalucia, Extremadura and Castilla-La Mancha. The data from the 1970 census reveal that 50 per cent of the inhabitants of Elche were immigrants (Gozálvez Pérez 1976, p. 238). This is a factor to consider in the trend of heights in Elche.

4.2. Secular trends and rural-urban differences

Figure 3 shows the existence of various cycles in the trend of Elche's height by years of birth: decline (1840–60), stagnation (1860–80), growth (1880–1920), decline (1920–30) and accelerated growth (1930–50). During the nineteenth century, there was no increase in height until the 1880s. Up to then, height had seen a period of stagnation for the generations born from 1837–45 to 1876–80. Looking at yearly data, there was a sharp fall at the end of the 1860s continuing into the early 1870s. The situation was similar in Murcia. Comparing Elche with Murcia, substantial differences existed in mean height during the nineteenth century. In Elche, height averaged 163 cm towards 1840 – three centimetres above the mean height of Murcia. This

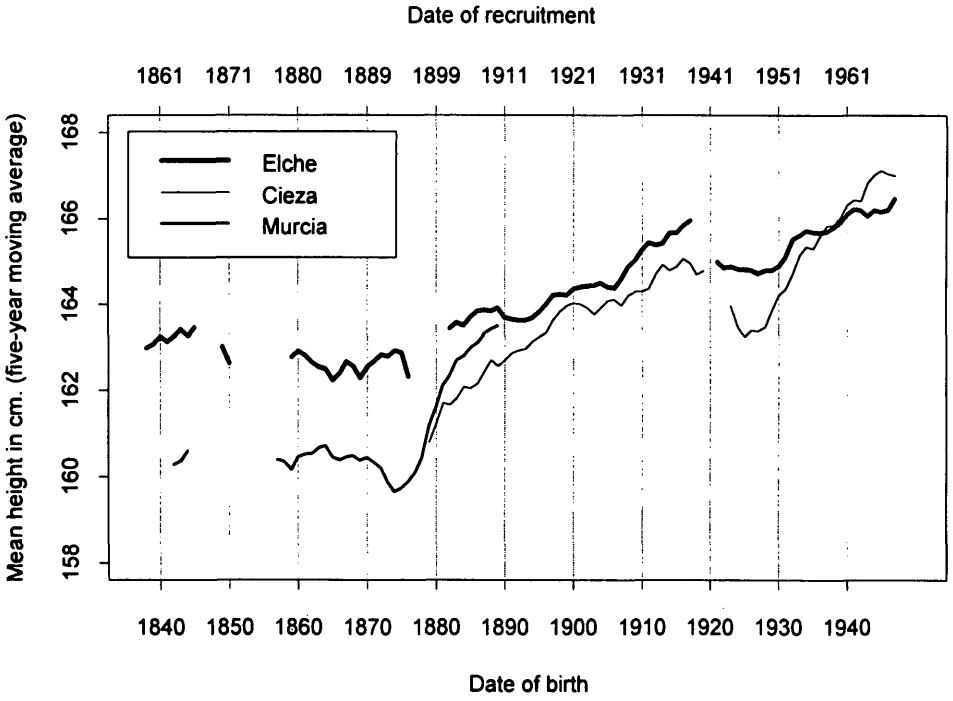

Figure 3. *Evolution of heights in Elche, Murcia and Cieza: 1837–1948.*

pattern continued until the 1880s. The larger share of the rural population in Murcia than that in Elche determined the trend of height in both places.

The gap between both cities narrowed when the height of conscripts was grouped by place of residence (Table 5). In the town, conscripts were taller than in the country, a difference which is more visible in the district of Murcia. The urbanisation of Murcia, larger than Elche and the provincial capital, might well be the cause of such greater differences. From 1840 to 1880, Murcia's conscripts coming from the town were taller by 3 and 4 cm than those coming from the country. In Elche, however, such differences were not so marked for the periods for which data is available. Between 1866 and 1880, the conscripts of the city of Elche were 1.5 cm taller than those from the country. But those living in urban Elche were slightly taller than those living in the city of Murcia.

4.3. Light and shade at the end of the nineteenth century

From 1880 the differences between Elche and Murcia changed. Until then mean height data was favourable to the former, but from 1880 to 1900 recruits were more than 1 cm taller than in Murcia in the 1890s. The data show that at the end of the nineteenth century Elche was fully involved in a process of urban and industrial expansion. Murcia's economy, on the other hand, relied heavily on agriculture, which was enjoying favourable condi-

Table 5. *Mean heights in Elche and Murcia by residence.*

	Elche		Murcia	
Quinquennium	Rural	Urban	Rural	Urban
1839–40			159.2	163.2
1841–45			159.8	162.8
1846–50			160.7	163.6
1851–55			160.1	164.0
1856–60			159.6	163.3
1861–65			160.1	162.8
1866–70	161.6	163.1	159.8	162.8
1871–75	161.9	163.6	159.0	162.6
1876–80	161.9	163.3	159.6	163.5
1881–85			162.1	164.4
1886–90			162.9	165.0
1891–95	164.7	163.2		
1896–1900	164.6	163.9		
1901–05	165.1	164.2		
1906–10	165.2	164.6		
1911–15	165.0	165.6		
1916–20	165.5	165.6		
1921–25	164.6	165.0		
1926–30	164.8	164.9		
1931–35	165.3	166.0		
1936–40	165.3	166.1		
1941–45	165.5	166.2		
1946–48	166.2	166.5		

tions as a result of the commercialisation of its horticultural products, mainly paprika. The paprika industry, however, was based in rural areas. As with flour milling, the paprika industry did not require intensive labour or urban concentration like Elche's shoe and textile industries from 1880 onwards. The structure of Elche began to change in this period as a result of the development of factories and the spread of wage-earning work. The substitution of factories for craftsman's workshops is a well-documented reality in the last two decades of the nineteenth century. The expansion affected all industrial activity (Miranda 1993). The data, however, suggests that this end-of-century industrialisation and urbanisation did not bring about much improvement in welfare levels.

At the beginning of the twentieth century, the height of rural conscripts improved dramatically. This was brought about by the growth of the agricultural sector and implies improvements in welfare in the rural milieu. The conscripts of the city of Elche had increased their height by 1 cm from 1866–70 to 1901–05, while those from rural areas became 3 cm taller. This progress was more marked for the generations born during the 1880s and to a lesser extent for those born in the 1890s. The increase in height in the town

was not as significant as that in the country and was only attributable to the generations born after 1896. This situation was similar to that of Murcia, where mean heights increased by 3 cm for those born after 1880, though this increment was definitely greater in rural areas than in the city. At the beginning of this century, the marked differences between town and country in either district had virtually disappeared.

Comparison with the series for Cieza, a smaller town and district, yields consistent results. Like Murcia's, Cieza's population was agriculture-based. Toward 1880–90, Cieza had developed irrigated farms specialising in fruit trees for export. The influence of the economy on the labour market and on welfare levels was favourable – mean heights increased in Cieza by 3 cm among those born between 1880 and 1900.

4.4. The effects caused by Spain's Civil War and Franco's early policies

During the twentieth century the trend of height is clearly upward. However, this process was abruptly disrupted by the outbreak of the 1936–9 Civil War. The generations born in the 1920s and 1930s suffered the worst deterioration in height of twentieth century Spain. This negative cycle took longer than expected as a consequence of the adverse effects caused by the War's aftermath. The long postwar period saw a disastrous policy of economic and political isolation (1940–9). These were years of great economic harshness, poor health and nutritional defficiency that gave rise to unhealthy bodies. All economic indicators declined: net product and *per capita* income, real wages and the living standards achieved in the mid-1930s would not return until the end of the 1950s. In this context, the deterioration of biological standards of living was a natural outcome. The decrease in height was greater in Cieza than in Elche, but it was marked in both places. In Cieza it fell by 3.3 cm for those born between 1916 and 1927. In Elche the maximum height was reached among those born in 1917 and the sharpest fall occurred in 1927.

The relevance of unhealthy stunted bodies becomes evident if we analyse the height distribution. The share of conscripts under 155 cm was reduced considerably at the end of the nineteenth century. This shows that important dietary improvements had been achieved in the first decades of the twentieth century. By 1880, the percentages varied from one place to another. Stunting and dwarfism were more marked in rural areas than in industrial ones. The percentage of those under 155 cm by 1890 was 6.7 per cent in Elche, as compared with 10.3 per cent in Cieza and 11 per cent in Murcia. By 1911–15, the index had improved to 3 per cent in Elche and 3.9 per cent in Cieza, but it worsened again during the civil war and postwar periods. The percentage of the stunted rose again but this time more in rural areas. Thus in Cieza, it was as high as 9.7 per cent in 1921–30 as compared with 4.3 in Elche. During the war and the period afterwards, there probably

Table 6. *Percentage of conscripts with heights under 155 cm.*

Quinquennium	Elche	Cieza
1837–40	11.1	
1841–45	10.3	
1846–50*	9.0	
1851	6.1	
1856–60*	12.5	
1861–65	12.5	
1866–70	11.2	
1871–75	12.5	
1876–80*	11.5	17.6
1881–85	7.7	12.5
1886–90	4.4	9.5
1891–95	6.7	10.3
1896–1900	4.8	7.7
1901–05	5.9	8.1
1906–10	6.0	8.1
1911–15	3.0	3.9
1916–20*	3.9	5.9
1921–25*	4.5	9.7
1926–30	4.2	9.7
1931–35	4.3	4.6
1936–40	3.2	4.7
1941–45	3.7	2.8
1946–48	2.4	1.7

Note: In the periods marked *. no data are available for 1847, 1857, 1878, 1879, 1880 and 1919 in Elche, and for 1876, 1877 and 1921 in Cieza.

were various local patterns of stunting influenced by local problems of food supply and distribution, but also by the role played by each municipality during the war.

4.5. Recovery and convergence

Height recovered its upward trend among the generations born in the late 1930s and in the 1940s. Changes in economic policy and the liberalisation and growth of the economy in the 1950s led to changes in dietary patterns and to improvements in health infrastructure and medical equipment. Although late, Spain caught up with the process of international economic recovery and growth triggered by the end of World War II. Wages, *per capita* income and net product rose, as did the biological standard of living. Diet and health improved, as shown by increases in height. The process of economic convergence between Spain and the developed countries ran parallel to a converging trend of height between Spain and the rest of Europe. From 1960 (born in 1940) onwards Spaniards registered the largest height increase in all the western European countries (Chamla 1983, Floud

1994). This converging pattern was also visible within the different regions of Spain and between urban and rural areas (Martínez Carrión 1994b).

Figure 3 shows that the stature of the conscripts of Cieza and Elche was converging by the end of the period. The increase of height in the agricultural milieu was greater than that in industrial districts, which suggests significant environmental improvements in rural areas. Likewise, no marked differences in height were observed by place of residence, in contrast to previous years. During the first decades of the twentieth century, living standards improved mainly in the country. After the effects of the war and its aftermath, town conscripts were slightly taller than those living in the country. The differences, however, were not as great as for those born before 1880–90.

In any event, the stature of Spaniards and of Elche's male population at the end of the period studied was still far from the standards reached by modern well-nourished populations. Table 7 compares various percentiles of the stature of Elche's young men, born in different years, with those of conscripts born into a modern society and enjoying one of the highest

Table 7. *Elche's height percentiles compared to modern height standards.*

Year of birth	Draftee age	Number of cases	25th percentile	50th percentile	75th percentile	90th percentile
1875	19	247	158.0	162.0	166.5	169.7
1900	21	302	160.2	164.0	168.0	171.3
1925	21	448	161.0	165.0	169.1	171.8
1948	20	969	162.5	166.5	170.2	174.0
United States[a]	18		172.4	176.8	181.2	185.1

Note. US data (for 1960) from National Center for Health Statistics 1977, reported in Steckel (1996).

standards of living of recent years. In this case, the modern percentiles are those of US conscripts born in the 1960s (Steckel 1996). The Table clearly shows that, as the twentieth century moved forward, the percentiles of Elche's conscripts came increasingly closer to those of a developed modern society, though the gap was still large. It is obvious, then, that by 1940, the nutritional status, or in other words, the biological standard of living of Elche's young male population was a long way from that typical of an advanced modern society.

4.6. Height and migration

Migratory movements might have had an influence on the trends and patterns of height in rural-urban areas. It is worth noting that the periods in which migration was intense coincided with small height increases. Migra-

tion into Elche accelerated between 1877 and 1897 and again beginning with the second decade of the twentieth century, but even more so in the 1940s (Gozálvez Pérez 1976, p. 232). The first period was characterised by a stagnation in urban heights while men born in rural areas increased markedly in height. The data on the enrolment of conscripts dwelling in Elche, but having been born elsewhere, is given in Table 8. Their numbers at the end of the century were not large and only the 1886–90 quinquennium stands out. Owing to the nature of the information, we do not know the time when they arrived and settled in Elche. In any case, the mean height of immigrants was below that of the native population. Height differences between those born inside and outside Elche were on the increase until 1901–05 in a context of poor increments in urban as compared with rural height.

The period with most immigration was after 1940, which coincided with yearly increments in height in a context of growing industrialisation and urban expansion. But as the percentage of immigrants rose, height increments declined, as can be seen when one compares height in Elche with the upward trend of height in other towns such as Cieza. There is an absolute correlation between the immigration data recorded by population censuses and the data furnished by draft records on the birth place of conscripts. The 1960s and 70s saw the largest numbers of immigrant conscripts coming from outside Elche, accounting, at times, for over 50 per cent of the total. In this period the mean height reached in Elche was exceeded by other non-industrial towns in south-eastern Spain (Martínez Carrión and Pérez Castejón 1998). Environmental factors and housing conditions may have had an effect on this. It is also likely that the strong immigratory movement may have counteracted any possible improvement in income generated by industrialisation and thus served as a counterbalance to the upward trend in height of Elche's natives. But the difference is not significant. Comparing the mean height of conscripts born inside and outside Elche reveals no marked differences between the two. However, a slight trend below the average height of all conscripts was seen among immigrants from 1926–30, a period coinciding with a boom in immigration.

4.7. Differences by social group

Finally, sharp differences in stature existed by socio-occupational category (Table 9). High-income groups, such as students, were the tallest throughout the period under study. In the nineteenth century, rural men were shortest. Marked differences existed between students and farmhands and farmers – over 4 cm during the period 1879–96. Shoe industry workers (mainly espadrille workers), professionals and construction workers maintained an intermediate position, being relatively well-nourished subgroups during that period, a situation that changed with the arrival of the new

Table 8. *Mean height of conscripts in Elche by place of birth.*

Quinquennium	Mean height of immigrant conscripts	Mean height of all conscripts	Percentage of immigrant conscripts	Total number of conscripts
1837–40		162.9		673
1841–45		163.4		772
1846–50		162.8		533
1851–55		163.1		271
1856–60		162.6	1.4	870
1861–65		162.5	0.2	1,237
1866–70		162.6		1,296
1871–75	160.8	162.8	2.6	1,286
1876–80		162.6		461
1881–85	163.2	163.6	4.5	1,415
1886–90	163.7	163.8	6.2	1,447
1891–95	163.1	163.6	2.0	1,869
1896–1900	163.5	164.2	1.0	1,997
1901–05		164.4	0.9	1,849
1906–10	164.3	164.9	1.8	1,632
1911–15	165.8	165.4	6.4	1,423
1916–20	165.2	165.6	5.4	1,532
1921–25	164.6	164.9	5.9	2,590
1926–30	164.6	164.8	11.5	2,799
1931–35	165.1	165.6	17.9	3,012
1936–40	165.4	165.8	24.0	3,191
1941–45	165.5	166.0	35.2	3,700
1946–50	165.9	166.5	37.6	5,021
1951–55			52.7	5,654
1956–60			45.6	3,220
1961–66			19.5	10,280

Note: Mean height was not computed for quinquennia where the number of immigrants was less than 20.
Immigrants were included in the calculation of the mean height of all conscripts.
Mean height for the 1946–50 quinquennium has been computed using only data on conscripts born in 1948 or before.

century. While the living standards of peasants, businessmen and shop assistants improved, and high income earners maintained their standards, the nutritional status of shoe workers and tanners declined. The crisis of factory labour was worst during the first years of the twentieth century and above all during World War I and postwar, a period marked by a sharp rise in inflation that erased the nominal wage increases of previous years.

The convergence in height between social classes is documented up to the period around 1940 in Table 9. By that time hardly any differences existed across industries and within industrial subgroups. Convergence was most obvious among workers in the manufacturing industries, around 165 cm. It

Table 9. *Mean heights in Elche by profession and period.*

Draft year	1879–96		1901–13		1914–24		1951–65	
Year of birth	1860–77		1881–94		1894–1904		1931–45	
Industry	N	M	N	M	N	M	N	M
Primary								
Farmer	1,989	162.0	1,478	163.7	1,418	164.0	355	166.2
Labourer	258	162.1	495	163.7	515	164.3	1457	165.6
Secondary								
Shoemaker	721	164.1	556	163.5	411	163.7	2185	165.3
Construction	55	163.6	34	164.7	25	164.4	676	165.0
Textile	118	162.8	27	165.7	51	164.8	467	165.3
Wood	36	163.8	23	164.1	22	163.0	180	165.3
Metal	44	163.6	16	162.2	20	162.9	416	165.5
Tertiary								
Trade	110	162.6	69	163.6	64	164.1	649	165.8
Professionals	20	163.8	53	164.5	88	163.7	832	167.3
Students	55	166.9	42	165.0	34	166.7	312	169.3

Note: N = sample size, M = mean height.

is particularly surprising that farmers registered the largest increase in size in the twentieth century. Professionals and students are still the tallest of all, with heights close to 168 cm. Overall, the data suggests that even though income levels determine the trend of height, environmental conditions also play a part. The quality of life in the country and rural areas was reflected in relative increases in the height of farmers and peasants in a context of crisis in traditional agriculture and the modernisation of farms, but, above all, of improved rural health and nutrition.

5. Discussion

The impression we get from an analysis of the data is that stature constitutes a good measure of the secular changes in biological living standards and health in Spain. The trajectory of height reveals the existence of trends in living standards, which allows us to analyse the relationship between economic growth and well-being. It should be noted that the trend of height in the towns under study does not agree with conventional welfare indicators, specifically in the nineteenth century. Stature – as an indicator of biological standards of living – constitutes a much wider measure of welfare than real wages and *per capita* income since it covers aspects of the welfare and quality of life of people not covered by conventional measures. Unlike the latter, height is a quantitative synthetic indicator of importance to the study of living standards, one that takes account not only of nutritional intake but also of the effects of such factors as urbanisation, public health and industrialisation.

The evolution in the height of the birth cohorts of 1830–40 to 1940–8 shows the existence of well-defined phases. By the mid-nineteenth century, environmental, health and nutritional conditions were clearly favourable to Elche's population. Comparatively, Elche's conscripts were, as a whole, taller than those from other towns of south-eastern Spain in the 1830s and 1840s. Mean height was 163.2 cm, two centimetres above the height in Murcia, and still greater than other smaller rural towns of south-eastern Spain (Martínez Carrión and Pérez Castejón 1998). If we compare the average height of the Spaniards born in those days – 160.9 cm – with that of Elche's population, the latter enjoyed relatively better health status than most Spaniards, their average nutritional intake being greater than that of the other towns studied, and its environmental conditions were probably better.[7]

The situation worsened from the 1860s and 1870s onwards, as shown by the relative decline in height. The larger number of conscripts under 155 cm (Table 6) reveals the spread of weak, unhealthy bodies and the existence of serious stunting. This deterioration has also been observed in other Spanish towns which have been the subject of study. Causal factors include the impact of epidemics, increased infant and child mortality, general morbidity and adverse economic conditions.[8] Social mobility data – particularly the rise in immigration – seem to point to a period of economic difficulty. A strong migratory movement has been documented between 1858 and 1877, a period when Elche lost its natural demographic surplus, and about 6,500 people left for the Algerian coast, North Africa and South America in search of work. Some of the reasons suggested for the rise in immigration have been the existence of problems in the structure of agriculture (Gozálvez Pérez 1976). It follows from this argument that the greatest difficulties were sustained by rural communities. The data on height seems to support this hypothesis. The differential analysis of height by place of residence confirms the existence of strong rural-urban contrasts in welfare standards. Thus, the increase in urban heights by more than 2 cm over rural heights between 1866 and 1880 shows that the living standards of people born in the country were inferior. In the country, welfare might also have been influenced by the penetration of trade relations in rural economies, which undoubtedly weakened their position, thus increasing the debts of farmers and ruining their nutritional status, a hypothesis which seems suggestive enough but needs empirical verification.[9]

The possibility that disease and epidemics had a greater impact on the

[7] For the estimated height of male populations after adjustment in the Spanish draftees born in 1838, see Gómez Mendoza and Pérez Moreda (1995), p. 87.

[8] The rise in infant and child mortality between 1860 and 1880 is well documented in the rural communities of central Spain and in parishes of the Mediterranean coast in southeastern Spain (Alicante). See Reher *et al.* (1996).

[9] As an example for Hungary, Komlos (1989).

rural districts than in the urban ones cannot be discarded as a causal factor. The presence in Elche of malaria and cholera epidemics and summer-related diarrhoea-like diseases between 1854 and 1874 is well documented (Gozálvez Pérez 1976, pp. 222–3). Mortality data, however, has not been grouped by zone of residence, but the same epidemics – particularly malaria – have been reported for Murcia during this period and turn out to have been more serious in rural areas than in urban ones. Height data revealed that there was increased stunting in cohorts born between 1855 and 1880 (Martínez Carrión 1994a). This recession in the wellbeing of populations born in the 1860s and 1870s coincides with a boom in espadrille-making that lasted until 1890. We are probably dealing here with the inequality curve described by Kuznets.

The turning point occurred toward the 1880s, a period that initiated an upward trend in height that continued until about 1920 for Elche and Cieza. There were other towns in southeastern Spain which also registered an upward trend for the generations born from 1880 onwards (Martínez Carrión and Pérez Castejón 1998). But the information on the trend of height by municipal district and place of residence reveals greater height increments among farming communities. It is worth noting that these increments were greater in places where height levels were initially lower. Altogether, comparing the evolution of height in Elche with that in other municipalities from 1880 onwards, height increases were not so marked. Between 1875 and 1905, agriculture-based communities or municipalities largely dependant on farming grew 3 and even 4 cm taller, whereas in the district of Elche the increments were only 1.5 cm and even less in the urban area. This period of small height increments coincided with a phase of industrial development in Elche and other places within the Valencia region. Urban economies recovered in the last third of the nineteenth century thanks to the dynamism of the manufacturing industry in general and the shoe industry in particular. In the 1880s and 1890s, industrial activity accelerated; the number of craftsmen and specialised factories increased as did their productive capacity as a result of the introduction of new machinery and equipment. By the end of the nineteenth century, the shoe industry was thriving, bringing with it further industrial activity and urbanisation.[10]

The absence of substantial increase in urban heights in Elche in contrast to its countryside and other agrarian communities was no doubt related to environmental factors. Labour and health conditions and lack of hygiene at homes and factories were constantly denounced as a 'social issue' by the working class at the end of the nineteenth century. In 1884, the *Junta*

[10] On industrial growth in the late nineteenth century in southeastern Spain and Alicante province, see Miranda (1996) pp. 253–73. The author points out the importance of the formation of companies in almost all industrial sectors, but in particular in the food, textile and shoe industries.

Provincial de Sanidad (Provincial Health Board) criticised the lack of a sewage system, drains and a water supply network in Elche (Moreno Sáez 1987, pp. 120ff). This situation remained unchanged at the beginning of the twentieth century according to the *Instituto de Reformas Sociales* (Institute for Social Reform). This institute also pointed out the importance of infections among workers in Elche and Alcoy, another important industrial centre. The recurrent presence of diseases such as tuberculosis, malaria and typhoid even in the first decade of the twentieth century points to the low degree of development of the health system and the little attention paid to health inspections and care. The role played by child labour in factories should not be neglected as a factor which could have had a negative influence on height during childhood and early adolescence.[11] The existence of 'survival wages' in industry, as the 1903 general strike revealed, forced eight- and ten-year-old boys to work fourteen and sixteen hours doing specific jobs, thus helping the head of the family to make ends meet.[12] Compelled by poverty, many working families kept up this situation until the second decade of the twentieth century. Between 1914 and 1923, child labour declined considerably, but it was still common by 1928, though the number of working hours per day had been much reduced by that time. Under these circumstances, it is only natural that height increased so little during the first stages of industrialisation and that the most progress occurred within farming areas.

The relationship between *per capita* income and height in the first stages of industrialisation in the period prior to the First World War is unclear. The available data raises questions as to the improvement of nutritional status during the first stages of economic growth. This doubtful relationship between height and income in the early stages of industrialisation has been reported by other studies and explained by the Kuznetsian idea of unequal increases in income at the onset of modern economic growth: in the Habsburg monarchy during the course of the second half of the eighteenth century, in the United Kingdom between 1820–50, in Germany around 1860–85, in late nineteenth century Montreal, and in the *antebellum* United States (Komlos 1989, Floud *et al.* 1990, Ward 1993, Steckel and Floud 1997). In the case of Elche, the expansion of urbanisation and the higher social mobility – 6,000 immigrants between 1877 and 1897 – could have led to a greater risk of contracting a disease from overcrowding and poor housing conditions, thus counteracting any beneficial effects of higher income from industrialisation.

During the twentieth century the upward trend of height implies better

[11] Differential growth patterns can be seen in working class children in England at the beginning of the twentieth century, Floud *et al.* (1990), pp. 232ff. See also Harris (1994).

[12] Elche's general strike of 1903 became a model of socialist strategy in social conflicts (Vives Garcia 1974). On child labour in Elche and Spain, see Moreno Sáez (1987), pp. 126–33, and Borrás Llop (1996), pp. 242ff.

nutrition and health. There was also a greater consistency between height and income data. The trend of height shows (1) an increase for the drafts of the first third of the twentieth century; (2) a significant decline in heights during the Civil War and the autarchic period – reflected in the generations born in the 1920s; (3) a sharp rise in the 1950s, i.e. those born in the late 1930s and throughout the 1940s. Surprisingly enough, height increased for the Civil War and post-war generations. This seems to indicate that the evolution of final mean height is determined by nutritional status and health conditions at adolescence. Thus, data suggests that the years of the height spurt at age 14–17 were as decisive as those of childhood. This could have great relevance to the study of living standards.

The height increments among those measured during the first decades of the twentieth century were due to better environmental conditions and health care and to a decline in child mortality. Improved hygiene and working conditions in workshops and factories, the rise in real wages and the narrower urban-rural wage gap in the 1920s all explain the converging trend of height between rural and urban areas and between industrial and farming ones (Simpson 1995a, b). Labour legislation was introduced from the beginning of the twentieth century as a result of greater pressure from workers' organisations. Despite the fact that the laws were often neglected, they helped to reduce severe inequality and to relieve the lack of social protection among women and children. In the field of health, a reform plan was launched by the General Health Law of 1904, which led to the creation of a new health administration and, in the medium term, to the setting up of new health-care institutions (Martínez Navarro 1994). Their work contributed decisively to the decline of child mortality and generally to the establishment of better health conditions.

The Civil War of 1936–9 and post-war periods were particularly harmful to height, and hence to welfare. The height levels achieved by 1935–6 would not be seen again until the early 1950s. The generations born in the 1920s saw a severe decrease in height by 2 or 3 cm. The rural and agricultural areas were more affected than the urban-industrial ones, but the available evidence is not conclusive. It is likely that the upgrading of urban health may somehow have counteracted any nutritional losses imposed by a shortage of supplies and the lack of essential foodstuffs during the war and post-war periods. As expected, the anthropometric evidence shows not only that purchasing power lost ground (lower *per capita* income and real wages) but also that the working population was several centimetres shorter, one of the shortest populations in Europe, thus leading to negative effects on health and productivity of labour. It can be said with certainty that the price paid was too high from a nutritional point of view.

The convergence of height took place at the end of the period studied, although the process began at the turn of the century. Around 1940, the heights of Elche's and Cieza's conscripts were level with those of all

Spaniards. In those days, the mean height of native Spaniards was slightly greater than 166 cm and similar to that of people born in Elche and Cieza. The progress made during the first decades of the twentieth century narrowed the gap between the heights of Elche and Spain, which by 1897 were of 164 cm and 162 cm respectively. It is possible that this phenomenon repeated itself in other Spanish regions, but the Civil War of 1936–9 put an end to the process of convergence.[13] After a stationary period of more than 10 years caused by the Civil War and its aftermath, the generations born in 1940 recovered the standards achieved before 1920 and started a trend towards sustained growth up to the present. Between 1945 and 1965, the increase in height of conscripts was again spectacular. Mean yearly increments were above those of other European populations (Chamla 1983, Floud 1994). This phenomenon, however, should be contrasted to the low point of departure after the war.

Surprisingly enough, the acceleration of urbanisation and industrialisation from the 1940s in the city of Elche coincided with the small increments in height achieved by the workers in manufacturing industries. It could be deduced from the available data that industrialisation counteracted the potential beneficial effects of income and employment generated by industrialisation; and that the accelerated urbanisation caused by the swift demographic growth of the city from 1940 had short-term negative effects on welfare. However, a more detailed analysis of height data by birth place is necessary. Immigration – particularly from rural areas – probably accounted for the deficient increments to adult heights at the end of the period under consideration. The mean height of immigrants served as a counterbalance to that of the native population and could have negated the benefits produced by urbanisation and industrialisation.

While undoubtedly urbanisation and industrialisation eventually brought with them improvements in public health and the welfare of immigrants in the medium and long run, it is also true that the settlement of immigrants in fast-developing cities, as is the case with Elche, could have negatively affected health and welfare standards (high blood pressure, obesity, stress, depression, etc.) in the short run. This is also suggested in other studies of the biological growth of immigrants in Spanish industrial belts (Rosique and Rebato 1995). The inclusion of these new variables will undoubtedly enrich the discussion on the evolution of living standards during Spain's industrialisation.

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[13] Height data in twentieth century in Spain, in Coll and Quiroga (1994), Martínez Carrión (1994a, b) and Gómez Mendoza and Pérez Moreda (1995).

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