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3 The Standard of Living of the Workers in a Spanish 4 Industrial Town: Wages, Nutrition, Life Expectancy 5 and Height in Alcoy (1870–1930)

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9 **Abstract** Many studies carried out on the evolution of the standard of living have shown
10 that it is advisable to use several indicators as there is no single indicator that reflects all of
11 the dimensions of well-being or that does so without incurring value judgements. Fol-
12 lowing this line of research, this study examines the well-being of the workers of Alcoy
13 during the industrialisation process using four indicators: real wages, nutrition, life
14 expectancy and height. As happened in other European industrialized regions some dec-
15 ades before, between 1870 and the end of the nineteenth century we can observe a “puzzle”
16 as two indicators point to an increase in the standard of living and the other two reveal the
17 opposite. The “puzzle” later disappears because from the beginning of the twentieth
18 century to 1930 the four indicators show that well-being increased.

19 **Keywords** Industrialization · Welfare · Workers · Health reform · Spain

20 **JEL Classification** N3 · J1 · N9 · H4

A1 The original version of this article was revised: The section 5 was missed out and the Conclusions part was
A2 published incorrectly. Now the section 5 is included and correct Conclusions section has been provided in
A3 this erratum.

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21 1 Introduction: The Problem of Well-Being Measurement

22 The majority of studies published before the 1980s used income per person or wages to
23 estimate the standard of living. This point of view was based on the neoclassical economic
24 theory that maintains that well-being is utility and, as this is subjective, should be measured
25 in terms of monetary income as the recipients make choices in the market according to
26 their tastes and preferences (Meier 1980; Stiglitz 1993). The use of monetary income as an
27 indicator of the standard of living was first criticised in the 1970s and 1980s. The critics
28 argued that income per person or wages are inputs of well-being, but they do not reflect the
29 standard of living because they do not always capture some of its components such as life
30 expectancy, education, working conditions, available leisure time, and costs of living in the
31 city or environmental degradation.¹

32 Amartya Sen's study was transcendental in this respect as it introduced a new con-
33 ception of the standard of living. Monetary income is not well-being, but a means to obtain
34 certain ends (to have health, to satisfy needs, to have choices, to have free time, to enjoy a
35 long life). These are the ends that constitute the standard of living and to obtain them a
36 series of access rights must exist (health, education, credit and liberty) (Sen 1993). At the
37 end of the 1980s a group of economists, including Sen, designed the HDI based on these
38 tenets. The HDI combines three elements, GDP per capita in constant dollars and adjusted
39 for purchasing power parity, life expectancy at birth and educational attainment and is
40 obtained through calculating the average of the three.² The HDI may seem more reliable
41 than income per capita because it includes other elements of well-being. However, it also
42 has disadvantages. The first is that it conceals social inequality. The second is that it does
43 not include important standard of living elements: working conditions, unemployment and
44 the deterioration of the environment or the respect for human rights. The third drawback
45 (common to all synthetic indicators) resides in the weighting. The HDI attributes a third
46 part of well-being to income, another third to life expectancy and the remaining third to
47 educational attainment. Why not assign 50% to income and 25% to each of the other two
48 variables? Or, why not attribute 50% to life expectancy and 25% to the other two elements
49 of well-being? Given the wide range of tastes and preferences, all weighting contains value
50 judgements.

¹ We are referring to Nordhaus and Tobin (1973), Myrdal (1974), Samuelson (1983), or Morris (1979), who proposed alternative well-being indicators to income per person. The Nordhaus and Tobin's EWM (Economic Well-being Measure) and the Samuelson's NEW (Net Economic Well-being) modified the income adding variables like the value of leisure time and the housewives' work and deducting the military costs and the contamination and urban life costs. Morris proposed The Physical Quality of Life Index, which includes life expectancy at the age of 1 year, infant mortality and the adult literacy rate and is obtained through the arithmetic mean of its three parts. Morris has defended the viability of the indicator because it contains a function of well-being defined by the enjoyment of a long life with the possibility of prospering due to literacy and because, in under-developed countries, a substantial part of basic consumption is not made through the market, so infant mortality and life expectancy are better indicators than income for capturing nutrition and health. These variables are also easy to estimate and therefore are more reliable than the dubious figures for income of many under-developed countries.

² On the HDI, consult the Human Development Reports published from the year 2000 by the United Nations Development Programme. In 2010, the way to estimate the HDI was modified. The life expectancy was conserved as an indicator of health but the way to estimate education and the income changed, replacing the arithmetic average of the three components by a geometric one.



51 In the 1990s, average height became established as an indicator of the welfare.³
52 Anthropometric studies show that although there is a genetic load in height, this one is
53 potential and it is altered by three factors that, along with genetics, determine the height
54 that could be reached at age of 21. We are talking about the nutrition, morbidity and
55 physical wear because the height is the result of the “net nutritional input”, which is the
56 difference between “gross nutritional input” (ingested nutrients) and the energy spent
57 through basal metabolism, physical activity and diseases. This makes the average height a
58 biological measure of the standard of living, since the nutrition reflects the real wage and
59 the consumption and the morbidity and the physical wear reflect some non-monetary
60 elements of the standard of living as the epidemiological environment, the sanitary level
61 and the labour conditions during childhood and adolescence.

62 Many studies published since the end of the 90’s support that, due to the multidimensional
63 nature of the well-being, there is no single indicator of well-being that reflects all of its
64 components or does so without incurring value judgements. Therefore they advise that the
65 evolution of the standard of living should be studied by comparing several indicators.⁴

66 The objective of this article is precisely to study the evolution of the well-being of the
67 workers in Alcoy during the industrialisation process using four indicators: real wages,
68 nutrition, life expectancy and average male height. Furthermore, we are analysing the
69 effects of the public expenditures in the standard of living during the last decades of the
70 nineteenth century and the first term of the twentieth.

71 The study is structured as follows. The first section is a short introduction explaining the
72 history of the industrialization process in Alcoy. The second section presents the four
73 indicators of well-being mentioned above. In the third section we will analyse the evo-
74 lution of the standard of living between 1870 and the end of the nineteenth century. A
75 “puzzle” emerged during this period, as two indicators pointed to an increase in well-being
76 while the other two reveal the contrary. The fourth section studies the evolution of the
77 standard of living between the beginning of the twentieth century and 1930. The “puzzle”
78 disappeared during this period. Finally, the conclusions of the article maintain that the
79 events in Alcoy coincide with the model recently proposed by Floud et al. (2011) regarding
80 the evolution of the standard of living of the workers in British cities during the Industrial
81 Revolution.

82 2 The Industrialisation of Alcoy

83 Alcoy (Fig. 1) is located in the interior and mountainous area of the province of Alicante.
84 Its geographical location gave to the city the advantage of having hydraulic energy
85 available of the Molinar river’s falls of water and wool of the flocks of sheep that grazed in
86 the valleys in winter and in summer in the mountains. This endowment of factors explains
87 the development of a wool industry during the modern age, organized by the verlagssystem,
88 which had its moment of glory in the eighteenth century. In the beginning of that

³ There is an abundant bibliography on anthropometry. Here we will only mention a few pioneering studies: Fogel and Engerman (1974), Engerman (1976), Eveleth and Tanner (1976), Fogel et al. (1982), Fogel (1989), Tanner (1990), Steckel (1995), Steckel and Floud (1997), Komlos and Baten (1998) and the recent compilation of studies edited by Floud et al. (2014). For Spain, see Martínez-Carrión and Puche (2011).

⁴ Pioneer studies which defend the use of several indicators of well-being include Crafts (1997), Floud and Harris (1997) and Horlings and Smits (1998). More recently, Stiglitz et al. (2010). For the Spanish case, Escudero and Simón (2003) have studied the evolution of well-being between 1850 and 1992 using income per person, the Physical Quality of Life Index, the Human Development Index and height.



Fig. 1 Alcoy

89 century, Felipe V's New Plant Decrees after the War of Succession⁵ unified the Spanish
90 market, so alcoyan drapes could be sold in Castile and in the American colonies without
91 yielding custom duties. Spinning and wool carding in peasant households located out of
92 town went together with the beating, weaving and dyeing held in Alcoy by craftsmen
93 organized in guilds.

94 These protoindustries began to be inefficient at the end of the 18th due to the high
95 transaction costs, reason why some traders began to concentrate production in factories
96 with hydraulic machinery.⁶

97 The existence of entrepreneurs, trained workforce and hydropower, as well as the
98 progressive mechanization of spinning and weaving factories made Alcoy in the mid-
99 nineteenth century the second Spanish wool producer centre after Sabadell and Terrassa,
100 cities located in the province of Barcelona.⁷ Alcoy was specialized in wool of lower price
101 and quality than the Catalan, and its trade was focused in the Spanish market, protected
102 with high customs duties. At the same time, and thanks to hydropower and the wide range
103 of drapes, a paper industry was developed in the city, becoming in 1856 the second largest
104 producer of Spain after Barcelona. The third industrial sector in Alcoy during this period
105 was the mechanical industry needed to repair and build machinery.⁸

⁵ The war of succession to the Spanish Crown was originated after the death of Carlos II in 1701. France and the Kingdom of Castile defended Felipe of Anjou, of the dynasty of the Bourbons. The Kingdom of Aragon and the Great Coalition (England, United provinces, Austria and Prussia) defended the Archduke Charles, of the dynasty of the Habsburgs. Once Philip of Anjou was named King of Spain, signed the Nueva Planta Decrees, which abolished the ancient privileges of the Crown of Aragon in 1707.

⁶ On the wool industry in Alcoy since the 14th c. to the 18 c., see Torr6 Gil (1994a, b, 2004).

⁷ Since we do not have data the Spanish production of wool in the nineteenth century, specialists have used tax data for the main production centres. Data suggest that in 1856, 30% of Spanish wool production came from Terrassa and Sabadell, and 10% of Alcoy. Nadal (2003, p. 141).

⁸ General studies on the industrialisation of Alcoy are Aracil and García (1974), Cerdá (1967, 1980) and Cuevas (1999). On the paper industry, see Gutierrez (2011) and Nadal (2003, pp. 154, 179).



106 Alcoyan textile industry experienced since the end of the nineteenth century a new
107 thrust thanks to the arrival of the railroad to the city and to the replacement of the hydraulic
108 energy by steam engines, elements that impacted favourably in the engineering mechanical
109 industry. In 1931, Alcoy remained the second Spanish wool producer centre. Also since the
110 end of the nineteenth, its paper industry became mechanized and specialized in the
111 manufacturing of cigarette's paper, which was sold on the Spanish market and in Cuba and
112 South America, being one of the few Spanish exporting companies.⁹

113 The industrialization of Alcoy provoked a strong demographic growth which is discussed in
114 the next section, and originated a structure of workforce with a strong component of industrial
115 workers.¹⁰ We are, therefore, studying a typical town of the first Industrial Revolution.

116 **3 Four Indicators of the Standard of Living of the Workers in Alcoy: Real** 117 **Wages, Nutrition, Life Expectancy and Height (1870–1930)**

118 The construction of a rigorous series of real wages requires nominal wage data drawn from
119 reliable sources and a cost-of-living index that contemplates: (1) retail prices in the area
120 under consideration of the goods and services consumed by the workers; (2) the relative
121 importance of each of these goods and services in consumption and (3) the variations in
122 demand derived from Engel's law.¹¹

123 Figure 2 shows the aggregate nominal wages of the workers in Alcoy between 1870 and
124 1930. The wages are drawn from primary sources which are specified under the Fig. 2. In
125 order to aggregate the series, we have included those professions for which we have wage
126 data for all of the years: rural day labourer, bricklayer, unskilled urban workman, weaver,
127 dyer, spinner, carder and shop assistant. We have finally applied an arithmetic and non-
128 weighted measure as we do not have sufficient information regarding the number of
129 workers of each profession.

130 Figure 3 shows the cost-of-living index with which we have converted the nominal
131 wages into real wages. The prices are retail prices and have been taken from mercurial
132 books, account books of the hospital of Alcoy and housing rental records. The goods and
133 services consumed by the working class and their weighting can be seen in Table 1.

134 The evolution of the cost-of-living index is highly similar to the one constructed by
135 Jordi Maluquer for Spain and which is also shown in Fig. 3: modest growth of prices
136 between 1850 and 1913; inflation during the First World War and the post-war period and a
137 subsequent decline (Maluquer 2006). There is, however, a small difference. In the case of
138 Alcoy, the CPI¹² increased more between 1896 and 1913 because the good economic

⁹ Gutiérrez (2011, op. cit.).

¹⁰ In 1860, 60% of the active population worked in the industry and this percentage came to exceed 75% in the Decade of 1920. The data have been calculated by José Joaquín García making use of the municipal censuses of population and the municipal statistics of labourers.

¹¹ Engel stated that the percentage of income allocated for food purchases decreases as income rises. Economists have extended this definition considering that as a household's income increases, the percentage of income spent on inferior goods decreases while the proportion spent on other goods (such as luxury goods) increases. One of the issues discussed in the debate on the standard of living of the British working class during the Industrial Revolution relates to the conditions that the estimate of real wages should fulfil. See, for example, Flinn (1974), Lindert and Williamson (1983), Crafts (1985), Scholliers (1989), Feinstein (1998) and Clark (2001).

¹² The CPI measures the changes in the price of a market basket of consumer goods and services representing the consumption of the households.

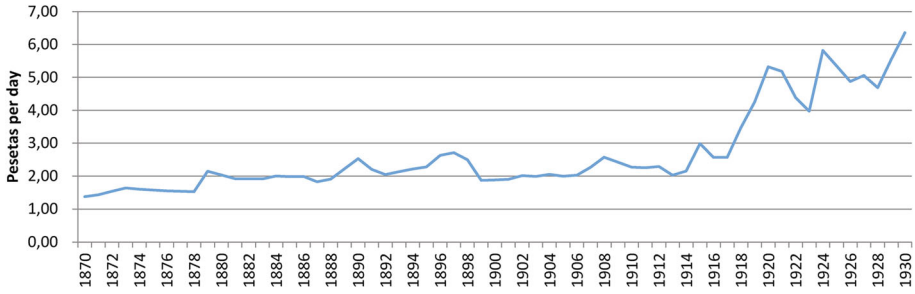


Fig. 2 Nominal wages in Alcoy (1870–1930). Nominal pesetas *Source:* The nominal wages have been obtained from the documentation in the following four archives: the Archivo Municipal de Alcoy, the Archivo de la Diputación Provincial de Alicante, the Archivo de la Real Fábrica de Paños de Alcoy (ARFPA) and the Archivo Histórico del Instituto Nacional de Estadística. The total number of observations was 12,300 wages which provides the sample with sufficient significance. Until 1881, data come from the records of ARFPA, the Hospital’s account books and budget settlements of the City Hall, completed with the occasional available statistics and historical press. Between 1881 and 1930 data come mainly from “Census Books of personal identification cards” and from labor agreements that were signed in the city since 1881

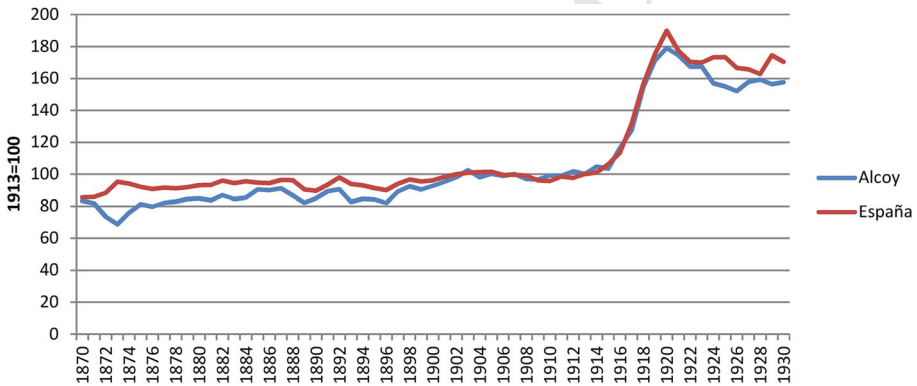


Fig. 3 CPI in Alcoy and Spain (1870–1930). 1913 = 100 *Source:* The mercurial books have been consulted in the Archivo Municipal de Alcoy, in the Archivo de la Diputación de Alicante and in the Archivo Histórico del Instituto Nacional de Estadística. The accounts books of the hospital and the housing rental records can be found in the Archivo Municipal de Alcoy. In total, we have obtained 36,000 references of goods and services. See text

139 climate experienced by industry in the town gave rise to an increase in immigration which
140 increased the price of some foods and services. The composition of spending of working
141 class families in Table 1 is similar to that which other authors have created for Spain and
142 other regions. It is also similar to the composition of spending prevailing in Great Britain
143 during the Industrial Revolution: between 1871 and 1918, 69% of spending corresponded
144 to food. This percentage decreased to 65% between 1919 and the 1930s, therefore fulfilling
145 Engel’s law.¹³

¹³ Cost-of living indices of the Spanish regions are those of Moreno Lázaro (2006) for Castilla la Vieja; Lana Berasáin (2005) for Navarre; Molina de Dios (2003) for Mallorca and Pérez Castroviejo (2006) for Biscay. CPIs for the Great Britain of the Industrial Revolution in Feinstein (1998) and Clark (2001).



Table 1 Structure of spending of working class families in Alcoy (1871–1936) *Source:* The shopping basket for the period 1871–1918 has been taken from a family budget given by the Institute of Social Reforms. Those corresponding to the periods 1919–1926 and 1927–1930 have been constructed with information drawn from the purchases made by the town’s hospital and reflected in the afore-mentioned accounts books

	1871–1918	1919–1926	1927–1936
FOOD	69.88	68.90	65.77
Bread	21.56	16.60	15.93
Lamb	8.67	0.40	2.12
Pork	8.67	0.05	2.98
Veal	0.00	23.04	17.53
Wine and spirits	10.15	2.48	5.85
Oil	1.43	1.57	0.61
Legumes	2.72	2.41	4.02
Rice	2.68	5.44	2.90
Potatoes	0.00	2.46	1.53
Sugar and chocolate	4.33	3.78	4.64
Fresh fish	0.00	0.00	1.06
Salted products	6.64	0.22	0.28
Milk	0.00	1.42	0.28
Fruit and vegetables	1.45	0.17	0.42
Salt	1.08	0.87	1.12
Eggs	0.50	7.98	4.48
Housing	10.71	10.71	10.71
Clothing	7.14	6.34	8.55
Cleaning and hygiene	1.56	4.91	3.36
Heat and electricity	10.71	9.14	11.61

146 Nominal wages and the cost-of-living index have been used to estimate the first indi-
 147 cator of the standard of living of the workers of Alcoy: their real wages (Fig. 4).

148 A second indicator of the standard of living is nutrition. Table 2 shows the calories per
 149 person and day for five representative diets of the workers of Alcoy between 1868 and
 150 1928. The food and drinks consumed and their quantity have been estimated using diet
 151 records and also the apparent consumption method. More specifically, the diets of 1868
 152 and 1928 have been calculated using the diet records obtained from the municipal hospital
 153 and those of 1884, 1897 and 1912 have been drawn from records of the town’s food
 154 imports, enabling us to estimate the apparent consumption.¹⁴ Knowing the amounts of each
 155 product, we have calculated the calories through the Spanish Food Composition Database.

156 Table 2 shows that until the mid-1880s, the diet was monotonous and mainly based on
 157 vegetable products. Between 1884 and 1910, the diet continued to be vegetable-based, but
 158 with a wider range of products and a greater presence of animal products (meat, fish, eggs
 159 and milk) as well as sugar, which means that the nutrition transition began in the 1880s.¹⁵

¹⁴ The apparent consumption is a method widely used in Economy and Economic History to estimate the consumption of a country or a region. It is defined as the production plus imports minus exports, sometimes also adjusted for changes in inventories.

¹⁵ We use the term “nutrition transition” in the sense proposed by Popkin (1993). An initial period before the Neolithic period which Popkin called “food collection” was followed by the “hunger” stage. At the end of the eighteenth century, another phase began characterised by diets based on saturated fats, sugar and carbohydrates which, well into the twentieth century gave rise to an increase in obesity. We should point out that the nutrition transition did not occur in the same way in Atlantic Europe as it did in Mediterranean Europe as in the latter case it began later and was a slower process. See Pujol and Cussó (2014).

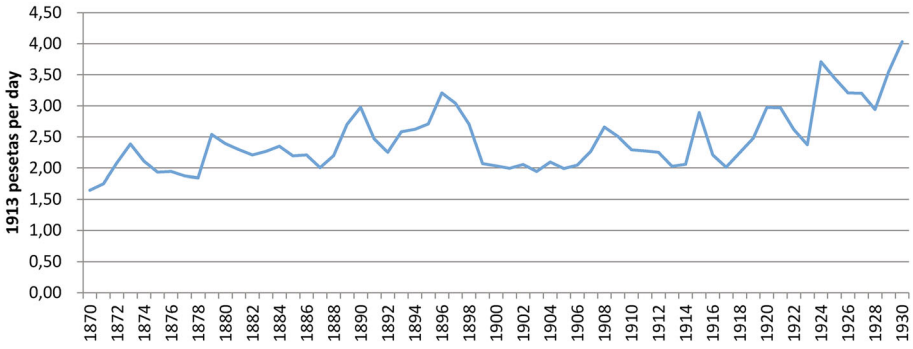


Fig. 4 Real wages in Alcoy (1870–1930). Own elaboration. Real wages in constant 1913 pesetas. To take into account the changes in the preferences of the consumers, reflected in the evolution of the composition of consumption baskets, we have calculated an index of Laspeyres using each shopping basket in the corresponding sub period

160 During the 1920s, the full Mediterranean diet became commonplace. It constituted a diet
 161 with more vegetable products than that of Atlantic Europe which was complemented with
 162 meat and eggs and with a high consumption of fish and milk.

163 A third indicator of well-being is life expectancy. We have calculated this by con-
 164 structing mortality tables with information drawn from the sources listed in the foot of the
 165 Table 3. The methodology used in the calculation of the mortality tables is based in the
 166 actuarial method, widely accepted (Deaton 2013) and explained in depth, for example, in
 167 Vazquez et al. (2003). The results can be found in the next table.

168 The fourth and final indicator of the standard of living which we are going to use is the
 169 average male height. In this case, the data have been provided by our colleague Javier
 170 Puche Gil, whom we thank for providing us with the average height of soldiers measured in
 171 Alcoy which can be seen in Fig. 5. We should point out that the graph only shows the
 172 height of the recruits born in Alcoy, therefore avoiding any bias caused by including young
 173 immigrants born in rural areas with lower heights. We should also note that the x-axis
 174 shows the years of birth of the recruits.

175 4 The Standard of Living of the Workers in Alcoy (1870-End 176 of the Nineteenth Century)

177 Between 1870 and 1898, the nominal wages (Fig. 2) grew at an accumulative annual rate of
 178 2.2% due to the increase in the demand for labour which occurred during this period.¹⁶
 179 However, wages fell in the last 2 years of the nineteenth century as this was when an
 180 adjustment began which had been triggered by the strong influx of immigrants into the
 181 town. This growth of 2.2% falls to 1.78% when the nominal wages are converted into real
 182 wages (Fig. 4). So, if we use real wages as an indicator of the standard of living during the
 183 last third of the nineteenth century, we will reach the conclusion that this improved slightly
 184 as the workers in Alcoy were able to buy a higher amount of goods and services. The same

¹⁶ This can be clearly seen between the end of the 1860s and the 1890s when the population of Alcoy increased by 30%.



The Standard of Living of the Workers in a Spanish...

Table 2 calories per person and day of the working man's diet in Alcoy (1868–1928) *Source:* In the Archivo Municipal de Alcoy we can find the monthly summaries of the introduction of food products into the town. This data was drawn from Beneito (2003) and with it we have estimated the diet of the years 1884, 1897 and 1912 through the apparent consumption method. The diets of 1868 and 1928 have been drawn from the diet records of the town's hospital and can be found in the Archivo Municipal de Alcoy

Food	1868	1884	1897	1912	1928
Wine (red)	79.39	126.46	110.06	85.01	116.38
Oil (olive)	286.50	490.78	224.68	321.27	128.26
Fish (sardine)		11.57	37.44	18.95	2.32
Salted products (cod, salted, raw)	33.82	25.40	20.12	13.14	8.32
Horse meat	0.00	14.27			
Pork (unspecified cut)	122.89	54.40	89.38	58.13	92.21
Beef (veal, unspecified part, raw)	0.00	2.81	4.85		5.02
Lamb (unspecified part)	159.94		99.47	75.65	102.62
Charcuterie (sausages)		4.64	5.22	6.06	7.16
Rice/chick peas (average of the two)	430.77	176.23	231.51	149.60	63.58
Bread (white wheat)	815.88	1249.32	1349.26	1496.69	1671.74
Eggs (hens, fresh)	3.06	0.00	81.71	57.21	70.51
Milk (cow's, full fat)	32.19	8.00	4.47	1.95	1.45
Vegetables (green beans, raw)				0.04	4.62
Hen (whole, raw)	2.32	8.18	5.00	7.69	14.06
Sugar (white)	62.14	55.16	50.06	106.65	238.72
Salt					
Vinegar (wine)	0.42	0.42	0.42		
Potatoes (raw)	17.29	17.28	17.28	25.60	38.90
Chocolate (dark, with sugar)					2.66
Soup (consommé) (vegetable broth)					262.50
Total (Kcal)	2046.61	2244.90	2330.94	2423.62	2831.05

Table 3 Life expectancy in Alcoy (1877–1930)

Years	Men	Women
1877	33.07	36.70
1900	32.06	35.90
1910	35.07	38.13
1920	35.40	40.36
1930	43.78	49.10

Own elaboration using several sources. The number of people counted in each year classified by age groups is drawn from the Population Census of the town of Alcoy. The number of deaths by age and the number of births of 1877, 1900 and 1930 have been obtained of the doctoral thesis of Beneito (1993). For the years 1910 and 1920 have been used the deaths of the Registro Civil

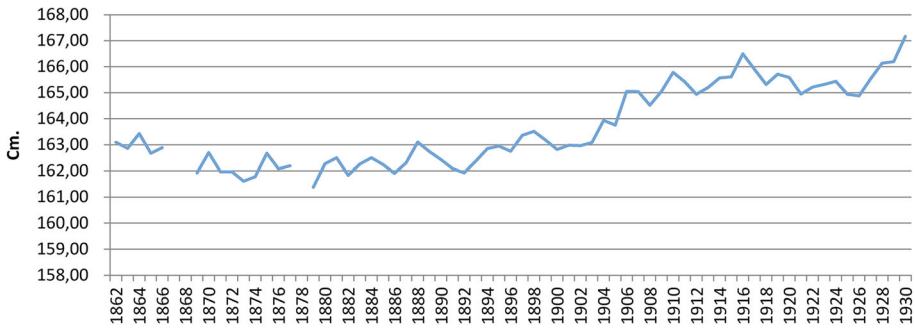


Fig. 5 Height of the conscripts born in Alcoy (1870–1930). *Source:* Puche Gil (2009). From his excellent work on Alcoy (including 16.102 data of recruits between 19 and 21 years measured from 1876 to 1936) we have selected only the series of conscripts born in the city, and all the data are standardised at age 21

185 result is generated by the nutrition indicator as energy consumption between 1868 and
 186 1897 rose from 2046 to 2330 kilocalories, as we can see in Table 2.

187 If we compare the first two indicators of well-being with the third, we observe that the
 188 life expectancy fell between 1877 and 1900 (Table 3). The explanation for this phe-
 189 nomenon resides in the fact that Alcoy experienced an *urban penalty*, a term used by
 190 historians and demographers to define the higher death rate in urban areas during the
 191 Industrial Revolution.¹⁷ We believe that this phenomenon could be analysed using Eco-
 192 nomic Theory and, more specifically, that relating to market failures. First we will present
 193 our hypothesis and subsequently attempt to ratify it in the case of Alcoy.

194 In any Economics manual we will find a chapter which talks about the virtues of the
 195 market using the metaphor of the invisible hand to explain how the State should intervene
 196 when there are problems that the market cannot resolve satisfactorily. There are many of
 197 these problems or failures: imperfect information, public goods, merit goods, negative
 198 externalities, monopolies and periodical crises together with high rates of unemployment
 199 (Stiglitz 1993, pp. 195; Krugman et al. 2007, pp. 258). Our hypothesis is that the *urban*
 200 *penalty* was a consequence of four of these market failures. The first is concerned with the
 201 provision of public goods. These are goods which private companies have no incentive to
 202 provide, since they are non-excludable and non-rival: nobody can be excluded from their
 203 free use and use by one individual does not reduce availability to others. The paradigmatic
 204 example is a lighthouse. Although a lighthouse is necessary, no private business will
 205 construct one because it cannot exclude free riders from using it. A second is that of
 206 providing merit goods. Merit goods are those such as housing, healthcare and education,
 207 which are considered necessary for a satisfactory standard of living and which the market
 208 does not produce optimally, either because it provides them too slowly or because the
 209 amount supplied is insufficient. The State should intervene in the provision of these so-
 210 called merit goods because in this way it will increase overall well-being. The third type of
 211 failure refers to those derived from imperfect information. An example is food products, as
 212 the consumer often cannot know whether they have been adulterated or are in poor

¹⁷ On the urban penalty, Preston and Van de Walle (1978), Woods and Woodward (1984), Woodward (1984), Kearns (1988, 1991), Bairoch (1988), Schofield et al. (1991), Mooney (1994), Vögele (1998, 2000), Szreter and Mooney (1998), Woods (2000, 2003), Haines (2001, 2004). A statement of the situation in Spanish is to be found in Escudero and Nicolau (2014).



213 condition. Finally, there is the issue of negative externalities, referring to the negative
214 consequences that the action of an economic agent has on the well-being of a third party.
215 An example would be the installation of a chemical company that contaminates a river,
216 thus preventing any fishing activity.

217 In our opinion, the *urban penalty* was the result of an environmental deterioration which
218 increased the risk of contracting infectious diseases transmitted through water, food and
219 air. Let us see why this increased mortality was related to market failures derived from an
220 anarchic urbanisation:

221 4.1 Contaminated Water

222 Basically, this was due to the absence of sewage facilities. Given that homes were not
223 connected to a sewage system by pipes and waste water was evacuated in buckets into the
224 drains of the street, this constitutes a public good. Private companies did not undertake the
225 construction of a sewage system because nobody could be excluded from its free use. Paul
226 Krugman uses this as an example of a public good in his Economics manual, referring to
227 how the municipal authorities were obliged to construct the modern sewage system of
228 London after the Great Stink of 1858 (Krugman et al. 2007, pp. 258–259).

229 4.2 Spoiled Food

230 A market failure due to imperfect information. Incorrect handling, deficient hygiene
231 standards of warehouses and shops and adulteration gave rise to the sale of spoiled food
232 unknown to the consumers. This was likely to be more serious among the working class as
233 the upper and middle classes would have had access to more 'reputable' stores which
234 mitigated the imperfect information problem.

235 4.3 Polluted Air

236 This negative externality was also more severe in the working class neighbourhoods and
237 was due to two causes. The first is related to the slowness of the market to provide a merit
238 good such as housing and the second to the freedom of urbanising and construction without
239 any types of regulations. The bibliography on construction economics shows that the
240 supply of housing is inelastic in the short term.¹⁸ In addition to this market failure, the
241 demand for housing "shot up" in the working class neighbourhoods as a consequence of an
242 avalanche of immigrants. Therefore, rent prices also increased which obliged families to
243 sublet rooms to other people which generated overcrowding and polluted air. Another
244 contributing factor was that the building of narrow streets, tall buildings and small flats was
245 permitted which prevented adequate ventilation.

246 The only efficient way of correcting market failures such as those that caused the *urban*
247 *penalty* is State intervention. This can be seen in the success of the sanitary reform
248 measures proposed by the hygienists: sewage system, quality control of food, construction

¹⁸ The construction of housing requires a series of previous conditions which extend the execution time of the works (the project design, purchase of the land, construction license, bank loans, hiring of the construction company and the time of execution was rarely less than 2 years). Although there are many studies that explain why adjustments in the real estate markets do not take place in the short term, we can highlight Smith et al. (1988).



Table 4 Percentage of deaths from infectious diseases in Alcoy and the adjacent agricultural area (1875–1900) *Source:* Beneito (1993)

Period	Alcoy (%)	Adjacent agricultural area (%)
1875–1879	52.80	45.00
1898–1900	60.00	47.50

249 of cheap housing which tempered overcrowding and the hygienic regulation of urban
250 development and housing construction.¹⁹

251 We will now examine the data that confirm that Alcoy suffered from an *urban penalty*.
252 During the last third of the nineteenth century, the population density of the town was very
253 high with an average of 90,000 inhabitants per km² and 250,000 inhabitants per km² in
254 some working class neighbourhoods (Dávila 1993). This was due to two facts. The pop-
255 ulation increased by 30% as a result of immigration and Alcoy had serious problems in
256 terms of its urban growth due to its location in a valley between several mountain ranges
257 which is crossed by three rivers. Therefore, in addition to a high population density there
258 was a high compactness (the ratio between the built-up area and the open space) (Dávila
259 1993, op. cit.). If we also add the absence of sewage facilities and the quality control of
260 food and the overcrowding of homes, it follows that the incidence of infectious diseases
261 transmitted through the air, water and contaminated foods would have risen. This can be
262 seen in Table 4, which shows the percentages of mortality caused by infectious diseases in
263 Alcoy and in the adjacent agricultural area during the last third of the nineteenth century.
264 We can observe that the percentages were higher in Alcoy than in the rural area and that
265 the incidence of these diseases in the town rose from 52 to 60%, which explains the
266 reduction in life expectancy. In the same respect, the air-borne diseases represented 39% of
267 mortality rates and those transmitted by water and contaminated food represented 15%.
268 The remaining 6% of mortality was due to infections caused by other vectors (Beneito
269 1993). Moreover, it is plausible, although data are not available, that between 1880 and
270 1897 the percentage of deaths caused by infectious diseases in the total overtook the 60%
271 of the last years of the nineteenth, because we can see in the Table 5 that the mortality rate
272 was 34.5‰ in 1887.²⁰ This phenomenon suggests that the city began to suffer the urban
273 penalty (higher mortality rates and lower life expectancy than in the hinterland) in the 1860
274 and 1870 decades but the hardest situation was lived in the 1880 and the first 1890, and it
275 did not begin to be mitigated until the implementation of the sanitary reform, since 1893–
276 1894 (see Table 6). This would explain that the mortality rate in 1900 was similar than in
277 1877 and the percentage of mortality caused by infectious diseases in the total was slightly
278 higher in 1900 than in 1877.

279 Another fact which reveals the existence of an urban penalty in Alcoy is the contrast
280 between the crude mortality rates in the town, those of Spain and those of rural Spain.
281 Although for comparison purposes these rates are affected by the population structure, we
282 believe that the results shown in Table 5 are significant. In 1878, Alcoy had a similar rate
283 to the Spanish average. In 1887, this rate increased, surpassing the rate for Spain and the

¹⁹ Other measures proposed by the hygienists were the paving of the streets, refuse collection, vaccination, the “Gotas de Leche” child nutrition programme and the outreach campaigns about child care and child nutrition and personal and domestic hygiene. On health reform in the cities, see Szreter (2002a, b, c, 2005). Also Bell and Millward (1998), Fraser (1993), Luckin (2000), Harris (2004) and Sheard and Power (2000).

²⁰ In fact, in other Spanish city suffering urban penalty as La Unión, this percentage reached to 86.4% between 1877 and 1900. (Escudero, García-Gómez and Martínez Soto, work in reviewing).



Table 5 Crude mortality rates in Alcoy, Spain and Rural Spain (1878–1900) *Sources:* Alcoy, Beneito (2003). Spain, Nicolau (2005). Rural Spain, Reher (1990)

Years	Alcoy	Spain	Rural Spain
1878	30.20	30.40	n/a
1887	34.90	32.70	30.20
1897	30.32	28.30	27.9
1900	29.30	28.80	n/a

Table 6 Public expenditure on the sanitary reform of Alcoy (1866–1914) *Source:* See text

Five year period	(1) Spending on sanitary reform	(2) Spending on sanitary reform per capita
1866–1870	42,368.51	1.50
1871–1875	53,731.57	1.75
1876–1880	57,254.43	1.78
1881–1885	43,865.97	1.41
1886–1890	41,952.68	1.39
1891–1895	102,464.71	3.33
1896–1900	127,105.87	4.05
1901–1905	116,564.85	3.57
1906–1910	233,768.63	6.97
1911–1914	390,918.44	11.33

Constant pesetas of 1913

284 rate of rural Spain. Although at the end of the nineteenth century the rate of Alcoy had
 285 fallen, it was still higher than the other two rates.

286 If we now use height as an indicator of the standard of living (Fig. 5), we can observe
 287 that it also reveals a decrease in well-being during the last third of the nineteenth century as
 288 the average height of those born in 1862 was 163 centimetres which evolved roughly
 289 constant in the period between this year and 1898. As we already know, height at the age of
 290 20–21 years of age is the result of the net nutritional input, the difference between the
 291 crude nutritional input (the nutrients consumed) and the energy expended through basal
 292 metabolism, physical activity and illnesses. The stagnation in height in Alcoy had three
 293 causes: a) despite the increase in food consumption the diet was still not sufficient to cover
 294 the energy needs required by physically demanding jobs; b) there was a high incidence of
 295 child and adolescent labour with harsh working conditions²¹ and c) the deterioration of the
 296 urban environment gave rise to higher morbidity rates.

297 All of this indicates that the standard of living of the workers in Alcoy diminished
 298 during the last third of the nineteenth century as the slight increase in real wages and
 299 consumption masks the deterioration in sanitary and working conditions reflected in
 300 morbidity, life expectancy and height.

²¹ For child labour and the harsh working conditions in Alcoy during the industrialisation process, see Beneito (2003).

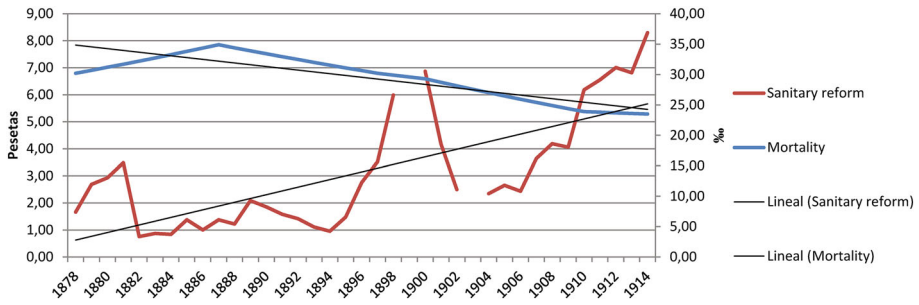


Fig. 6 Crude mortality rate and expenditures in the sanitary reform in Alcoy (1878–1914). Own elaboration. Sanitary reform expenditures per capita in real 1913 pesetas with a gap of 5 years. Crude mortality rates in % Sources: Budgets of the local government of Alcoy from 1865 to 1911 (sanitary reform) and «Estadística de movimiento natural de la población entre 1843 y 1860» (Archivo Municipal de Alcoy), Register of deaths in Alcoy (Civil register of Alcoy) and Beneito (2003)

301 **5 The Standard of Living of Workers in Alcoy (Beginning of the Twentieth** 302 **Century-1930)**

303 Figure 2 shows that between 1901 and 1930, nominal wages grew substantially with an
 304 accumulative annual average rate of 4.23%. We should point out however, that between
 305 1901 and 1913, wages remained virtually unchanged as a result of the afore-mentioned
 306 adjustment in the labour market. The nominal wage grew strongly during the First World
 307 War and the 1920s. The inflationist gap generated by the conflict and the strike movements
 308 forced entrepreneurs to increase wages which subsequently continued to rise due to the
 309 positive situation that the town’s industry experienced during the Dictatorship of General
 310 Primo Rivera and to the emergence of a labour market with collective bargaining.²²

311 Between 1901 and 1930, real wages (Fig. 4) also increased, although at a lower
 312 accumulative average rate than nominal wages (2.7% as opposed to 4.23%). However,
 313 between 1901 and 1913 real wages remained practically stable; they increased in 1914 and
 314 1915 despite the increase in the CPI; they fell temporarily in 1916 and 1917 as a conse-
 315 quence of the higher inflation and, although they later experienced variations, they
 316 displayed a clearly upward trend until 1930. Therefore, if we use real wages as an indicator
 317 of well-being, we will reach the conclusion that well-being increased between the
 318 beginning of the twentieth century and 1930.

319 The second indicator of the standard of living which we have used indicates the same
 320 trend. As we can observe in Table 2, in 1897 calories consumption was 2330; in 1912 it
 321 was 2423 and in 1928 it was 2831. The evolution of life expectancy also indicates an
 322 increase in well-being because in 1900 it was 32.06 years for men and 35.90 years for
 323 women and in 1930 it had increased to 43.78 and 49.10 years respectively (Table 3). The
 324 better nutrition undoubtedly contributed to the decrease in mortality but the information
 325 that we will examine below shows that a crucial factor in the progressive disappearance of
 326 the urban penalty was the sanitary reform which the local government of Alcoy imple-
 327 mented at the end of the nineteenth century.

²² A more in-depth analysis of the evolution of nominal and real wages can be found in García-Gómez (2013), pp. 503–536.

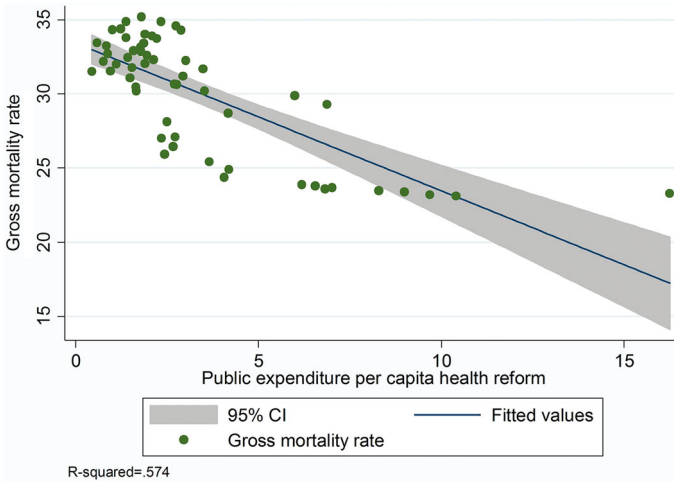


Fig. 7 Mortality and sanitary reform

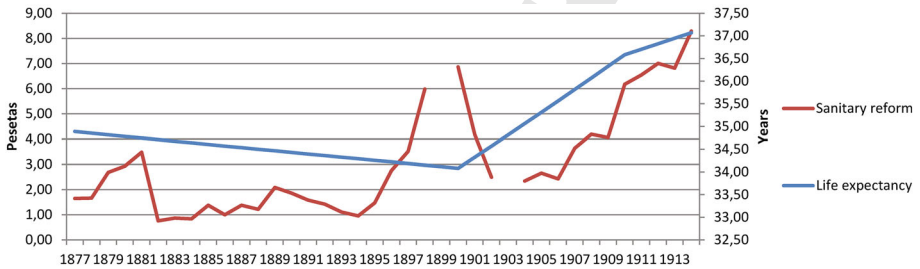


Fig. 8 Life expectancy and expenditures in sanitary reform in Alcoy (1877–1914)

328 From the 1870s, hygienists, republicans, socialists and anarchists demanded the
 329 municipal authorities of Alcoy to undertake a sanitary reform. This request was rejected
 330 until the 1890s by both conservatives and liberals, the two parties that dominated the local
 331 government during the period known in Spain as the Restoration.²³ These parties opposed
 332 the sanitary reform with two arguments based on radical liberalism. The first was that the
 333 reform required an increase in taxes and this was counterproductive because it would drain
 334 money away from agriculture, industry or trade. The second argument was that the excess
 335 death rate in the working class neighbourhoods was a natural consequence of poverty and
 336 bad habits of the poor. However, the pressure exerted by the left-wing parties and the
 337 coming to local power of councillors of the reformist wing of the liberal party led by José
 338 Canalejas explains why this reform was implemented in the 1890s.²⁴

²³ The period known in Spain as the Restoration began in 1876 when a military coup d'état restored the monarchy under Alfonso XIII and ended in 1923 when General Primo de Rivera established the Dictatorship.

²⁴ García-Gómez (2016) and García-Gómez and Salort (2014) have studied the political reasons why the health reform was delayed until the 1890s.

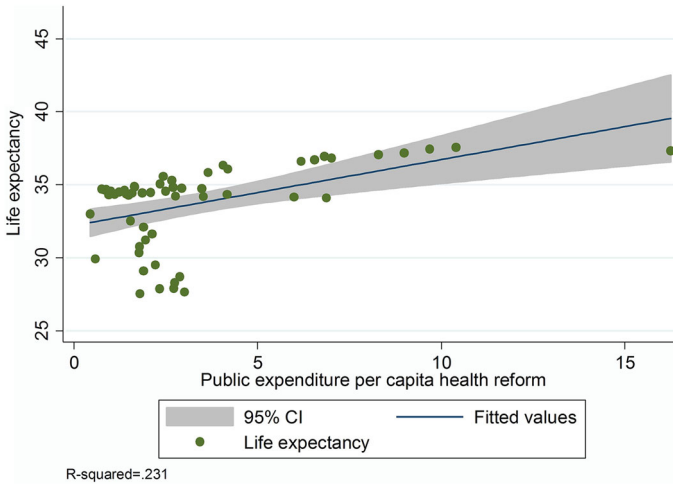


Fig. 9 Life expectancy and sanitary reform

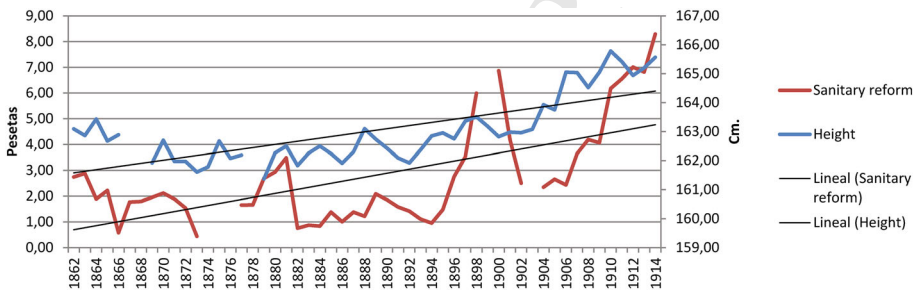


Fig. 10 Height and expenditure in sanitary reform in Alcoy (1862–1914)

339 We have quantified the sanitary reform using the settlements of the budgets of the local
 340 government and by calculating the following expenditure items: water, sewage facilities,
 341 street cleaning, woodland, parks, slaughterhouse, municipal doctors, midwives, hospital,
 342 urban planning studies and cemetery.²⁵ Table 6 contains this information. In Column 1 we
 343 can see the cost of the reform in constant pesetas of 1913 and in Column 2 the cost per
 344 inhabitant. We can observe that the reform began during the 1890s reaching its greatest
 345 impetus between 1906 and 1914.

346 The sanitary reform contributed to alleviate the above-described market failures which
 347 reduced the risk of contracting infectious diseases transmitted by air, water and contam-
 348 inated food. This can be seen in the following etiological data. Between 1898 and 1900,
 349 60% of mortality in the town was due to infectious diseases, of which 39% were air-borne,
 350 15% were transmitted through water and food and 6% were caused by other vectors. Then,
 351 between 1928 and 1932, deaths caused by infections had fallen to 40%; those caused by
 352 air-borne diseases had fallen to 27%; those transmitted through water and food to 9% and
 353 those caused by other vectors had fallen to 4% (Beneito 1993).

²⁵ The settlements can be found in the Archivo Municipal de Alcoy.

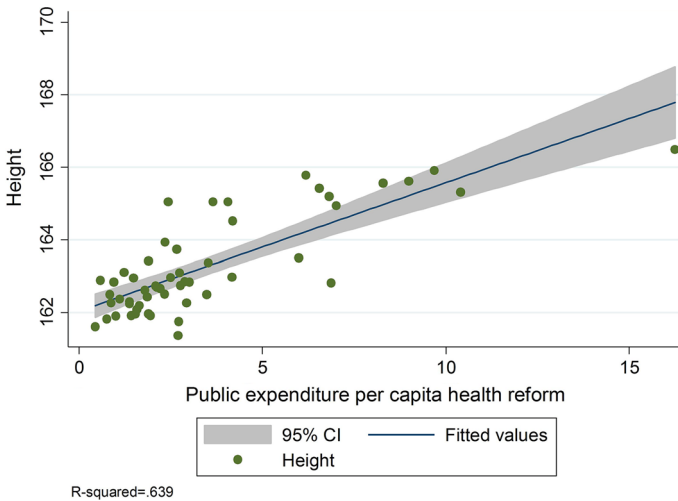


Fig. 11 Height and sanitary reform

354 It is worth comparing the evolution of the sanitary reform efforts and the mortality
355 indicators. In Fig. 6 we can see the crude mortality rate in Alcoy between 1878 and 1914
356 and expenditure on sanitary reform per person between the same years. We should point
357 out that we have introduced this second variable with a gap of 5 years as the effects of
358 public spending on health and mortality are not immediate. We can observe that both
359 variables are inversely proportional, which coincides with the hypothesis that sanitary
360 reform could be necessary although not sufficient condition to the reduction in mortality.

361 Figure 7 shows the statistical correlation between both series. As we can observe, the
362 Pearson's product-moment coefficient is 0.77 with a p value 0.000, so the correlation is
363 statistically significant with a 1% confidence.

364 Figure 8 shows how life expectancy fell between 1877 and 1900, a period in which per
365 capita expenditure on sanitary reform was very low (1877–1894) or when the effects of the
366 higher expenditure were still not visible (1896–1898). We can also observe that both
367 variables grew at the same rate between the beginning of the twentieth century and 1914.

368 We find a high correlation between the life expectancy and the sanitary reform
369 expenditures (Fig. 9) as the Pearson's product-moment coefficient is 0.67 and statistically
370 significant with a confidence of 1%.

371 We will now consider the evolution of the fourth indicator of the standard of living:
372 height. As we can see in Fig. 10, the conscripts born in 1898 had an average height of
373 1.63 m while those born in 1930 had an average height of 1.67 m. There are three reasons
374 for this increase in net nutritional input: (a) the higher consumption of calories was now
375 sufficient to cover the energy requirements of the work; (b) the State passed laws that
376 regulated child labour and improved working conditions²⁶ and (c) sanitary reform reduced
377 morbidity.

378 It is worth observing the relationship between sanitary reform and height. Figure 10
379 suggests that both variables display an upward trend and their correlation coefficient

²⁶ From the beginning of the twentieth century, the State enacted legislation that improved working conditions: regulation of child and female labour, a reduction in the working day to 9 h and the Sunday rest law. See Benito (2003).



380 (Fig. 11) is statistically significant (0.73) in the same confidence interval than in the
381 previous correlations.

382 Based on all of the above, we can maintain that the standard of living of the workers in
383 Alcoy increased in the period from the beginning of the twentieth century to 1930 as
384 observed in the series of real wages, nutrition, life expectancy and height.

385 6 Conclusions

386 Many studies reveal that it is advisable to analyse the evolution of the standard of living
387 using several indicators as there is no single variable that reflects all of the components of
388 well-being or does so without incurring judgement values. In this article we have studied
389 the standard of living of the workers in Alcoy between 1870 and 1930 using four indi-
390 cators: real wages, nutrition, mortality and height. The conclusions of the study can be
391 summarised as follows:

392 Between 1870 and the end of the nineteenth century, real wages and nutrition increased
393 slightly, but life expectancy and height decreased. This “puzzle” can be explained by the
394 “urban penalty” that existed, the high incidence of child labour and the harsh working
395 conditions. Therefore, it seems correct to confirm that the standard of living decreased as
396 the slight increase in consumption of the working class of the town masked the deterio-
397 ration in health and working conditions reflected in morbidity, life expectancy and height.

398 This pessimistic panorama changed between the beginning of the twentieth century and
399 1930. Real wages increased as did nutrition, life expectancy and height. The increase in the
400 well-being of the working class was undoubtedly due to the market (increased productivity
401 and wages), but also to the State intervention. The sanitary reform of the town reduced the
402 market failures that had given rise to the urban penalty and the enactment of several laws
403 that regulated child and adolescent labour contributed to improving the biological standard
404 of living of the workers.

405 In our opinion, the scenario in Alcoy coincides with the model recently proposed by
406 Floud, Fogel, Harris and Chul Hong (2011, op. cit.) for the industrialisation process of the
407 British cities. According to these authors, between 1810 and the mid nineteenth century,
408 real wages increased modestly as did nutrition. However, this slight increase in gross
409 nutritional input was not sufficient to increase net nutritional input due to the harsh con-
410 ditions of child and adolescent labour and the increase in morbidity related to the urban
411 penalty. After 1870, better nutrition, the sanitary reform in the cities and the improved
412 working conditions for children and adolescents would explain the decrease in mortality
413 and the increase in height.

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