

# **WELL-BEING AND THE LATE 19TH CENTURY AGRARIAN CRISIS: ANTHROPOMETRIC EVIDENCE FROM RURAL CATALONIA**

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## **Abstract**

This paper is an approach to explore the evolution of the biological standard of living during the years of the late 19th century agrarian depression. We use a new dataset on conscripts from rural western Catalonia, which adumbrate that no decline took place in the height of the young males born between 1879 and 1903. The current findings also suggest remarkable differences in biological living standards across territories and individuals which, in addition, seem to have changed over time. The currently available evidence indicates that the agrarian depression might have had a less negative impact on the overall well-being of the (western-) Catalan population than one might have expected.

Key words: Anthropometrics, Living Standards, Agrarian Crisis, 19th Century, Globalization

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## 1. Introduction

The late 19th century agrarian depression is a well-researched topic in economic history.<sup>1</sup> The standard narrative of the topic links this crisis with the development of a global and more integrated economy during the second half of the 19th century. It argues that falling transport costs and growing agricultural output led to increased competition, a drop in the prices of agricultural products, and, finally, a fall of European landowners' income in the 1880s and the 1890s. Farmers' response to these events has been also analysed. The existing literature on this topic has argued that the rise of agrarian tariff duties in late 19th century Europe was strongly influenced by farmers' demands for protection. Some scholars have also suggested that the late 19th century mass migration cannot be totally disentangled from the situation of agriculture in peripheral Europe. Other studies on rural change point out that the agrarian depression could have stimulated the modernisation of the agriculture in the Old Continent.

The exact impact of the crisis still remains unclear, however. There is no doubt that it was fairly heterogenous: as Ramon Garrabou (1975; 1988) has clearly shown, it varied across countries and regions, it did not affect all agrarian products in the same way, and it differed by social classes and groups. But whereas some economic historians have tended to stress its negative impact, others have suggested a less pessimistic view. To give some examples, Jaime Reis (1988) has concluded that the main sectors of the Portuguese agriculture experienced neither substantial nor long-lasting losses during the crisis period. Of course, this evolution paralleled trends in output, rents, wages, and profits, which, according to this scholar, did not suffer from a general drop either. Giovanni Federico has arrived at similar conclusions by looking at the case of Italy. After re-estimating the evolution of the gross output over the long-run, he has concluded that "*there is no 'agrarian crisis' in the 1880s (production of cereals stagnated instead of falling) and the breakthrough of the 1890s is downgraded to an acceleration within a long-run upward trend*" (Federico, 2009: 239). James Simpson has also analysed the nature and consequences of the agrarian crisis in Spain. According to him, "*the extent of the crisis has often been exaggerated*" and, therefore, "*the 'agrarian crisis' in Spain was relatively small*" (Simpson, 2001: 99). This scholar has argued that wheat prices fell less in Spain than in most Western European countries, wages also raised less, land rents increased more, whereas emigration and livestock specialisation were less intense by north-western

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<sup>1</sup> The existing literature on this field is enormous and difficult to be summarised. A collection of essays covering several European countries can be found in Garrabou (1988). See also O'Rourke (1997); Williamson and O'Rourke (1997), the chapters and bibliography included in Pamuk and Williamson (2000) or in Pinilla and Lains (2009) as well as the works quoted in this section.

European standards. Thus, the moderate impact of the agrarian crisis – together with other factors – would have hampered the modernisation of the Spanish agriculture.

So far the debate on the impact of the agrarian crisis, interesting as it might be, has usually tended to miss one important piece of the puzzle: the evolution of the non-material well-being of the rural population during the late 19th century as essential part of the overall living standard.<sup>2</sup> This paper aims to help filling this gap by focusing on the north-eastern Iberian region of Catalonia, a relatively well-developed area in southern Europe and a region where the agrarian crisis seem to have taken place “...*in all its force*” (Garrabou and Pujol, 1988: 113). More precisely, we analyse height data for the cohorts of young males born between 1879 and 1903 in the western and more rural Catalan province of Lleida. Of course, this is not the first attempt to analyse the impact of the agrarian crisis by considering anthropometric evidence on living standards.<sup>3</sup> It is, nevertheless, one of the few studies that specifically focuses on this important issue and is designed to cover an entire provincial territory in Spain for the first time by utilising a relatively large sample of data.<sup>4</sup>

The paper is organised as follows. Section 2 deals with the data and methodological issues. Section 3 reviews agricultural and demographic trends in late 19th century western Catalonia. Section 4 explores how the biological living standard as measured by height data evolved in rural western Catalonia during the years of the agrarian crisis. Section 5 looks at height trends by comparing regions and individuals for the province of Lleida. Section 6 concludes.

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<sup>2</sup> Various anthropometric studies showed how fundamentally crucial net nutritional status and health are for the human capital development (and, thus, in turn even for economic growth). Correspondingly, the WHO (1995) states that well-being is much more than the command over services and goods. The net nutritional status (and thus the mean height) is the outcome of the available diet quantity and quality, parasite exposure, disease stress, and physical workload, and correspondingly various factors shaping the environmental circumstances (e.g. Komlos, 1985; Steckel, 1995). Consequently, the anthropometric method considers the strong connection of welfare, health, and nutritional status with mean height: the net nutritional status affects the development of stature during the whole growth period from fecundation onwards until adolescence with particular importance of the first three years in life due to babies’ special fragility and susceptibility (see e.g. Scrimshaw, 2000). Therefore, the net nutritional status is responsible for the attainment of the possible genetic height potential and this way determines the mean final adult height of a population. Thus, mean height of a (homogenous) population can be utilized to measure its (biological) standard of living.

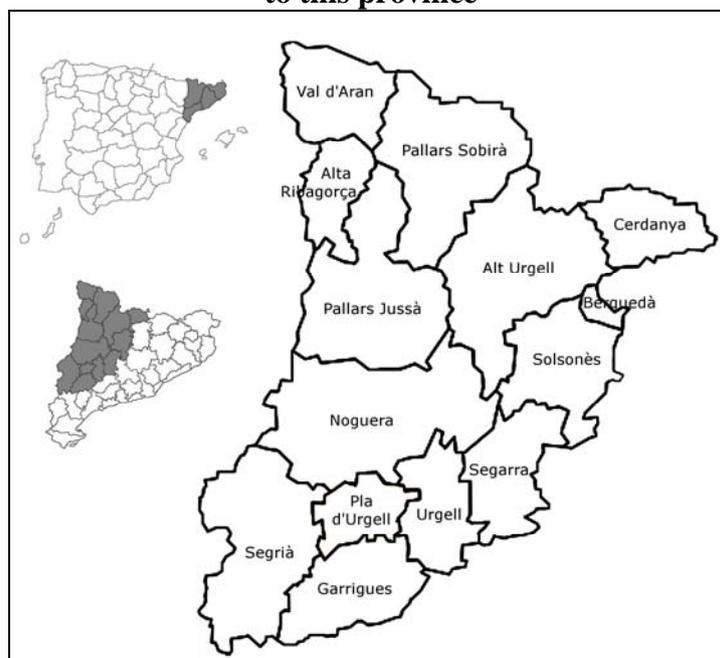
<sup>3</sup> See, for example, Federico (2003), Kopczynski (2007) and Banerjee, Duflo, Postel-Vinay & Watts (2010), for Italy, Poland and France, respectively. For the particular case of Spain, see among others, Martínez-Carrión (1991), Cámara (2009); García-Montero (2009); Ramon-Muñoz, J.M. (2009), Hernández & Moreno (2009) and Martínez-Carrión & Puche-Gil (2009).

<sup>4</sup> The dataset we use in this paper is still under construction and forms part of a broader project on the evolution of the biological living standard in Catalonia. It is expected that a second version of this paper will be able to use a more complete dataset including height information for all the municipalities of the province of Lleida and perhaps additional information for other Catalan provinces.

## 2. Data and methodology: description and potential shortcomings

In Spain, the military service was introduced as universal for men with the Recruitment Act of 1856 (Royal Order of January 30<sup>th</sup>), the cohort born in 1836 being the first one called up under the new legislation (Martínez-Carrión & Puche-Gil, 2010). This process of enrolment to the military service produced a large amount of information. Municipal authorities prepared local lists of recruitment, the so-called *Actas de Clasificación y Declaración de Soldados* (Acts of Classification and Declaration of Soldiers), which included, among others, the name, birth year, and the physical stature of the draftees. After the local recruitment process had been conducted by the local councils, in a second step the provincial administrations also played a role in both the enrolment process and the final decision concerning the entry to the military service (Cámara, 2006). The Recruitment and Replacement Act of 1896 established examination commissions at provincial level, the so-called *Comisión Mixta* (Mixed Commission), in order to control the fitness and other declarations stated by the potential soldiers to be excused from the obligatory military service. The information collected in the two recruitment rounds was finally summarised in the *Libros de Reemplazo* (Recruitment Books), which are available for the recruitment period of 1898-1924.

**Figure 1**  
**The western Catalan province of Lleida and the counties that totally and partly belong to this province**



**Notes and sources:** Our own elaboration.

The dataset used in this paper is based on the information collected in the Recruitment Books of the western Catalan province of Lleida.<sup>5</sup> It includes data for 102 out of the 322 localities existing in this province in the late 19th century, namely almost 25 % of the population living in western Catalonia by 1900. More precisely, our sample contains all the towns that nowadays are the capitals of the 14 counties that either totally or partially belong to the province of Lleida<sup>6</sup> – with the exception of Puigcerdà, Berga and Lleida itself (Figure 1).<sup>7</sup> In addition to the capitals, our dataset contains height information stemming from the smallest villages of the province according to the 1900 population census. Using counties as administrative units and 1900 as reference year, we have included as many small villages as necessary to match with the total number of inhabitants living in the capital of the corresponding county. By applying this criterion, so far we have been able to collect approximately 18,000 individuals and almost 16,500 height measurements for young men enlisted during the recruitment period of 1898-1924, which corresponded to the birth cohorts of 1879-1903 (Table 1).<sup>8</sup>

**Table 1**  
**Current dataset on heights for the province of Lleida, 1879-1903**

Period of birth	Period of recruitment	Total conscripts	Conscripts with height data
1879-1883	1898-1903	3,285	3,071
1884-1888	1904-1909	3,651	3,386
1889-1893	1910-1914	3,904	3,475
1894-1898	1915-1919	3,400	3,090
1899-1903	1920-1924	3,752	3,374
<b>Total</b>		<b>17,992</b>	<b>16,396</b>

**Notes and sources:** Our own elaboration from *Libros de Reclutamiento*.

<sup>5</sup> Provincial Recruitment Books provide less information than the local Acts of Classification. Nevertheless, the former covers the entire municipalities of the province of Lleida over the period 1898-1924. This coverage would be impossible to achieve by using solely local information.

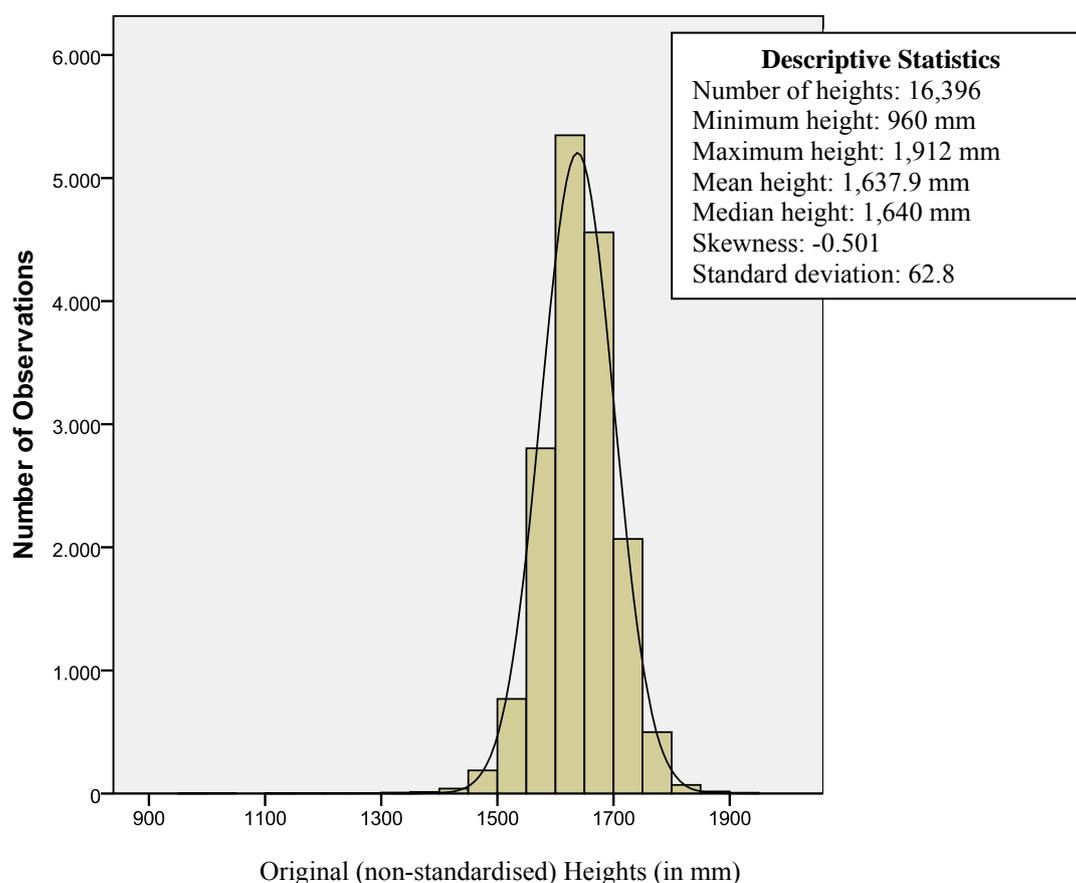
<sup>6</sup> Catalonia is divided into four provinces, namely Barcelona, Girona, Lleida and Tarragona. The administrative level immediately below is the county and the municipality. At present, Catalonia is divided into 41 counties and 947 municipalities. These 41 counties, in turn, are grouped into 7 territorial entities.

<sup>7</sup> Lleida is the capital of the province as well as the capital of the county of Segrià and it cannot be considered a rural town. Puigcerdà is the capital of the county of Cerdanya. It does not belong to the province of Lleida though the county partially does. The same is true for Berga, the capital of Berguedà.

<sup>8</sup> In the current paper, we focus on the data from the so-called territorial entities of Ponent and Alt Pirineu i Aran. The former includes the counties of Garrigues, Noguera, Segarra, Segrià, Pla d'Urgell i Urgell, located in the southern and plain area of the province. The latter includes the counties of Alta Ribagorça, Alt Urgell, Cerdanya, Pallars Jussà, Pallars Sobirà i Val d'Aran, which are located in the northern and more mountainous part of western Catalonia. The county of Solsonès and the municipality of Gòsol (Berguedà) also belong to the province of Lleida and they are included in the territorial entity of Comarques Centrals. Nevertheless, they are not considered here, because the observations we were able to compile are not yet sufficient to conduct a proper comparison with the other regions. At the current stage, for Ponent we collected 11,520 height observations of which 6,278 cases stem from the villages (956 missing values) and from Alt Pirineu i Aran 4,876 individuals of which 3,032 cases stem from the villages (705 missing values).

The information that the utilised registers contain do not only refer to those males that were finally selected to serve, but it also includes those potential conscripts that were provisionally or definitively excluded from military duties due to height shortage or other reasons. This means that our sample is affected neither by censoring nor by truncation (Figure 2), the latter being one of the main potential shortcomings in military samples (e.g. Komlos, 2004). However, our data are not normally distributed, but follow a quasi-normal (Gaussian) skewed pattern. More precisely, it has a negative skew due to the existence of several extremely low heights which are not necessarily explained by measurement errors. Whether these low heights are the result of environmental or genetic factors is difficult to be said and will require a further analysis in the future. At the present stage, the only that can be stated is that outliers showing a very short height have also been found in other Iberian regions (Ayuda & Puche-Gil, 2014) and that the number of cases in our sample is very small.

**Figure 2**  
**Distribution of heights (in mm) in the non-standardised sample and descriptive statistics, 1879-1903**



**Notes and sources:** Our own elaboration from *Libros de Reclutamiento*.

However, looking into the individual data in more detail we found that the extreme low heights (below 1,200 mm) are mostly associated not with the younger age groups but with the adult age group.<sup>9</sup> Therefore, it is interesting to not simply exclude, but instead consider the outliers in order to depict the overall (biological) living standard and potential changes in the course of time correctly.

The skewness to the left might be affected by a second important shortcoming of the data on hand: as common in (Spanish) conscript data, it includes recruits enlisted at different age, including those that potentially did not attain final height yet. Throughout the 19th and early 20th centuries the Spanish military authorities modified the enlistment age in several occasions. The fixed age of 20 years was established in the first universal recruitment (1856) and was applied until the first draft of 1885. Then it was reduced to 19 years in the second draft of 1885, while it was again established to 20 years between 1901 and 1905. Finally, in 1907 the age of recruitment was established to 21 years. No other changes took place in the age required for the military service before 1970 (Martínez-Carrión & Puche-Gil, 2010).

Nevertheless, the modifications in the recruitment age have important implications in the interpretation of the height series. It is well-known that with the onset of puberty height growth can experience a further period of acceleration (other than the main one in infancy), the so-called “adolescence growth spurt”. Although after this peak the velocity of growth progressively reduces, height continues to increase until the late teens or early twenties depending on the living conditions in which the individuals grow up in (Floud, Wachter & Gregory, 1990: 13; Bogin, 1999: 92; Tanner, 1981; Komlos, 1985; Guntupalli & Moradi, 2009). Therefore, comparing the height of conscripts measured at different moments of their adolescence growth spurt may bias the final results. So far, though, for different historic populations it is unclear when this growth process was finalised.

Different approaches exist as how to tackle this issue. A simple way is to exclude all observations other than those that already reached an age of 21 years in order to account for the mentioned fact that the growth period can be prolonged until beyond the teenager years due to inadequate net nutrition. However, this is a very inefficient method. Firstly, the data on hand often only provide information on younger individuals which would be completely lost this way (as it would be the case with our dataset). Secondly, in general, by conducting such

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<sup>9</sup> Of a total of six observations with a height below 1,200 mm, four stem from draftees that were measured when they were 21 years old.

an exclusion, the number of observations is substantially reduced. This is an important limitation as the standard error is a function of the number of height measurements. In other words, the smaller the amount of conscripts in a sample, the larger the standard error and the confidence intervals, and, thus, it is all the more difficult to depict significant variation in a given height difference.

The ideal option to deal with the issue would be performable in case that the draftees' age has been increased by one year in two subsequent recruitment drives.<sup>10</sup> But our data do not provide information on conscripts that would enable us to conduct such a direct comparison of the different age groups, because in the actual cases on hand in which the recruitment age was increased there are one-year-gaps in the conscript data (1900 and 1906). Although the available data do not provide information detailed enough in order to determine potential age effects exactly, nevertheless the dummy approach helps us to detect that actually also in the Catalan conscript data individuals below 21 years of age still seemed to have been growing, and, therefore the heights require to be standardised.

**Table 2**  
**Results of the regression by controlling for age group dummies, 1879-1903**  
**(Coefficients in millimetres)**

	Model 1: Including all observations of the current sample		Model 2: Excluding those observations of the current sample with a height below 1,200 mm	
	Coefficient	P-values	Coefficient	P-values
Constant	1,643	0.00	1,643	0.00
Alt Pirineu i Aran	-7.0	0.00	-6.6	0.00
Dummy19	-19.4	0.00	-19.2	0.00
Dummy 20	-8.9	0.00	-9.0	0.00
Adjusted R <sup>2</sup>	0.011		0.002	
Sample size	16,396		16,389	

Note: For sources see text. Reference category is the age group of 21years old, in Ponent. All coefficients are significant at the 1%-level. The dependent variable is the non-standardised mean height.

Table 2 presents the results of an Ordinary Least Square (OLS) regression. The models are very simple and only aim at testing the potential effect of belonging to a certain age group on the average height of a cohort. They include dummies that depict the different age groups that

<sup>10</sup> Then we could directly compare the heights of these groups in order to define the long-bone growth length, as both age groups were born in the same birth year (experiencing the same environmental conditions in their early life time). A similar method was followed by Martínez-Carrión & Moreno-Lázaro (2007) by using annual revisions for those males that were temporarily excluded from the military service, as they did not reach the minimum height required.

are present in our dataset and which potentially were still growing at the time of height measurement, namely those of 19 and 20 years. As reference category we employed those draftees living in western plain counties and aged 21 years old when enlisted. We controlled for the region of residence (unfortunately we do not have the place of origin) of the conscripts, namely whether they lived in mountain (Alt Pirineu i Aran) or plain (Ponent) counties.<sup>11</sup> We also check the potential influence of outliers by excluding those observations of the current sample with a height below 1,200 mm. The results remain similar. These models are not ideal, however, as the data have the caveat that the observations of the 19 and 20 years old individuals are the same as specific recruitment years. Thus, the age dummies included in the regression model might be capturing both the potential age-specific residual effect and the birth-year related impact due to changing nutritional and environmental conditions. However, we can assume that at least the ‘19-dummy’ depicts the age effect quite properly, because the draftees of the 19 years old group were born in the years before the agricultural crisis set in, namely the years 1879 and 1880.<sup>12</sup> The results of the econometric test seem to confirm our assumption that the 19 year olds were still growing and thus would bias the picture one gets concerning the development of well-being: according to the results based on our dataset, overall, the conscripts being 19 years of age were of statistically significantly lower mean height than their 21 year old fellows (on the 1%-level).<sup>13</sup>

**Table 3**  
**Estimates on height growth across ages for the draftees of Lleida born between 1879 and 1890**

Age	Year of birth	Year of recruitment	Conscripts with height data	P <sub>50</sub> cm	Height growth	
					age	cm
19	1879-1880	1898-1899	1,321	162.30	19 to 20	0.90
20	1881-1885	1901-1905	3,549	163.20	20 to 21	0.80
21	1886-1890	1907-1911	3,695	164.00	19 to 21	1.70

**Notes and sources:** See text and Table 3.

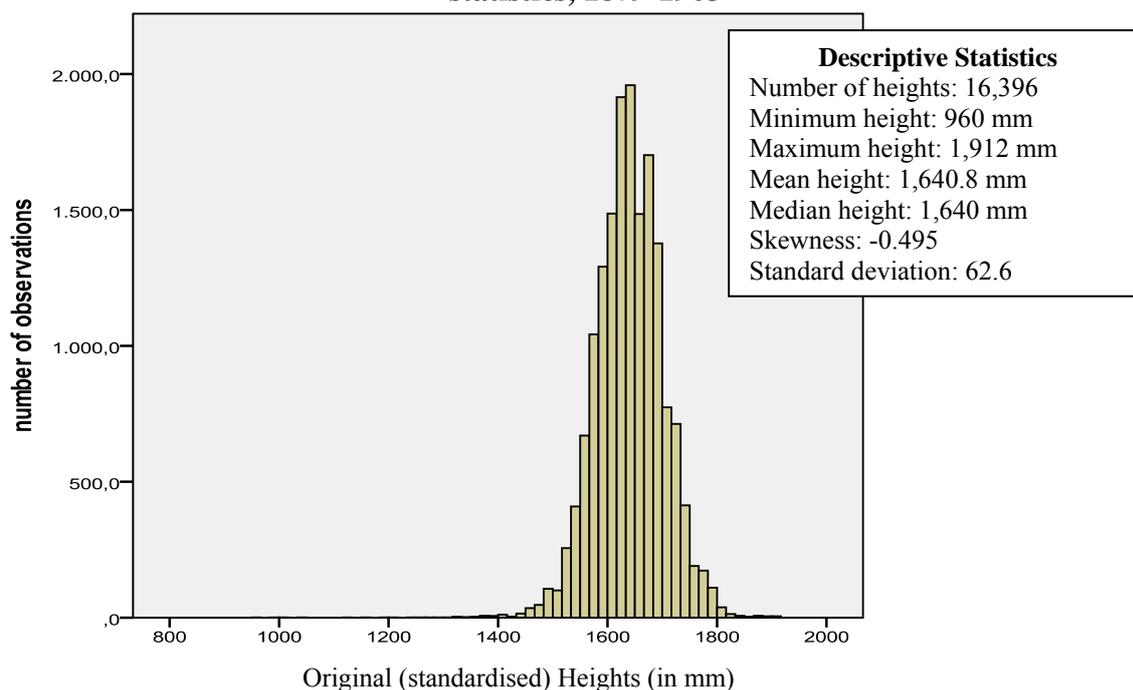
<sup>11</sup> Our dataset is still under construction. Nevertheless, we have found a high correspondence between the province of residence and the province of birth of the enlisted draftees in western Catalonia. For example, of a sample of 6,600 young males recruited in the province of Lleida between 1916 and 1924, only 300 had been born in provinces others than Lleida.

<sup>12</sup> For an approximate chronology of the agricultural downturn in late 19<sup>th</sup> century western Catalonia, see section 3, particularly Figure 6.

<sup>13</sup> Also the 20-years-old are on average statistically significant smaller in height than the reference group; and that the millimetre-gap between these both groups is half of the mean difference of the 19- versa 21-year-old individuals fits in the picture of growth, having the studies on the Yassis curves in mind. However, in the case of our dataset it is difficult to disentangle the actual age effect from the noise of the environmental influences for this age group, as the individuals that were recruited at age 20 were draftees in the years in which the agricultural crises was on the go.

Considering this evidence, it is therefore clear that a standardisation procedure has to be applied in order to ensure un-biased data, to make the observations of the different recruitment years comparable and to enable us to conduct a correct interpretation of the temporal development of the mean height.

**Figure 3**  
**Distribution of heights (in mm) in the in the standardised sample and descriptive statistics, 1879-1903**



**Notes and sources:** Our own elaboration from *Libros de Reclutamiento*. Heights have been standardised at the age of 21 years, as it is explained in this section.

In the absence of the definite information on the potential height residual, several procedures can be used to standardise the heights of conscripts over time (Ramon-Muñoz, J.M., 2009). Due to both data constrains and the stage of our research we have had to use a very simple method (Table 3). Firstly, we used the 50<sup>th</sup> percentile of the height of the three different age groups included in the recruit measurements: the conscripts born in 1879 and 1880 that were enlisted at the age of 19 years, individuals born in the period 1881-85 that were recruited at the age of 20 years, and, finally, draftees born between 1886 and 1890 that were measured at the age of 21 years. Secondly, we calculated the absolute variation of the 50<sup>th</sup> percentile height across the different age cohorts. Thirdly, we applied these variations to the corresponding cohorts in order to standardise heights: based on the computed information we reasoned that at the age of 20 males on average would be 0.80 centimetres taller if they would

have been 21 years old. Similarly, we assume that those males that were 19 years old would have attained 1.70 centimetres taller height at an age of 21 years.

Perhaps not surprisingly, after having applied the standardisation, the height distribution remains skewed to the left (Figure 3). Therefore, for our future analyses we plan to apply Mukherjee's "ladders of power" approach adjusting the data by cubing them to arrive at a normal distribution that allows an unbiased interpretation of the regression coefficients and residuals of potential explanatory variables.

### **3. The years of the agrarian crisis in western Catalonia: an overview**

The agriculture of the Old Continent did not remain immune to the forces of the first globalisation (e.g. O'Rourke & Williamson, 1997; O'Rourke, 1997). Growing competition, foreign markets collapse, overproduction, and a general fall in prices were features of the agrarian sector between the 1870s and the 1890s in Europe. These were the years of the so-called late-19th century agrarian depression (Abel, 1980; Tracy, 1984; Garrabou, 1988). Although its impact varied across regions and products, there are few doubts that European farmers had to cope with massive arrivals of cheap agricultural products from Asia, Africa and the Americas, a consequence of falling trade costs and international markets integration.

This was also the fact in Catalonia (Garrabou & Pujol, 1987). Placed in the north-eastern part of the Iberian Peninsula, Catalonia was found to be a case of early (and uncommon) industrialisation on the periphery of Europe (Pollard, 1981). In the late 18th century, it developed a remarkable cotton manufacture (Sánchez, 1989); in the 1830s, it began a factory-based industrialisation (Nadal, 1975). Correspondingly, by the late 19th century it had become the "factory of Spain" (Nadal, 1985), accounting for almost one-third of the Spanish industrial gross added value (Parejo, 2001; Tirado & Martínez-Galarraga, 2008).

However, industry was not equally distributed in the Catalan territory. Whereas the industrialisation process made remarkable progresses in the coastal and pre-littoral areas of the country, this was less apparent in western inner lands. By the mid-19th century, the number of people that were working in industry as their main activity was very low by Catalan standards in the province of Lleida. According to the 1860 population census, manufacture only occupied 10 % of the total labour force, which is half of the Catalan average

(Ramon-Muñoz, R., 2013). Instead, three-fourths of the active population in the province depended on agriculture, including cattle raising activities and farming.

**Table 4**  
**Land use by main crops in Lleida, Catalonia and Spain, c.1860-c.1900**

Crops	Lleida			Catalonia			Spain		
	c.1860	c.1885	c.1900	c.1860	c.1885	c.1900	c.1860	c.1885	c.1900
<b>Panel 1. Crop structure, as a percentage of the total cultivated area</b>									
Cereals and legumes	66,0	58,8	70,8	49,7	47,4	52,9	81,9	78,8	76,9
Tree and bush crops	32,3	38,3	23,7	49,0	49,9	40,0	16,0	17,1	16,5
Vineyards	19,1	26,0	10,0	32,3	33,0	20,6	8,9	9,3	8,0
Olive trees	13,2	12,3	13,6	11,3	12,3	14,0	5,4	6,3	6,7
Intensive crops	1,7	2,9	5,6	1,4	2,7	7,1	2,2	4,0	6,6
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
<b>Panel 2. Trends in crop area, index numbers (c.1885=100)</b>									
Cereals and legumes	76	100	108	90	100	96	89	100	95
Tree and bush crops	57	100	55	84	100	69	80	100	93
Vineyards	50	100	34	84	100	54	83	100	84
Olive trees	73	100	99	79	100	99	74	100	104
Intensive crops	41	100	172	44	100	228	46	100	159
Total	68	100	89	86	100	86	86	100	97

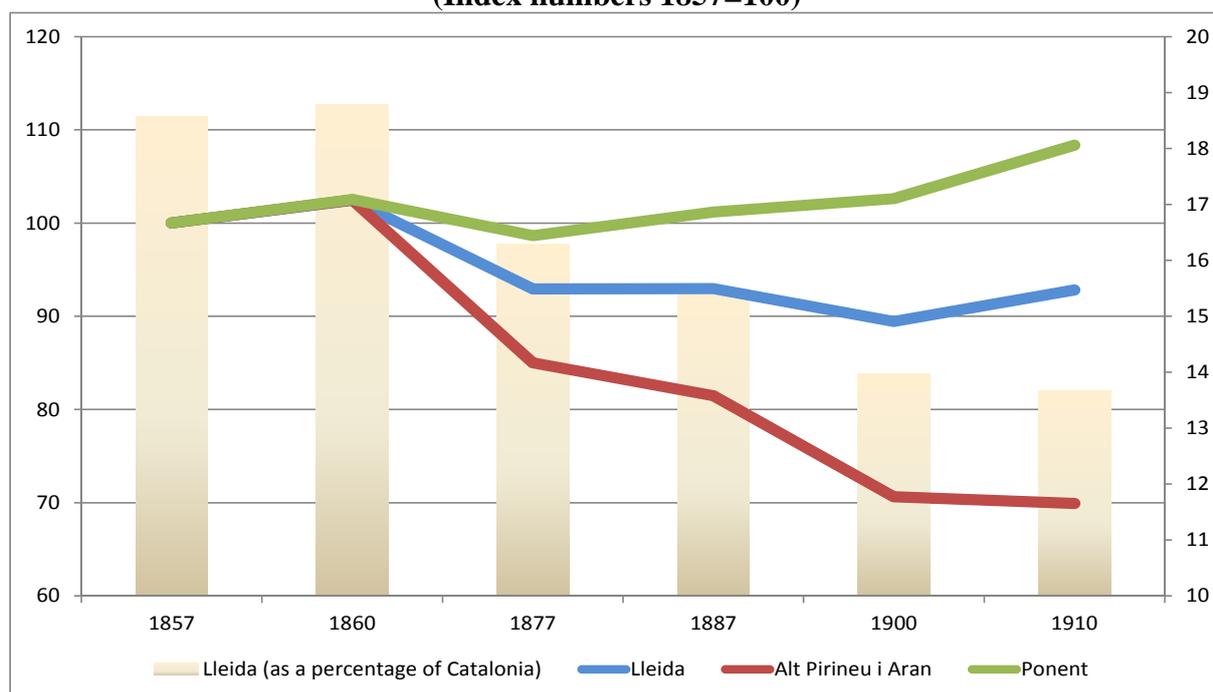
Sources and notes: Garrabou & Pujol (1987).

With a lower proportion of arable land but a higher amount of grassland, the northern and more mountainous counties of the province were mainly orientated to cattle husbandry, which had become a major economic branch in these territories (Crisis, 1887, vol. 3). By 1865, the judicial districts (*partidos judiciales*) of La Seu d'Urgell, Sort, Tremp and Viella – roughly equivalent to the present-day counties of Alt Urgell, Pallars Sobirà, Pallars Jussà, Alta Ribagorça and Val d'Aran – accounted for 70 % of the total number of cattle heads in Lleida (Giralt, 1990). Apart from grassland, these counties were also relatively well endowed with woodlands and forests from which timber and other forest products were obtained.

The opposite was true for the plain counties. Concluding from the available data, in the mid-1880s the judicial districts of Balaguer, Cervera and Lleida – roughly equivalent to the counties of Garrigues, Noguera, Pla d'Urgell, Segarra, Segrià and Urgell – concentrated around 10 % of the pasture land of the province. By contrast, these judicial districts accounted for around 80 % of the land devoted to the three main crops in western Catalonia, namely cereals, vineyards and olive trees (Crisis, 1887, vol. 3; Giralt, 1990). Of these three crops, wheat and cereals were the prime products, both in the mountains and in the plain. By the

1860s, they accounted for two-thirds of the total agricultural area of the province, a higher proportion than in the rest of Catalonia (Table 4). However, as time passed cereal crops, although growing in absolute terms, lost ground relative to other crops, particularly wine products. Between the mid-1860s and the mid-1880s, the area devoted to vineyards doubled in Lleida, whereas it remained almost stagnant in the rest of Catalonia (Garrabou & Pujol, 1987; Giralt, 1990; Gardeñes & Vicedo, 1993).

**Figure 4**  
**The evolution of the population in the province of Lleida, 1857-1910**  
**(Index numbers 1857=100)**



Notes and sources: Left axis: population trends, index numbers, 1857=100. Right axis: population of Lleida, as a percentage of Catalonia. Our own elaboration from <http://www.idescat.cat/>

The reasons of this expansion are well known. They are mainly connected with the increasing demand of wine in France since 1860, where vineyards were being affected by the *phylloxera*, a disease that wiped out vine rootstocks. Although progresses were more modest, the area devoted to olive trees also expanded in the province of Lleida, particularly in Les Garrigues and other southern counties. The increase of olive production was linked to both the increasing requirements of the domestic market and the expansion of international demand for olive oil (Ramon-Muñoz, R., 2011). The growth of both cereal crops as well as olive trees, and, above all, the boom of vineyards had an important consequence in the area: it made it possible that in the two decades before the mid-1885 the agrarian sector grew more in Lleida

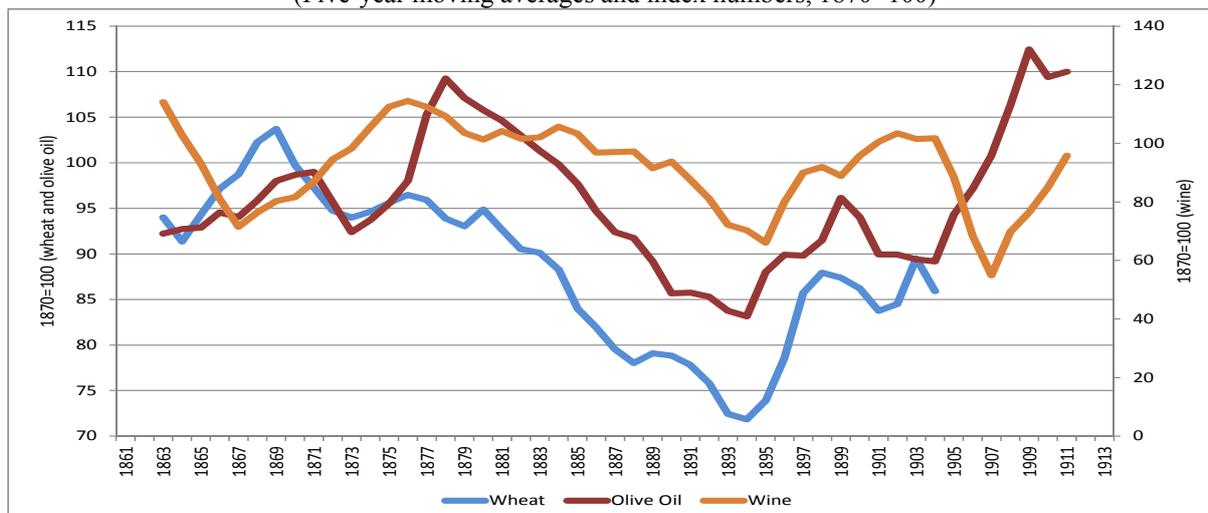
than in the rest of Catalonia and Spain (at least as measured by the number of hectares dedicated to the production of agricultural commodities).

In parallel to this extensive growth there was also an expansion of irrigated land in the province of Lleida, which went from 58,133 hectares in 1858 to 137,337 in 1900 (Garrabou & Ramon-Muñoz, J.M., 2011). Compared to the rest of Catalonia, this was an impressive growth which was the direct result of the building of the Urgell Channels, the largest water infrastructure for agricultural purposes in 19th-century Spain. In spite of the fact that the Urgell Channels failed in allowing a greater development of intensive and high value crops in the province of Lleida, they had a positive impact on agricultural productivity growth in the second half of the 19th century (Ramon-Muñoz, J.M., 2013).

Demography mirrored the expansive cycle of the western Catalan agriculture. After the population numbers of the province of Lleida had fallen by around 10 % between the 1860s and the 1870s, the process of depopulation ceased during the decade following the census year of 1877 (Figure 4). The evolution of the provincial population between 1877 and 1887 was the result of two opposite trends. In the mountain, population density was declining, although the rate of decline had decelerated relative to previous decades. By contrast, the population of the plain started a growing trend, offsetting the northern collapse. Interestingly, the demographic vitality of the plain counties after the mid-1870s – which run in parallel to the vineyard expansion – seems to have been partly dependent on the arrivals of migrants from the mountain areas of the province.

At some point, however, the agrarian crisis set in. The growth in the western Catalan agriculture appears to have ceased in the course of the 1880s. To start with, the prices of olive oil, wheat, wine, and perhaps other agrarian products fell in the last quarter of the 19th century (Figure 5), as it was also the case in many other European areas. Between the late 1870s and the early 1890s the value of olive oil declined by more than 20 % in nominal terms. A similar reduction can be observed in the case of wheat between the early 1880s and the mid-1890s. In fact, during the decennial periods 1874/84 and 1885/94 wheat prices declined more in Lleida (18.7 %) than in many other Spanish regions (Simpson, 2001). The case of wine was even more impressive: prices declined by 40 % during the decade after the mid-1880s and the area devoted to vineyards reduced by two-thirds, from 119,000 to 41,000 hectares – more than any other crop in the province.

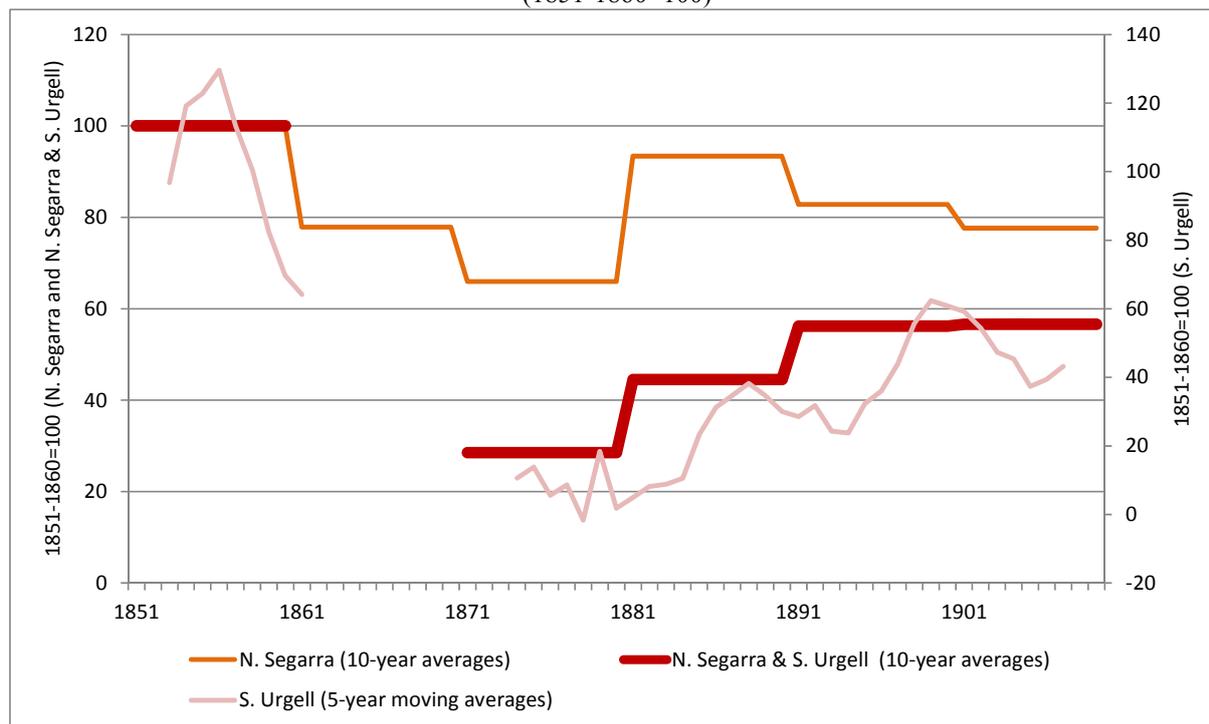
**Figure 5**  
**Olive oil, wheat and wine prices in the counties of Lleida, 1861-1913**  
 (Five-year moving averages and index numbers, 1870=100)



**Notes and sources:** Wheat and olive oil (left axis): Average annual prices taken from Sánchez Albornoz and Carnero (1975 and 1981) and GEHR (1980 and 1981). Wine (right axis): Average annual price in Balaguer from Vicedo (1999). Vicedo's prices end in 1897. From 1897 onwards, it has been assumed that the price of Lleida fluctuated according to the price for Sant Pere de Ribes, as given by Balcells (1968).

As in Europe, in western Catalonia agrarian prices fell due to the combined effect of increasing production abroad, falling transport costs, foreign markets collapse and growing arrivals of cheaper agrarian products from overseas. This was also true in the case of wine. Wine producers faced increasing difficulties in foreign markets, a consequence of a number of factors, including the recovery of the French production, the emergence of non-European wine competitors and growing protectionism in former import markets (Pan-Montojo, 1994; Simpson, 1995; Pinilla and Ayuda, 2002; Simpson, 2011). However, the crisis of the wine sector was also the result of another important factor: the invasion of the *phylloxera*, which began to affect western Catalan vineyards in the 1890s (Iglèsies, 1968; Giralt, 1990). A direct consequence of increasing difficulties in foreign markets and *phylloxera* invasion was the drop of the area devoted to wine production in Western Catalonia (and elsewhere in Iberia). As in the province of Lleida vineyards accounted for one-fourth of the total crops area, this drop had an enormous impact in the aggregate, the total number of hectares dedicated to the production of agricultural products falling by 10 % between the mid-1880s and the years around 1900 (Table 4). This fall was similar to that observed for Catalonia. It was, however, more intense when compared to Spain.

**Figure 6**  
**Indices of real land rents in two counties of Lleida, 1871-1910**  
 (1851-1860=100)



**Notes and sources:** The nominal rents of land have been taken from Pascual (2000) and Garrabou, Planas and Sagner (2001), respectively. They have been deflated by Maluquer de Motes' consumer price index, as given in Maluquer de Motes (2005).

Following the above mentioned drop in agricultural prices and land use, between the late 1880s and the mid or late 1890s the rent of land also experienced a falling trend (Figure 6). The available evidence suggests, however, that this late-19<sup>th</sup> century fall in land rents (and land prices) varied from one area to the other and by crops. For example, the northern part of the county of Segarra showed a long lasting decline in land rents compared to its neighbour county of Urgell (Garrabou, Planas & Sagner, 2001; Pascual, 2000). In the former, land rents dropped by more than 15 % in real terms. Instead, in the south of the county of Urgell, the decline in land rents between the late-1880s and the mid-1990s was followed by a robust growth during the second half of the 1890s, although land rents fell again during the first decade of the 20<sup>th</sup> century. Regarding the evolution of crop land prices, the price of land for cereals seems to have dropped before the mid-1880s, whereas in the case of vineyards it seems to have fallen later on (Bringas, 2000).

The number of cattle heads also seems to have declined in Lleida over the last decades of 19<sup>th</sup> century (Giralt, 1990). Unfortunately, the extent of this decline is difficult to be quantified

due to the low quality of the existing data.<sup>14</sup> The available figures show that some of the northern, mountainous judicial districts of the province, namely La Seu d'Urgell and Vielha, were particularly affected by the reduction of livestock. Consequently, the total number of cattle heads in northern Lleida declined relative to the rest of the province between 1865 and 1891.

The last decade of the 19<sup>th</sup> century appears to have been particularly harmful for the western Catalan mountainous counties, resulting in a rural exodus that accelerated in these areas from the mid-1880s onwards. As a result, in 1900 the population of the mountain counties was reduced by 30 % in comparison to 1860, in economic terms a very negative performance in the context of the Spanish mountain economies (Collantes, 2004). This drop was not offset by the demographic growth of the plain counties. Therefore, the population numbers declined in the province of Lleida between 1887 and 1900, as shown above in Figure 4.

#### **4. The evolution of mean height as proxy of living conditions in western Catalonia: preliminary results**

The question remains as to whether and to what extent did the mentioned price drop in the various different crops as well as the associated changes actually affected the overall local population. Did also the biological living standards in rural western Catalonia decline during the years of the agrarian crisis? The previous evidence might suggest a positive answer. The drop in prices is said to have damaged land rents and the income of owners, tenants and sharecroppers (Garrabou, Pujol, Colomé & Sagner, 1992:123). Contemporaries certainly argued that agriculture was suffering from a crisis in the province of Lleida. However, they also stated that – while prices were declining – agricultural wages were increasing (Crisis, 1887, vols. 2 and 3). Correspondingly, although owner's income presumably suffered, these trends in prices and wages might have rather meant a less negative effect for non-land owners, labourers and those dependent on wages. In fact, the available evidence shows that relative to the price of wheat the wages of male agrarian workers in western Catalonia increased from the 1860s to the 1880s, mainly because of the demand for labour in the vineyards. Between

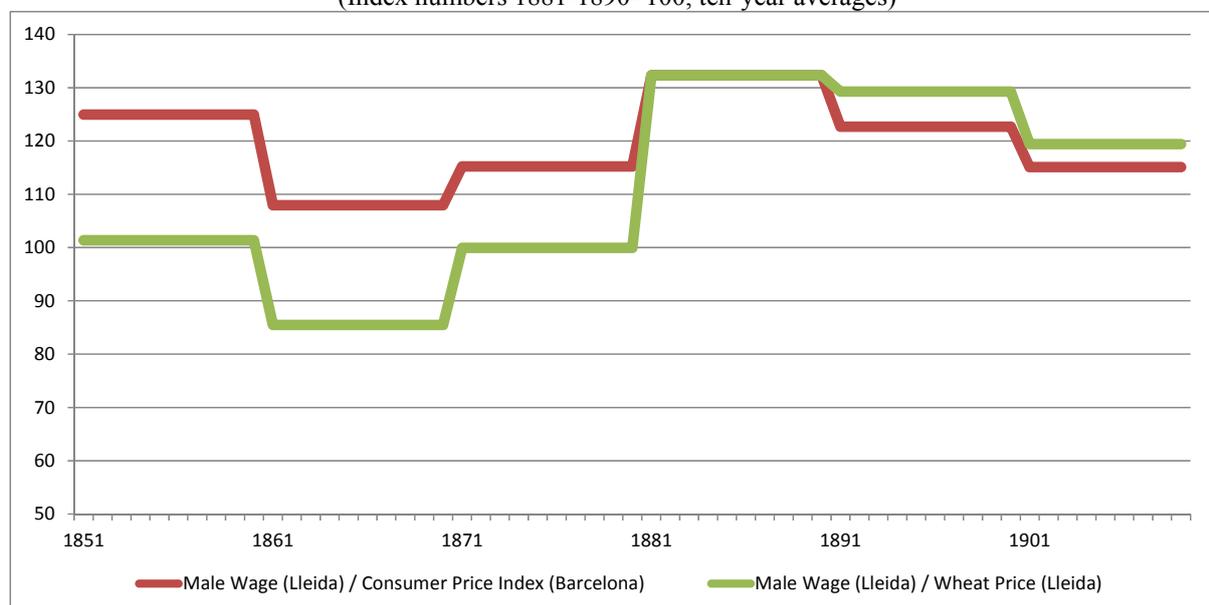
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<sup>14</sup> On the quality and reliability of the 19<sup>th</sup> century livestock censuses, see, among others, GEHR (1978) and, for the particular case of Catalonia, see Garrabou & Pujol (1987) and Giralt (1990).

the 1880s and the early 1900s, real wages certainly fell, but they did not return to the levels of the 1860s (Figure 7).<sup>15</sup>

In order to tackle the issue as to whether and, if so, to what extent the agricultural crisis actually affected the total Catalan population we utilised the conscript height data discussed above.<sup>16</sup> Figure 8 aims at shedding some light on the important open question: As proxy for net nutritional status and, thus, living standards, here we depict the evolution of the mean height of our large sample of male cohorts living in the province Lleida and born during the years of the agrarian crisis.

**Figure 7**  
**Male agricultural wages in Lleida, 1851-1910**  
(Index numbers 1881-1890=100, ten-year averages)

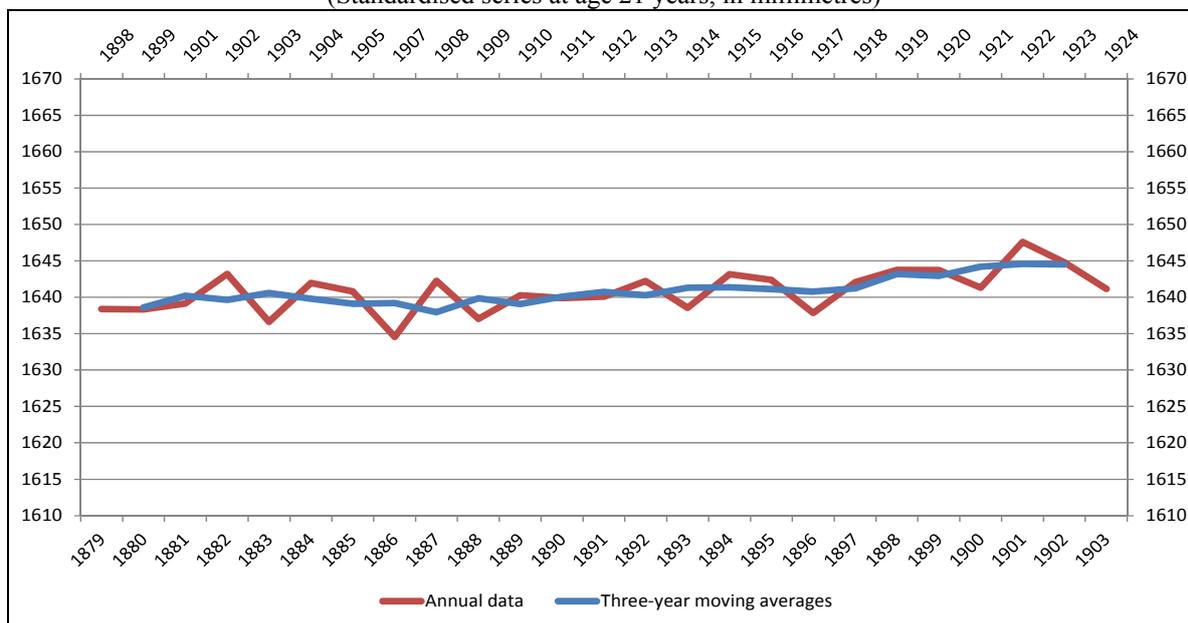


**Notes and sources:** Nominal wages taken from Garrabou, Pujol & Colomé (1991), Pascual (2000) and Garrabou & Tello (2002); wheat prices taken from Garrabou & Tello (1999), and the consumer price index taken from Maluquer de Motes (2005).

<sup>15</sup> Of course, it might be also argued that the fact that real wages were increasing did not necessarily mean better conditions for the labourers, because they might have deteriorated due to worsening labour conditions and unemployment (Garrabou, 1975). It is also clear that wage labour was not the only source of income for rural labourers, at least in western Catalonia (Garrabou, Ramon-Muñoz, Tello, forthcoming). On the other hand, rural wages did not always perform homogeneously in the different areas of the province, particularly after the 1880s. For example, they followed a downward trend in the county of Urgell and in some towns of southern Segarra, whereas the opposite was true for the northern area of this latter county (Pascual 2000; Garrabou & Tello 2002; Garrabou; Ramon-Muñoz; Tello, forthcoming).

<sup>16</sup> It is of course important to keep in mind that the males depicted here are only one part of the population, and that the female part might have been affected somehow differently. However, as any offspring height outcome is also partly affected by the net nutritional status of their mothers (due to the importance of the foetal period on the later life health and height attainment), we at least can depict the female status and possible changes in a potential gender bias to a certain extent indirectly.

**Figure 8**  
**The average height of conscripts in the counties of Lleida during the last quarter of the 19th century**  
 (Standardised series at age 21 years, in millimetres)



Sources and notes: See text. The aggregated data is weighted by the squared number of individuals to account for potential differences in the distribution of the observations.

As can be seen from the graph, the height series shows annual fluctuations and a certain declining tendency during the first half of the 1880s. From 1893 onwards, fluctuations resumed, but now a certain upward trend can be observed: from 1,640 mm in the mid-1890s to 1,645 mm in the first years of the 20th century. However, the differences between favourable and unfavourable years were rather modest, accounting for less than 1 centimetre. When the period 1879-1903 is taken as a whole a clear conclusion emerges: the average height of the young males born during these years did not decline during the agrarian crisis of the late 19th century. In fact, and perhaps contrary to expectations, the data even indicates that height rose in late 19th century western Catalonia, since the cohorts of draftees born in the average period of 1901-1903 were approximately 5 mm taller than those born in the 1879-1881 triennium. This was, though very modest, nevertheless a positive change.

**Table 5**  
**Results of the regression by birth cohort, 1879-1903**  
**(Coefficients in millimetres)**

			Coefficient		P-values			
Dependent variable: height at the age of 21 years								
Constant			1,641		0.00			
<b>Region of residence</b>								
Plain Counties (Ponent)			Reference region					
Mountain counties (Alt Pirineu i Aran)			-7		0.00***			
<b>Year of birth</b>								
	Coefficient	P-values		Coefficient	P-values		Coefficient	P-values
1879	Reference	year	1888	-2.1	0.58	1897	3.6	0.32
1880	0.5	0.89	1889	1.8	0.59	1898	5.2	0.14
1881	0.5	0.88	1890	1.2	0.72	1899	5.0	0.15
1882	4.9	0.19	1891	1.5	0.66	1900	2.7	0.44
1883	-1.8	0.59	1892	3.5	0.29	1901	8.7	0.01***
1884	3.6	0.29	1893	0.1	0.97	1902	6.1	0.07*
1885	2.4	0.48	1894	3.6	0.30	1903	1.9	0.58
1886	-3.7	0.27	1895	3.9	0.24			
1887	3.7	0.26	1896	-0.6	0.85			
Sample size 16,396								
Adjusted R <sup>2</sup> 0.003								

Notes and source: See text. The dependent variable is the standardised mean height. P-values significant at 0.01 (1%-level), 0.05 (5%-level) and 0.1 (10%-level) marked with asterisks \*\*\*, \*\*, \* respectively. We ran the regression for the adjusted distribution of heights (not shown), finding no change in the results concerning the significances.

Even more important than the interpretation of the descriptives, also the econometric analysis actually confirms this impression of a missing negative effect on the overall living standard due to the agricultural crisis: no statistical significant detrimental changes took place in the course of the period under study. Controlling for the regional origin of the draftees and taking 1879 as a reference year,<sup>17</sup> our OLS regression model shows that only in two out of the 25 cohorts at our disposal height levels were statistically different from the average height of the 1879 cohort (Table 5). In fact, the results indicate that the individuals born in 1901 were on average almost 9 mm taller than those born in 1879. And the 1901 cohort was 6 mm taller than that born during the reference year. In the last case, however, the difference is statistically significant only at the 10 % level. For the other birth cohorts, according to the data, no statistically significant variation occurred relative to the reference year. This finding confirms the absence of a decline in the biological standard of living of the 1879-1903 young

<sup>17</sup> The year of 1879 has been selected as a reference year because it is the first one for which we have information. The number of observations is more or less similar for every cohort.

male cohorts living in the counties of Lleida.<sup>18</sup> It remains to be studied - by controlling for various potential explanatory variables -, as to whether the effect of the agricultural crisis as such was not that extreme, or whether different positive and negative aspects overall equal each other out.

**Figure 9**  
**The average height of conscripts in selected localities of Lleida during the last quarter of the 19th century**

(Standardised series at age 21 years, five-year averages, in millimetres)



Sources and notes: Ramon-Muñoz, J.M. (2009) and text.

Of course, it might be argued that our analysis starts too late to capture the real impact of the agrarian crisis on the biological wellbeing of the western Catalan population. It could be said that the stature of conscripts might have begun to decline prior to 1879 and then might have remained stagnant. This would explain why the height of the western Catalan draftees was not falling in the last decades of the 19th century. But, in addition to the argumentation that the crisis did not really set in before the 1880s, the further available evidence on heights does not confirm this view (Figure 9). According to the data for five localities of the plain counties of Lleida, the stature of young males remained rather constant during the 1870s: the average height of the cohorts born in the period 1871-1875 being around 1,644 mm, namely almost

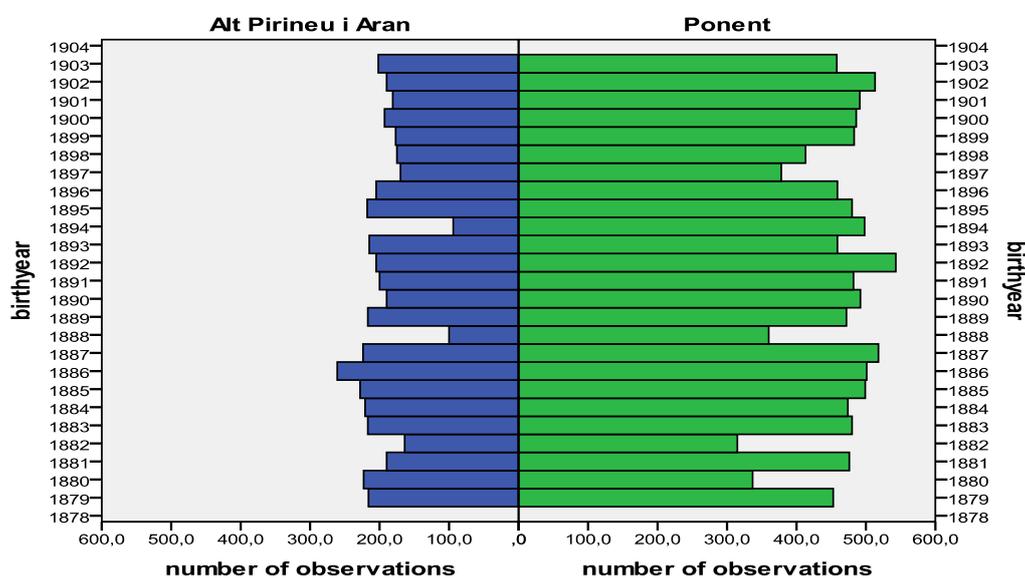
<sup>18</sup> The absence of decline in the mean height has been also found for other regions in Iberia. See, for example, Martínez-Carrion & Pérez-Castejón (2002); Martínez-Carrion & Moreno-Lázaro (2007); García-Montero (2009); Puche-Gil (2001).

the same as the average height attained by the birth cohorts of 1876-1880 (Ramon-Muñoz, J.M., 2009).

### 5. Height differences across territories and individuals in western Catalonia: further findings and some hypotheses

The aggregated data for the province of Lleida show no significant changes in the biological standard of living of the western Catalans throughout the last two decades of the 19<sup>th</sup> century. However, the econometric results depicted above in Table 5 suggest the existence of statistically significant differences in height depending on the region the conscripts stem from, namely mountain (Alt Pirineu i Aran) or plain (Ponent) areas, the former being shorter than the latter. Of course, further analysis based on a larger number of observations will have to confirm these preliminary results. Nevertheless, it is tempting to have a first closer look at the development of the regional differences.

**Figure 10**  
**Number of observations by birth cohort and region, 1879-1903**



**Notes and Sources:** Our own elaboration from *Libros de Reclutamiento*. See also text and footnotes.

**Table 6**  
**Results of the regression model by birth cohorts and regions, 1879-1903**  
 (Coefficients in millimetres)

	<i>Ponent</i>				<i>Alt Pirineu i Aran</i>			
	Non-Adjusted distribution		Adjusted distribution		Non-Adjusted distribution		Adjusted distribution	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	1642.6	0.00	4,453E9	0.00	1629.6	0.00	4,355E9	0.00
1879	<b>Reference year</b>							
1880	2.8	0.51	1,941E7	0.58	-1.9	0.77	-1,839E7	0.72
1881	3.4	0.39	2,408E7	0.45	-7.5	0.27	-6,445E7	0.22
1882	5.9	0.18	4,279E7	0.23	3.5	0.62	2,226E7	0.69
1883	-4.7	0.23	-4,026E7	0.20	4.3	0.51	2,772E7	0.59
1884	2.0	0.61	1,023E7	0.75	6.8	0.30	4,739E7	0.35
1885	5.5	0.16	3,995E7	0.20	-4.6	0.48	-3,916E7	0.44
1886	-8.8	0.02**	-7,550E7	0.02**	6.4	0.30	4,663E7	0.34
1887	2.7	0.48	1,779E7	0.57	5.7	0.38	3,562E7	0.48
1888	-4.8	0.26	-4,418E7	0.20	4.7	0.57	3,889E7	0.55
1889	0.1	0.98	-1529881,714	0.96	5.5	0.40	3,666E7	0.47
1890	1.1	0.78	4074519,952	0.90	0.5	0.94	-2597074,539	0.96
1891	-0.8	0.83	-1,226E7	0.70	6.6	0.33	4,195E7	0.42
1892	-0.0	1.00	-4704632,430	0.88	11.7	0.08*	8,358E7	0.11
1893	-4.5	0.26	-4,078E7	0.20	10	0.13	8,530E7	0.10*
1894	0.4	0.92	-924939,119	0.98	14.6	0.08*	1,138E8	0.08*
1895	0.9	0.82	3356784,219	0.92	10.4	0.11	7,909E7	0.12
1896	-4.1	0.31	-3,786E7	0.24	6.8	0.31	4,738E7	0.36
1897	-0.2	0.97	-4661912,209	0.89	11.7	0.10*	8,874E7	0.10*
1898	2.4	0.56	1,511E7	0.65	11.4	0.10*	8,382E7	0.12
1899	3.7	0.35	2,428E7	0.44	7.4	0.28	5,311E7	0.33
1900	0.5	0.91	-1114620,335	0.97	7.4	0.28	5,993E7	0.26
1901	6.2	0.11	4,375E7	0.17	14.8	0.03**	1,168E8	0.03**
1902	-0.6	0.87	-4724393,411	0.88	22.9	0.00***	1,737E8	0.00***
1903	1.3	0.75	4375211,369	0.89	3.1	0.64	3,039E7	0.56
Adj.R <sup>2</sup>	0.001		0.001		0.004		0.004	
N	11,520		11,520		4,876		4,876	

**Notes and Sources:** See text. The dependent variable is the standardised mean height. P-values significant at 0.01 (1%-level), 0.05 (5%-level) and 0.1 (10%-level) marked with asterisks \*\*\*, \*\*, \* respectively.

How did the mean height in the more mountainous region of the province of Lleida evolve in comparison to the south throughout the last quarter of the 19th century? At the present stage, our data indicate the following: By applying an OLS regression model and taking 1879 as the reference year, first of all we can state that – similar to the overall series – the region-specific

height series show no declining trend. Actually, we find the net nutritional status (as proxied by the mean height) to remain quite similar over time in Ponent. In this sub-region, interestingly, the only statistically significant variation seems to have taken place in 1886 with a statistically significant decline in mean height by 9 mm (5%-level).<sup>19</sup> Overall, the males from Alt Pirineu i Aran seem to have grown up under more adverse conditions than the ones from Ponent as indicated by their lower mean height. But according to the height series, in Alt Pirineu i Aran none of the cohorts under study were exposed to particularly adverse conditions in comparison to the 1879-level. Even the particularly malign effect hitting Ponent did not affect Alt Pirineu i Aran. On the contrary, a certain improvement took place in this northern part of the province, with positive statistically significant year-wise changes occurring during the 1890s (Table 6: on the 10%-level). Moreover, the data indicate that the 1901 and, in particular, the 1902 birth cohort had beneficial conditions during their growing years: the mean height is statistically significant taller by 15 mm (on the 5%-level) respectively 23 mm (on the 1%-level).<sup>20</sup>

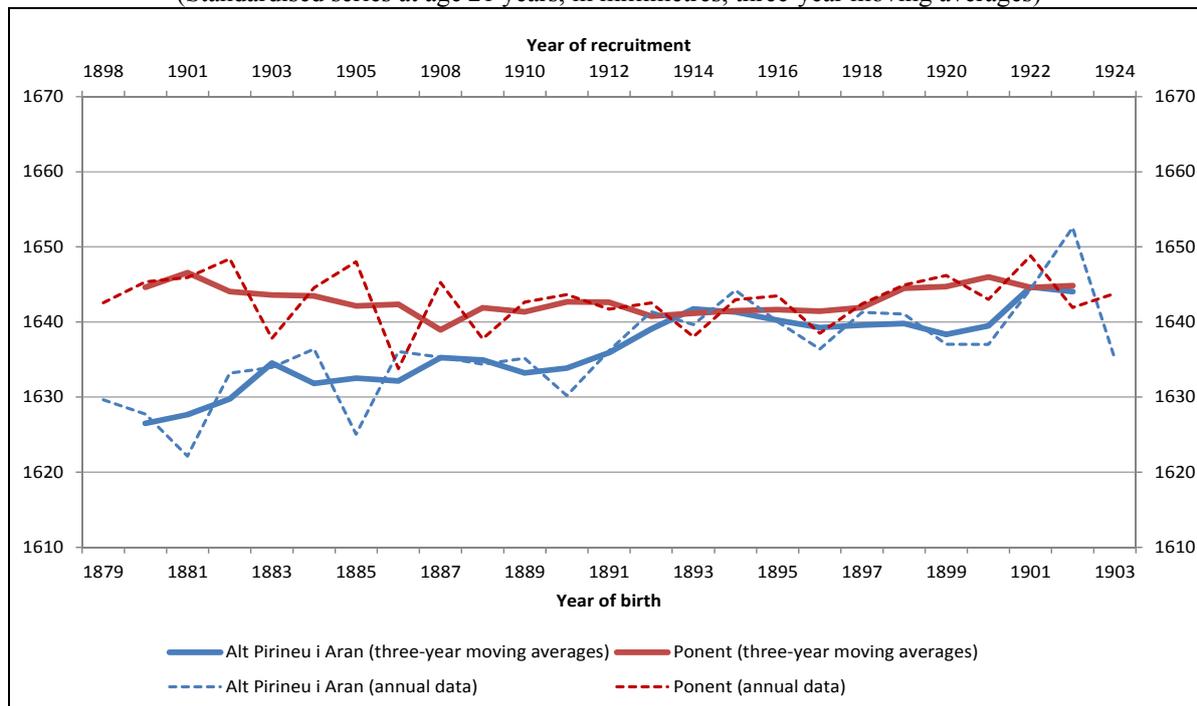
In the long-run, a comparison of the height series point towards the occurrence of a certain convergence, as the male mean height from Alt Pirineu i Aran moved towards the height level in Ponent (Figure 11). But is the visual impression actually confirmed in the quantitative analysis? By applying dummy variables for the two sub-periods – until 1894 (which seems to be the year culminating in the nadir in prices of crops in Lleida province: see Figure 6) and the following years –, we split the sample in two subgroups to get a first depiction as to whether a structural change might have taken place. In regressing the two sub-periods for Ponent and Alt Pirineu i Aran separately the results indicate that actually no statistically significant change took place for the plains, whereas the mountainous region experienced a significant improvement with the mean height being approximately 7 mm taller (1%-level) for the birth cohorts from 1895 to 1903 in comparison to the reference period from 1879 to 1894 (Table 7). This change seems to also drive the variation in mean height if we consider the whole dataset without differentiating between sub-regions: showing a highly statistical significant difference in mean height of circa 3 mm between the two sub-periods.

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<sup>19</sup> As shown in the previous section, this impact seems to also drive the overall height series for Lleida due to the different number of observations that are available for the two sub-regions, although the distribution is quite constant for the years the data are available (Figure 11).

<sup>20</sup> These findings are not based on an especially low number of observations in comparison to the remaining years under study.

**Figure 11**  
**The average height of conscripts in the counties of Lleida by main regions during the last quarters of the 19<sup>th</sup> century**  
 (Standardised series at age 21 years, in millimetres, three-year moving averages)



**Notes and Sources:** Our own elaboration from *Libros de Reclutamiento*. See also text and footnotes.

**Table 7**  
**Regressions considering a potential structural change around 1894**  
 (Coefficients in millimetres)

	<i>Ponent</i>		<i>Alt Pirineu i Aran</i>		<i>Total</i>	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	1642.5	0.00	1633.5	0.00	1639.8	0.00
Period 1879-1894	Reference category					
Period 1895-1903	1.2	0.29	6.7	0.00***	2.9	0.00***
R <sup>2</sup>	0.001		0.002		0.001	
N	11,520		4,876		16,396	

**Notes and Sources:** See text. The dependent variable is the standardised mean height. P-values significant at 0.01 (1%-level), 0.05 (5%-level) and 0.1 (10%-level) marked with asterisks \*\*\*, \*\*, \* respectively. NB: The effects are the same for the adjusted data distribution.

These findings fit together with the picture one can get considering additional sources, namely those dealing with diet quality and health environment. Concerning the first aspect, according to Pujol-Andreu *et alii* (2007), in Catalonia, contrary to the north-European pattern, the

consumption of milk was very modest even in the most northern municipalities of the country despite the fact they were more husbandry orientated. In addition, by considering the written sources for La Seu d'Urgell and Tremp, Cussó and Garrabou (2003-04) suggest that animal protein supply improved remarkably in north-western Catalonia from the late 19<sup>th</sup> century onwards. Our data seem to confirm this improvement in diet and it could be hypothesised that the so-called milk effect was operating. The milk-effect hypothesis states that increased consumption of milk by children and young people leads to greater average height of the population (e.g. Koepke & Baten, 2008; Takahashi, 1984; and Bogin, 1988: 277-78 for a further discussion). The existence of a positive and direct association between milk consumption and height (and military rejection rates) has been found for modern times, but also for 19th century Europe (e.g. Baten & Murray, 2000; Baten, 2009).

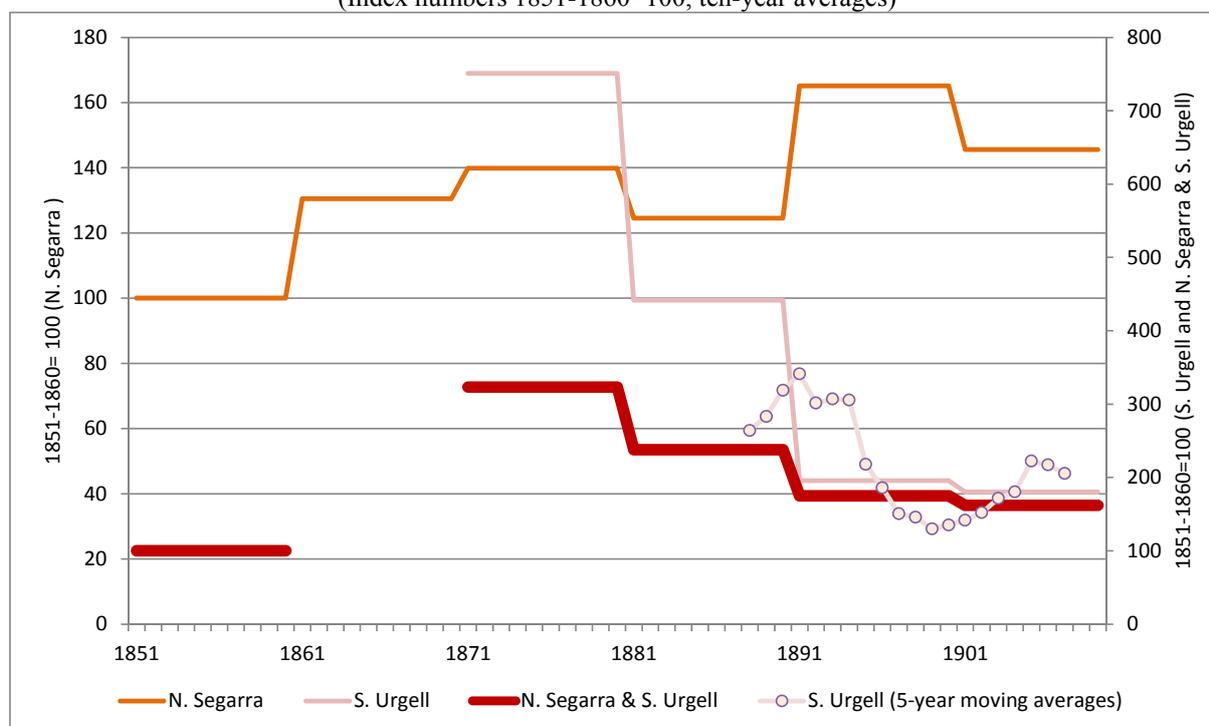
Concerning the second aspect, the existing demographic evidence presented in section 3 might suggest that the economic crisis was even more extreme in the north, driving people from the mountain counties away to the plains. This resulted in changes in the population density, with an increase in the plains from 1877 to 1900 whereas it dropped in the mountains over the same time span. The rural exodus in the northern part of the province presumably enhanced living conditions for those remaining in the areas, due to an improved health environment and more resources in per capita terms: pronounced changes in population density often did affect living standards in historic populations, firstly, due to a change in the danger of an easier spread of disease or parasite exposure; and, secondly, the fact that net nutritional status can be directly affected also by a declining availability of high quality and quantity diet per person. Moreover, also related unequal food distribution can result even in stagnating or decreasing mean height despite a national economic increase (e.g. Steckel and Floud 1997; López-Alonso and Condey 2003; Haines 2004; Chanda et al. 2008; Dalgaard and Strulik 2009).

To sum up, both factors discussed above, seem to have been affecting the temporal changes and regional differences in the net nutritional status of the population. After increasing our dataset we will have to conduct further analyses in order to clarify the actual developments more exactly, in particular while controlling for various potential explanatory variables.

Furthermore, the data indicate the existence of remarkable height differences across individuals during the study period. For example, the difference in mean height across the

draftees belonging to the first quartile of the height distribution and those placed in the third quartile was almost 10 centimetres.

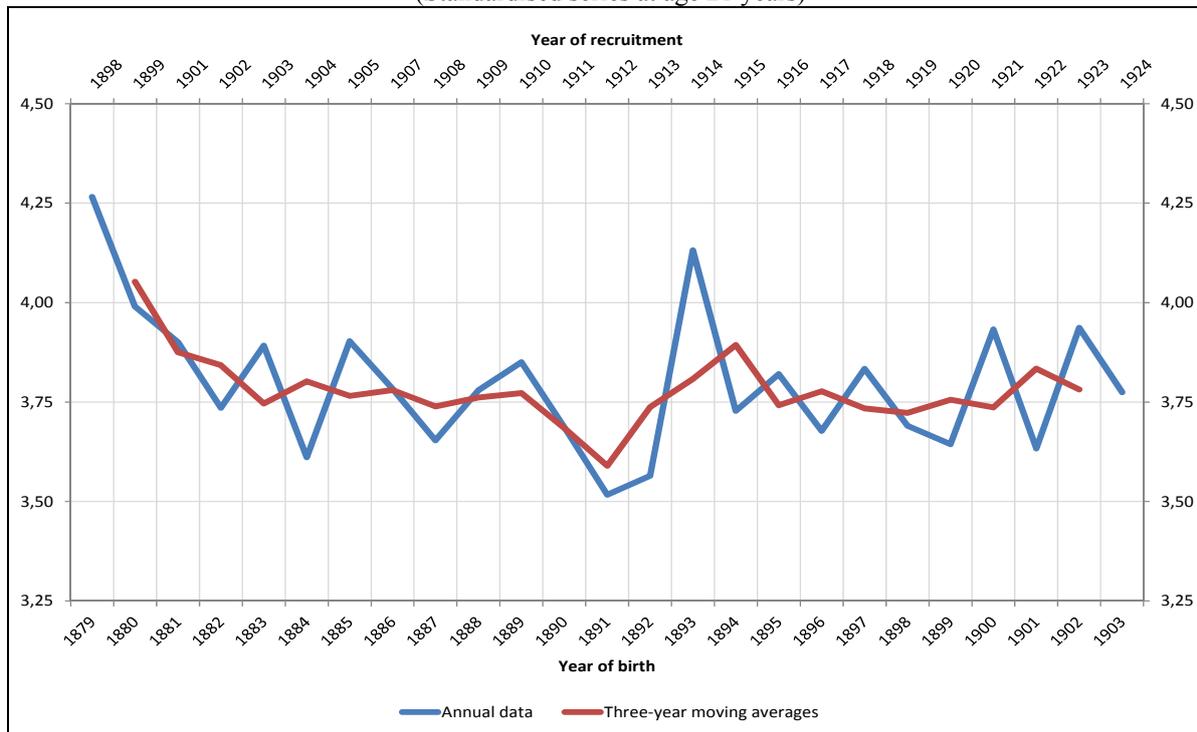
**Figure 12**  
**The wage-rental ratio in two counties of Lleida, 1871-1910**  
 (Index numbers 1851-1860=100, ten-year averages)



**Notes and sources:** Figures 6 and 7.

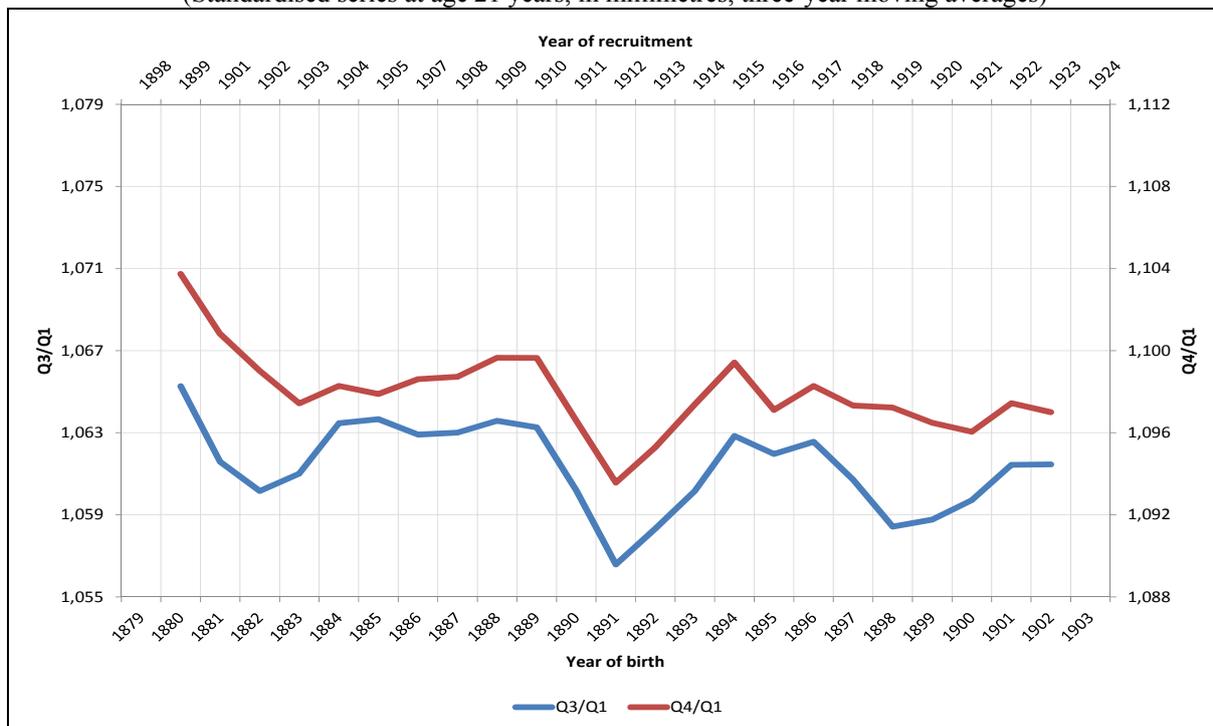
Did this huge difference in the mean height across individuals (and probably social groups) remain constant over time? The literature on this topic has pointed out that the impact of the crisis varied across social classes and groups (Garrabou, 1988). This is clear when trends in the wage-rental ratio are analysed. As fragmentary as it is, the available evidence shows that agrarian wages rose relative to the land rents between the mid or the late 1880s and the mid or the late 1890s, depending on the counties (Figure 12). The available series for the southern part of the county of Urgell – which are very volatile – suggests, nevertheless, a long-term decrease of the wage-rental ratio during the 1880s and also in the second half of the 1890s, whereas rural wages would have increased relative to land rents in the early 1900s. Instead, the available information for the north of the county of Segarra indicates a clear improvement of agrarian wages relative to land rents between the 1880s and the 1890s. This information also shows that the wage-rental ratio was higher in the first decade of the 20<sup>th</sup> century than in the 1870s, as in most countries of the Old Continent (O'Rourke & Williamson, 1997).

**Figure 13**  
**The evolution of height inequality as measured by the coefficient of variation in late 19th century western Catalonia**  
 (Standardised series at age 21 years)



Notes and Sources: Our own elaboration from *Libros de Reclutamiento*. See also text and footnotes.

**Figure 14**  
**The evolution of height inequality as measured by the ratio between quartiles in late 19th century western Catalonia**  
 (Standardised series at age 21 years, in millimetres, three-year moving averages)



Notes and Sources: Our own elaboration from *Libros de Reclutamiento*. See also text and footnotes.

Our currently compiled data on heights seem to fit better with this latter evidence. Figure 13 shows the evolution of height inequality in western Catalonia, as measured by the coefficient of variation (CV).<sup>21</sup> According to these data, height inequality declined between 1879 and 1891; it resumed in the early 1890s, but after its peak in 1893 it followed again a downturn trend during the second half of the decade (though it never recovered the low level of 1891). Taken the period 1879-1903 as a whole, and despite ups and downs in the CV, height inequality seems to have been lower in the late 1890s than in the years around 1880. The same can be said when inequality is measured by using the ratio between quartiles, as shown in Figure 14. These findings, of course, will require further confirmation as our dataset is enlarged and more robust analyses are applied. At present, the only that can be said is that this picture of declining inequality in the 1880s and a certain increase in the 1890s has been also found in other Catalan areas not so far away from the plain counties of the province of Lleida (Ramon-Muñoz, R. & Ramon-Muñoz, J.M., 2013).

## 6. Conclusions and research agenda

In this paper we explore the evolution of the biological standard of living in Western Catalonia during the years of the late 19th century agrarian depression. Based on a new dataset with almost 16,500 height measurements for young men enlisted during the recruitment period of 1898-1924, the available information indicates that no decline took place in the height of the western Catalan draftees born between 1879 and 1903. Whether stagnation has to be considered as a negative output of the agrarian crisis is difficult to be established. The available evidence on agricultural price movements, the evolution of land use, and the trends in population growth would suggest that the impact of the agrarian crisis was rather negative in the province of Lleida. Instead, the results presented in this paper – provisional as they must be considered – would suggest that during the years of the agrarian depression the overall well-being of the (western-) Catalan population was less negatively affected than one might have expected. However, this general conclusion will require further

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<sup>21</sup> The CV is a helpful statistic which has been applied in many international studies on the biological standard of living, but until recent years has had a limited use among those Spanish scholars working on historical anthropometrics.

qualifications. In this respect, an essential issue is to place the long-term trends in the mean height of the western Catalan young males in the context of late 19<sup>th</sup> century Europe.

We also tentatively explored the possibility that biological living standards varied across regions and individuals. The data indicate statistically significant differences among the young males settled in the more mountainous part of the province and their contemporaries in the plain areas of counties of Lleida. Huge differences between individuals (and perhaps across social classes and groups) have been also found. Whether these differences reduced over time or not has been also considered. Nevertheless, this issue will require a deeper analysis based on an enlarged dataset and even though one might hypothesise that individual (and perhaps territorial) differences tended to decline throughout the crisis times, particularly during the 1880s, no conclusive answer can be provided yet.

This is a work in progress; the dataset is still under construction; and the results this paper has provided have to be considered far from definitive. Having said this, it is also true that the contents developed through this work can be useful for establishing new hypotheses on the exact impact of the late 19<sup>th</sup> century agrarian crisis in well-being and how it actually affected the net nutritional status of the whole population or rather a certain social (or territorial) group. In the future we will not only enlarge the dataset, but compile information on various potential determinants in order to more clearly assess the effect of economic fluctuations on the biological standard of living in late 19<sup>th</sup> century western Catalonia.

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