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The nutritional status of manufacturing workers and craftsmen in central Spain in the eighteenth century

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Abstract: This article analyzes the relative level and evolution of the net nutritional status of manufacturing workers and craftsmen born in the last third of the eighteenth century in central Spain. It uses the anthropometric and occupational data included in the records of the general conscription carried out during the Napoleonic invasion. The findings are interpreted in light of the recent contributions made regarding the evolution of the economy and industrial products of central Spain during the second half of the eighteenth century. Significant differences can be observed between the different professions and economic sectors, largely explained by income levels, a possible selection for some occupations in accordance with physical characteristics, and access to animal proteins. Furthermore, the data also reveal an overall decrease in height and an increase in inequality between professions during the period.

Keywords: Nutritional status, Central Spain, eighteenth century, height, inequality

JEL CODES: I14, I31, N33, J44, R11

Introduction[1]

[1] I thank Enrique Llopis Agelán, José Miguel Martínez Carrión, Vicente Pérez Moreda, José Antonio Sebastián Amarilla, and the two anonymous referees for their many helpful comments on different versions of this work. The research leading to these results has received funding from the Universidad Complutense de Madrid (predoctoral fellowship FPI-2005/ECON), the Ministerio de Economía y Competitividad (projects HAR2013-47182-C2-2-P and HAR2012-33810), and the European Research Council (project EINITE, ERC Starting Grant No 283802).

The field of anthropometric history has developed rapidly over the last few decades (Steckel, 1995 and 2009; Komlos and Baten, 2004) and Spanish historiography is no exception: Today, we know the levels, trends, and cycles of average height (a commonly accepted indicator of the biological standard of living or net nutritional status of a population) for the whole of Spain from the cohorts born at the end of the nineteenth century, as well as for a large number of towns and regions from those born from the mid-nineteenth century. Moreover, for the same period, we also know about socio-professional differences and their evolution in certain geographical environments, the evolution of nutritional inequality and its relationship with economic inequality, whether an urban penalty exists, and the relationship between nutritional status and literacy (Martínez Carrión, 2009 and 2012), to name only a few aspects studied in this field. This is a truly outstanding accomplishment, however it contrasts sharply with the meagre results obtained until now for the period before, with the only exceptions being the studies by Cámara (2006 and 2009) and Cámara and García Román (2010) based on data for Montefrío, a town in the province of Granada.

This article constitutes a pioneering contribution to the knowledge of how the average height of Spaniards evolved during the second half of the eighteenth century. The study is carried out from a specific perspective: that of the socio-professional differences in the final decades of the eighteenth century in an area covering a significant proportion of interior Spain, 90 communities corresponding to six of the current provinces of central Spain. More specifically, it is a comparative study of the levels and evolution of the nutritional status of manufacturing workers and craftsmen with respect to other occupational groups, and an analysis of the differences found between them. Therefore, it addresses a new subject area from a time and geographical perspective that has attracted very little attention from researchers until now. This is not without reason. The absence of sources containing data representative of the whole social spectrum[2] and the vagueness or non-existence of professional information can explain the scant consideration received. These problems, as we shall see in the following section, have been resolved in this study with the use of a new primary source, namely the *Padrones de Alistamiento*.

In short, the key questions that this study seeks to answer are the following: Were there any significant differences in the net nutritional status between the different socioeconomic groups?

[2] Universal military service—"the nation in arms"—did not become widespread in Europe until after the French Revolution, and in many countries it was not applied until the second half of the nineteenth century or only in exceptional situations (as in the case of Great Britain during the First World War).

How large were these differences? What position did the manufacturing and craft trades have in the overall picture? What were the principal determinants of the differences between the various professions? Did the average heights of the different groups evolve differently? From what point in time? How intensely? Have any indications of a decline in industrial and craft activities reflected in the nutritional status of their workers been observed? Needless to say, only partial answers can be found to these questions, although I believe that they are significant from the perspective of the territorial context and the specific indicator.

The article is structured as follows: After this introduction the second section briefly reviews recent historiography in terms of the study of the economy and industry of interior Spain at the end of the eighteenth century; the third section describes the principal characteristics of the source used and the quality of its information is evaluated; the fourth section presents and analyzes the findings; finally, conclusions are presented in the fifth section.

The economy and industry of interior Spain at the end of the eighteenth century

Traditional views on the evolution of the economy, particularly the agricultural sector, and industry of central Spain throughout the second half of the eighteenth century have undergone changes in recent years. The traditional theories in modern historiography, the earliest of which can be traced to *Las crisis agrarias en la España moderna* (Anes, 1970)[3], defend a progressive exhaustion of the extensive agricultural growth model, giving rise to a slowdown of the economy, an increase in fluctuations, and finally, paralysis or even a depression, culminating in the great crisis of 1802-1805. However, there is a growing trend in the literature[4] that challenges these arguments. To summarize briefly, this new perspective considers that given the environmental and technological restrictions of the time, the economy of central Spain was far from reaching its growth potential. It was subject to institutional and social limitations—the moral and political obstacles referred to by Jovellanos—that constrained its growth, which has also probably been underestimated.

A strong argument to support the first criticism is that a few years later, after the end of the Spanish War of Independence (the Peninsular War), the agricultural sector was able to feed a

[3] A theory that, despite the caution adopted by Anes himself with respect to the final decades of the 1700s (Anes, 1970: 162-166) and the four decades after *Las Crisis*, has been defended in many articles in even-more-recent works (Marcos Martín, 2000: 584).

[4] See Yun (1991), Ringrose (1996: 114-117), Llopis (2002a), and Sebastián (2004).

much larger population without implementing any profound changes in its production model. With respect to the underestimation of economic growth, many authors[5] have pointed out that the indicator usually used as a barometer of the evolution of agricultural output, the tithe, progressively lost credibility in the final decades of the 18th century. There are several reasons for this.

First, although it is common knowledge that defaulting on tithes became a widespread practice after the Spanish War of Independence, there is now greater evidence with respect to both the quantitative importance of the fraud committed[6] and its early occurrence, even as early as the 1760s[7].

The second argument refers to an underestimation of the tithe series. The greater diffusion of certain crops [8] (Yun, 1991: 49)—as was the case of saffron in La Mancha, or hemp or esparto grass on a more general scale (García González and Gómez Carrasco, 2010: 89)—the introduction of the rotation of legume crops (Sebastián, 2004: 161), or the emergence of "new" crops, the most paradigmatic example being the potato[9], meant that a large portion of these crops were not evaluated by the tithing system. This is because these products were either not tithed, a lower percentage of them were tithed, or they were subject to a small cash payment that was not proportional to their output (Canales, 1985: 247-248). Furthermore, evasion practices seemed to be more common in these cases (Muñoz Dueñas, 1994: 162-163). A similar situation may have arisen with changes in the composition of livestock, whereby there was a reduction in sheep, which was subject to tithing (Canales, 1985: 248). In short, one of the intensive forms of agricultural growth—if not the only form due to the environmental and technical restrictions, lack of investment, and limited growth of urban demand—namely diversification, could not be assessed with the necessary rigor.

[5] See, for example, Robledo (2005: 107-109) or Llopis and Sebastián (2007: 85).

[6] According to Llopis and González Mariscal (2010: 21), among other types of fraud, it seems that the practice of excluding seeds and other costs had become widespread, which in the case of grains represented approximately 20 percent of the yield.

[7] For the Archdiocese of Toledo, which coincides with the area analysed in this study, see Rodríguez López-Brea (1995). For the specific case of the Toledo area of La Sagra, see Sánchez González (1985).

[8] For Castilla-La Mancha, see Sebastián et al. (2008: 6-7). With respect to the province of Toledo, Donézar (1984: 194-195) includes references about the introduction of legumes in the two-field crop rotation system.

[9] Potato crops seemed to have disseminated throughout Castile earlier than traditionally thought (Pérez Moreda, 1980: 413-415). The *Semanario de Agricultura y Artes dirigido a Párrocos* (1797) includes reports on potato crops in Toledo and La Mancha (García Ruipérez, 1999: 306-307).

Third, the diversification of agricultural products would also have reduced estimates in cases where tithe collection was leased out and the calculation of production was based on the deflation of cash payments with respect to wheat—irrespective of the real content—at a time when the terms of trade with respect to other agricultural products increasingly favored this grain.

Fourth, during this period farmland was being extended and the output of new farms was sometimes exempt from tithes for a period of time (Anes, 1970: 165), as the collector of the *diezmos novales* or *nobalios* (tithes for land newly brought into cultivation) was usually the Royal Treasury or the parish priest (García Sanz, 1977: 149-150; Robledo, 2005: 108-109).

A fifth, lesser-known argument is based on the changes in the management of one of the main components of the tithe: the *Excusado*. This was the amount paid by the taxpayer with the highest tithe, which, depending on the different estimates (Barrio, 2004: 261; Pérez Romero, 2009: 77), could have represented between 7 and 11 percent of the total tithe. It was administered by the Royal Treasury between 1761 and 1775, between 1777 and 1796 its situation varied depending on the bishopric, and after 1799 the Crown took over its administration once again.

To counter all of these arguments, there is only one factor that overestimates agricultural growth at the end of the 1700s (although logically by a smaller amount than the total of above-mentioned factors): The inclusion of the properties of the regular clergy in the tithe after 1796.

In no way do these observations seek to disregard the use of tithe information, instead they highlight its main limitations and reveal its objective meaning. It seems difficult to rebut the fact that the raw data of the tithe series were to a greater or lesser extent, depending on the territory and circumstances, biased downwards (by an amount that is difficult to estimate but always appreciable) with respect to the agricultural output that *a priori* they represented.

According to the *Catastro de Ensenada*, industrial and craft production employed 12.5 percent of the active population and represented 12.3 percent of the domestic product of the Crown of Castile (Marcos Martín, 2000: 644). Of this production, the output of woolen fabrics, the most important textile subsector, followed an overall rising trend throughout the first half of the 1700s. However, in the final decades of the century, the economic situation was favorable for some centers and negative for others, and varied depending on factors such as the sector, specialization in fabrics or highly specific tasks, type of demand to which production was targeted, sales networks, taxation privileges, or capacity to introduce certain innovations. In Castile, thanks

to their specialization in medium-high and high-quality cloth, the production centers of Segovia, Béjar, Guadalajara, and Valladolid were not affected by the decline until the end of the century. In the city of Toledo, the drapery sector recovered during the early decades of the century but, as in other places, it stagnated or declined in the second half and never regained the levels that it had reached in the sixteenth century.

Focusing on the analysis of the territory of this study, if we examine the maps of the *Atlas de la Industrialización* (Nadal *et al.*, 2003: 35) that show the number of looms and the production in yards in roughly 1790, we can see that the woolen textile industry in the old province of Toledo was among the largest in the whole of the Castilian interior[10]. The textile industries were highly important for sustaining domestic economies and therefore standards of living. Evidence of this lies in the fact that, according to the estimate carried out by García Ruipérez (1988), based on different sources such as the *Memorias de Larruga*, the *Diccionario Geográfico de Tomás López*, and the reports of the *Junta de Comercio y Moneda* at the end of the eighteenth century, in Castile-La-Mancha the textile sector employed, although with a varying degree of involvement, tens of thousands of people, including women and children. A paradigmatic example of the repercussions of these activities on domestic incomes[11], at least until the Spanish War of Independence, was the factory complex of the *Real Fábrica de Paños de Guadalajara, Brihuega y San Fernando*. In 1790 it employed more than 18,000 spinners working in their homes in more than 132 communities in the provinces of Toledo, Madrid, Cuenca, and Ciudad Real (Nadal *et al.* 2003, 48; González Enciso, 1980: 481-489)[12].

Apart from the "large" industrial centers, the majority of the textile industry was scattered across many small rural workrooms. This type of industry, far from collapsing during the economic decline at the end of the 1700s, according to some hypotheses (García Sanz, 1977: 251; Hernández García, 2010: 8-9) [13] , could have benefitted from a process of growing polarization,

[10] Toledo was, by far, the most industrial province of Castilla-La Mancha, particularly for woollen textiles. In addition to the city of Toledo, other towns engaged in the sector were Ajofrín, Consuegra, Madridejos, Menasalbas, Novés, and Sonseca.

[11] The income received by the women working as spinners in Castile-La Mancha was a crucial component of the household income and support for their families. Almost all the spinning of silk and wool was carried out by women, as was almost all of the linen and hemp fabrics, silk, and tightly woven woollen fabrics (García Ruipérez, 2004: 103).

[12] Another estimate, referring to the Toledo town of Ajofrín (García Ruipérez, 1988: 373), calculates that more than 5,000 women, many of whom were probably girls, were needed to provide yarn for the textile mills of this town in the mid-eighteenth century. This figure estimates 40 spinners for each wide loom and 20 for each narrow loom.

[13] These hypotheses are consistent with the findings of some case studies such as the case of linen from Galicia (Carmona, 1990: 105-124) or Leon (Sebastián, 2004: 161-164), or the case of wool in some parts of northern Castile (Hernández García, 2002: 36), the area of Cameros (Moreno, 1999: 343-488), Extremadura (Llopis, 1993: 49-52), or Andalusia (Parejo, 1987: 65-86).

proletarianization, and ruralization[14] due to the impoverishment of wide social layers, the lack of incentives for investment due to the existence of more lucrative businesses, and the reorientation of demand towards lower quality and cheaper products (Nadal *et al*., 2003: 28). As in the cities, the recent synthesis of Ricardo Hernández García (2010) of the drapery sector in Castile and León includes several examples of rural locations with a "successful" economic climate, at least until the final years of the century. Similar patterns arise from other studies for the case of Castile-La-Mancha (Jiménez de Gregorio, 1962; García Ruipérez, 1988: 376-377), including scattered data, testimonies, and reports.

Not much can be said about the other textile sectors. Linen seemed to have little importance in the territory of our study, apart from the testimonies of the creation of factories in Almagro and Valdapeñas and the exhortations of a few enlightened locals to promote a crop (Fernández Hidalgo and García Ruipérez, 1996: 35, 62, 176-177) that was not grown in the region. The silk sector was experiencing an even more precarious situation despite the creation of the *Real Fábrica de Talavera de la Reina* in 1748—supplied by cocoons and yarn from the surrounding area (Nadal *et al*., 2003: 40-41)—and the survival of the trimmings industry (*pasamanería*) in the city of Toledo (Nadal *et al*., 2003: 42). Only the lace factory in Almagro, created in 1766 using local traditions, began to enjoy a boom. At the end of the eighteenth century it employed more than 3,000 women and a large part of its production was exported to America. This prosperity lasted until well into the nineteenth century (Sarasúa, 1995).

On the whole, the importance of the remaining industrial activities and mining, except for unique cases such as the mines of Almadén, was marginal, and in many cases resembled more craft production than truly industrial activity[15].

In short, the historiographic contributions over the last few years generate a timid optimism regarding the evolution of the economy and industry of interior Spain in the second half of the eighteenth century. This "optimism" can also be derived from the product per capita "educated guesses" that have been reported in recent years with respect to the Crown of Castile (Yun, 1994), Spain as a whole (Van Zanden, 1999; Maddison, 2001; Carreras, 2003; Álvarez Nogal and Prados de la Escosura (2007, 2013), or even individual regions (Álvarez Nogal and Prados de la Escosura,

[14] This ruralisation would have been most evident in mountainous areas with a low agricultural capacity (Nadal *et al.*, 2003: 31) and more specifically, in our case, and consistent with the *Memorias de Larruga* and the socio-professional information contained in the *Padrones de Alistamiento*, in the *Montes de Toledo* and the southern slopes of the *Sierra de Gredos* in the current province of Ávila.

[15] See García Ruipérez (2004: 103-111).

2007). All of them have a common denominator: a slight growth in GDP per inhabitant in the second half of the eighteenth century, in some cases until 1820.

Sources and methodology

The sources traditionally [16] used by Spanish historiography in regional and local anthropometric studies are related to the enlistment data of the mid-nineteenth century, namely the *Expedientes Generales de Reemplazo* or *Expedientes Generales de Quintas (Expedientes)* (Martínez Carrión, 2009). For earlier dates, apart from the fact that very few records have been preserved, there are a considerable number of methodological obstacles (Cámara, 2006), including exempt social sectors (nobility and clergy), the irregularity or non-existence of quantitative height data, and *Expedientes* that do not state the age of the recruits, among other issues. This seems to have been a determining factor in restricting the time span of the immense majority of research projects conducted in Spain to date.

In contrast to the existing studies, the research carried out in this section uses a primary source that until now has been unknown, the *Padrones de Alistamiento* (enlistment registers)—hereafter *Padrones*—conducted in 1808 after the Napoleonic invasion in the old province of Toledo[17]. The basic structure of the *Padrones*, one for each community, was based on the *Real Declaración de Milicias de Carlos III* (Royal Declaration of Militiamen of Carlos III) of 1767[18], which is expressly mentioned in the second section. In line with this above-mentioned regulation, the *Padrón* of each locality included the male population between the ages of 16 and 40 with their name, age, height (barefoot), and depending on the rigorousness of the local authorities, the profession, nobility status, marital status, number of children, and sometimes also arguments for exemption due to family reasons, illness, or physical defects.

[16] Studies based on other sources have been carried out only rarely. Gómez Mendoza and Pérez Moreda (1985), in their seminal study on the height of Spaniards during the first third of the twentieth century, used data included in the *Estadística del Reclutamiento y Reemplazo del Ejército* and in the *Anuarios Estadísticos de España*. Also, the studies conducted by Quiroga and Coll (2000) and Quiroga (2001, 2002), for the whole of the twentieth century, are based on the *Hojas de Filiación* of the soldiers who undertook their military service in the Army.

[17] In the Municipal Historical Archive of the city of Toledo—boxes 6074 to 6079—the *Padrones* corresponding to 217 communities have been conserved. I selected the 99 with the best characteristics (those that include the numerical register of the height of all the recruits and whose histogram confirms the approximate adjustment to a normal statistical distribution), and included the 90 with professional information in this study.

[18] Newest compilation (*Novísima compilación*) lib. 6, tit. 6, law 8.

Some of the principal characteristics of the source have already been analyzed in depth recently (García Montero, 2010), so I will not go into great detail. Suffice to say that with no exceptions in terms of class or of any other type, it included all[19] males aged between 16 and 40. In other words, it was a universal draft. This avoids the fairly common problem, particularly for the eighteenth century, of armies formed partially or totally from volunteers and/or marginal sectors of society being drafted by force. In turn, this avoids any possible biases derived from the social origin of the members and changes in the "supply" and "demand" of recruits (Weir, 1997: 174-175). Furthermore, in those towns in which the information related to height was recorded numerically in the *Padrón,* the units of measure used were feet, inches, and lines[20], which corresponded, as clarified by Cámara (2006: 112-116), to a system based on the Paris foot and not, as might have been initially thought, on the Burgos Foot, the Castilian measurement of reference at the time. The height of all of the recruits was recorded, even those who were shorter than the minimum required height, avoiding the frequent methodological problems encountered in samples derived from truncated or censored distributions whose estimate requires the application of statistical methods that are not exempt from limitations and problems[21] (Komlos, 2004). The histogram (García Montero, 2010) also reveals a distribution close to a normal or Gaussian distribution that includes all the data. In other words, the measurements were carried out correctly. Further evidence of the richness of the data is the fact that the value of the standard deviation, 68,17 mm, is very close to the standard of 68,58 mm, which Komlos (2004: 169, footnote 6) suggests as a reference value, following the recommendations of modern auxology[22]. In many communities (90), the professional information of each recruit is recorded with a remarkable degree of detail[23]. A total of 194 different professions are mentioned, therefore, the richness and quality of the information, as we shall see in the following pages, provides an x-ray of the nutritional inequality between professions and economic sectors and its evolution.

[19] In only 9.71% of cases the height of the subject was not recorded; although, it never mentions that they were fugitives, instead it says they were residing outside of the town, absent, or similar.
[20] In 9.3% of cases the *dedo* (finger) was used (one *dedo* = 17.41 mm).
[21] With respect to this problem, which is fairly common in international historiography, Komlos (2004) provides a general view with the British case taken as a central theme.
[22] It has been proven that among populations that have finished their growth period, the standard deviation hardly varies in terms of space or time (Frisancho, 1990: 144 and 164).
[23] With respect to the degree of detail with which some towns recorded professional information, an example is that in more than a few cases, a distinction was made between the labourers in terms of the number of yokes that they owned and even their type (for mules or oxen). Furthermore, distinctions between the muleteers were made depending on the number of beasts that they had and their type (large or small) and even, exceptionally, the qualification of craftsmen was specified—master, official, or apprentice.

In short, the information provided by the source is of an extraordinarily high quality and includes a large number of subjects—a total (N) of 8.029 adult individuals aged 21 or over[24], and it includes their profession and covers a wide geographical area—90 towns and villages belonging to six of the current provinces of central Spain.

Map 1. Geographical location of the 90 communities studied

A final test to demonstrate the consistency and quality of the source consists in calibrating the representativeness of the occupational structure that can be drawn from the *Padrones,* comparing it with that of the closest population censuses of 1787 and 1797. The data from the

[24] An individual is considered as having reached adult height when the annual increase is less than one centimetre and there are four half-year periods in which the increase is less than 0.5 centimetres, which normally occurs between the ages of 18 and 22 depending on sex, race, and socio-economic factors (Malina, 1978: 22). In circumstances of chronic malnutrition, growth may continue until the age of 23 or 25. However, this type of growth, according to the empirical evidence collected in other studies (e.g., in the Spanish case Martínez-Carrión and Moreno-Lázaro, 2007; García Montero, 2009), would have been marginal and would not have influenced the results of this study.

1797 census are preferable, not only because of the closeness in time but because of the contrast with the widespread superiority attributed to the 1787 *Floridablanca* census; the detailed analysis carried out in the 1797 *Godoy* census renders it superior in terms of its occupational data (Pérez Moreda, 1983). First, the information is much more disaggregated. In industry and trades there are 54 different categories as opposed to the general classification of "manufacturers" (*fabricantes*) and "craftsmen" (*artesanos*), and farmers are divided into owners and tenants. Livestock farmers are divided into cattle farmers and shepherds, and finally, there is a much more detailed breakdown in the service professions, including those with particular skills. Secondly, it seems that the Floridablanca census was imprecise and arbitrary when assigning ages to each individual. Finally, there is a certain degree of confusion with respect to the inclusion of the institutional population, mainly ecclesiastic (regular clergy), in the 1787 census, being duplicated or, more frequently, excluded, although this has little importance for our study.

Table 1 compares the professional data[25] included in the *Padrones*—for individuals of 21 years of age or older[26]—with the occupational structure established by the Godoy (1797) and Floridablanca (1787) censuses. Despite the different characteristics of each census, the slightly different territorial boundaries, and the fact that the 1808 data correspond to a population sample and not the whole province, it offers a positive image of the quality of the information of 1808[27]. The percentage of the total "active population" assigned to the main categories was fairly similar on the three dates. The main categories are day labourers, farmers (including squires and landowners in 1808), shepherds, and skilled service sector employees and students (which can only be compared with the census of 1787).

[25] The number of observations of each category is as follows: squires and landowners N=108; students and highly skilled service sector employees N=203; muleteers and carters N=602; other professions related to trade N=316; trades and craftsmen N=709; farmers N=1436; day labourers N=3528; shepherds N=571; domestic help and servants N=556; total N=8029.

[26] The average age of the members of the different socio-professional categories into which I have grouped the trades is very similar, varying between 29.4 years in the case of shepherds and 30.6 years in the case of labourers, therefore any significant bias derived from a distribution of professions related to age can be ruled out.

[27] If we were to extend the comparison to include the data of the *Catastro de la Ensenada* (further away in time—1750—and less reliable in this aspect), the result would not discredit the data of 1808. According to Donézar (1984: 93), 74.5 percent of the active population of the province of Toledo was engaged in the primary sector in the mid-1700s, as opposed to 72.5 percent in 1808, and the proportion of day labourers to farmers was 2.5: 1 as opposed to 2.45: 1 in 1808.

Table 1. Occupational structure in the province of Toledo according to the censuses of 1787, 1797, and the *Padrones* of 1808

		Floridablanca Census (1787)	Godoy Census (1797)	*Padrones* (1808)
Primary sector	Day labourers	41.9	39.02	43.9
	Farmers	18.3	19.9	19.2
	Shepherds	-----	6.3	7.1
Secondary sector	Trades and craftsmen	9.7	20.01	8.8
Tertiary sector	Servants[28]	17.3	7.2	6.9
	Skilled service sector employees and students	3.4	3.1	2.5
	Trade	1.99	0.97	3.9
Other		7.4	3.5	7.7

Sources: *Padrones* (90 communities with occupational information) and own elaboration based on data from Spain's National Institute of Statistics (INE) ([1787] 1987) and ([1797] 1992) and Marcos González (1971: 27-32).

Only the proportion of servants and secondary sector workers differs significantly between the different census dates. These differences may be due to several things[29]. In the case of servants, the fact that shepherds do not appear in their own category in 1787 could be due to the fact that they were normally hired for long periods of time—at least a year—and received a good part of their salary in kind, such that they were probably most often included in the servant category, which explains the larger proportion of servants in the census of 1787 than in 1797 and 1808 (more than double). On the other hand, with respect to the secondary sector, a good part of the most industrialized towns of the province were not included in 1808 because the *Padrón* could not be found (in the cases of the cities of Toledo, Madridejos, or Consuegra), the *Padrón* was discarded because it did not contain information about height or because it was fragmentary and/or of poor quality (as in the case of Ajofrín, Menasalbas, and Talavera de la Reina), or the

[28] It is difficult to assign servants to a specific sector, given that although a significant proportion of them were engaged in agrarian tasks, others carried out agricultural and tertiary tasks.

[29] Assuming that the figure in the census of 20.95 percent of the active population engaged in craft and industrial trades was accurate. According to the census information in 1797 in the province of Toledo, the percentage of the active population working in the secondary sector was higher than the regional average—16.9 percent and national average—15.3 percent (Llopis, 2001: 511).

Padrón did not include professional information (as in the case of Escalonilla). This led to an underestimation of the percentage of employees in the secondary sector. Furthermore, it is likely that some day labourers, in Sonseca they were known as "wool labourers" (*jornaleros de la lana*) for example, carried out industrial tasks as wage-earners, which could have led to them being recorded differently (either as agricultural workers or industrial workers) in the different censuses. Finally, we cannot rule out that in the census of 1797 the occupational information may have been compiled with unknown criteria[30] different from those adopted in 1787 or 1808[31].

In short, the socio-professional data included in the *Padrones* could be considered an excellent *proxy* for the socio-professional structure of central Spain at the beginning of the nineteenth century, constituting, therefore, an appropriate empirical base for carrying out an analysis of nutritional and socio-economic inequality and its evolution.

Results

Figure 1 responds to one of the principal research questions posed in the introduction of this study. It shows the important differences existing in average height, and therefore the nutritional status between the main socio-professional groups[32]. Squires and large farmland owners had a higher biological standard of living, followed by students, skilled service sector workers, and livestock farmers (herd owners). The relative position of muleteers and carters was slightly higher than that of farmers and manufacturing workers and craftsmen. The latter were positioned slightly above the overall average. This should not be surprising considering that among those registered as muleteers and carters this must have been the main or only occupation for the vast majority of them. They were often medium and large muleteers who owned their own packs of beasts of burden[33]. This is comparable to the taxonomy proposed by Ringrose (1972: 144-145), who

[30] We should ask, for example, about the way in which the active female or child-adolescent population could have been recorded.

[31] Particularly remarkable is the fact that between 1787 and 1797 the total active population grew by 38.6 percent while secondary sector workers grew by 350%.

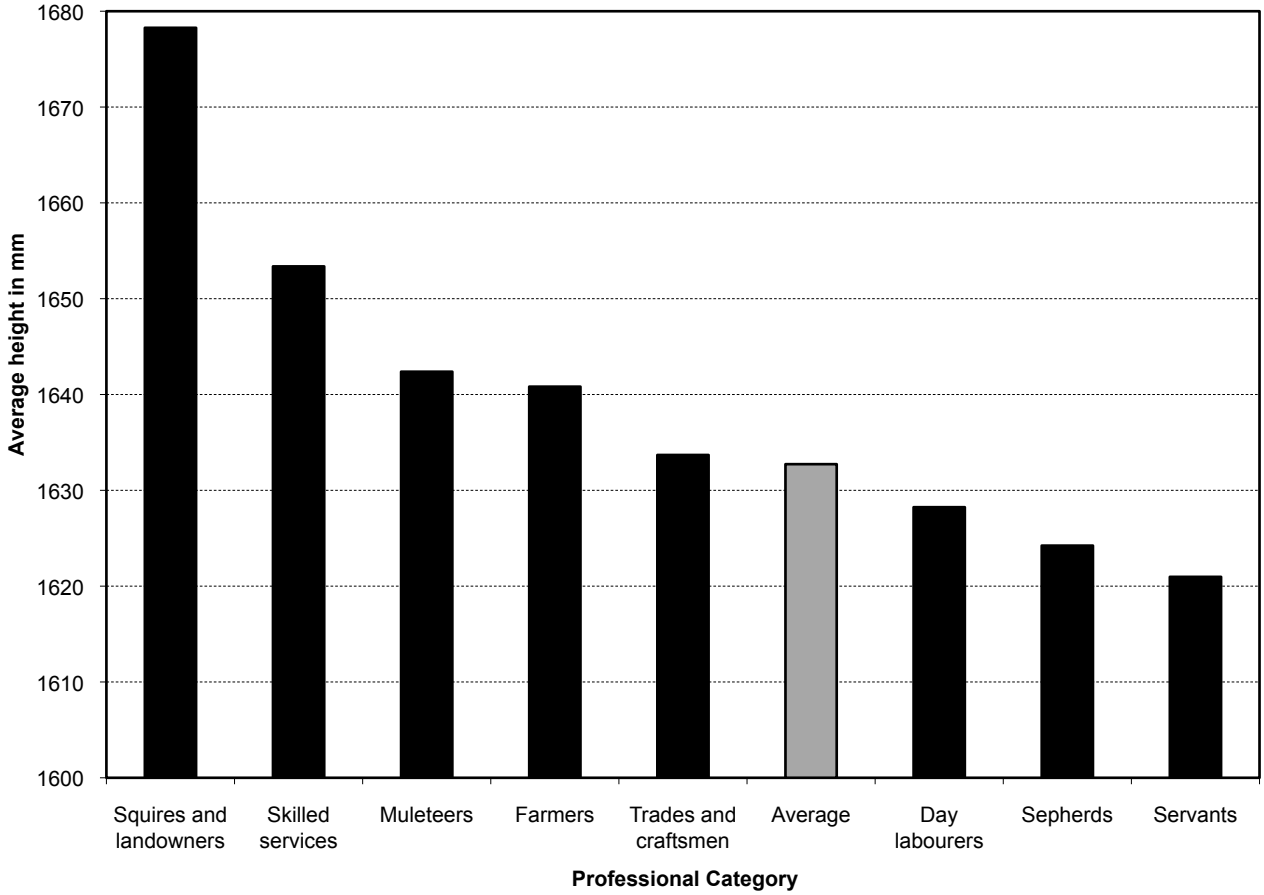
[32] Skilled service sector employees included: lawyers, administration staff, veterinary surgeons, scribes, apothecaries, surgeons, notaries, literacy teachers, and doctors. The trades and craftsmen category includes more than 100 different professions from the most frequent (those shown in Figure 2) to some that had a token presence such as *arquebusier*, sieve maker, gunpowder maker, or guitar luthier. In the "shepherd" category, other professions are included related to animal care. The servants group covers all professions related to agricultural tasks and domestic service, an important difference perhaps with respect to the physical workload developed by each type of worker; however, the average height of both groups is almost identical.

[33] This seems to be demonstrated by the data of some towns such as Illescas, La Guardia, or Villaseca de la Sagra, in which the number of animals owned by each muleteer and their type is specified. These communities were located in

distinguished between those specialized in the transport and trade of goods, usually articles of a certain value-added, and farmers and day labourers who worked as part-time muleteers during the seasons when less farm labor was required.

Figure 1. Average height of the main socio-professional groups

(average of those born between 1768 and 1787)



Source: Own elaboration based on the *Padrones* of 90 towns and villages (see Map 1).

The categories with the worst nutritional status (below the average) are those formed by day labourers, shepherds, and all types of servants. The result for day labourers is more predictable than that of the servants, who have been considered somewhat privileged among rural workers and were sometimes called the "aristocracy of the poor". Although their monetary wages were low and sometimes non-existent (Sarasúa, 1994: 217-218), the greater stability of

the areas that traditionally supplied the city of Madrid or close to the main roads that joined the capital with La Mancha and Andalusia.

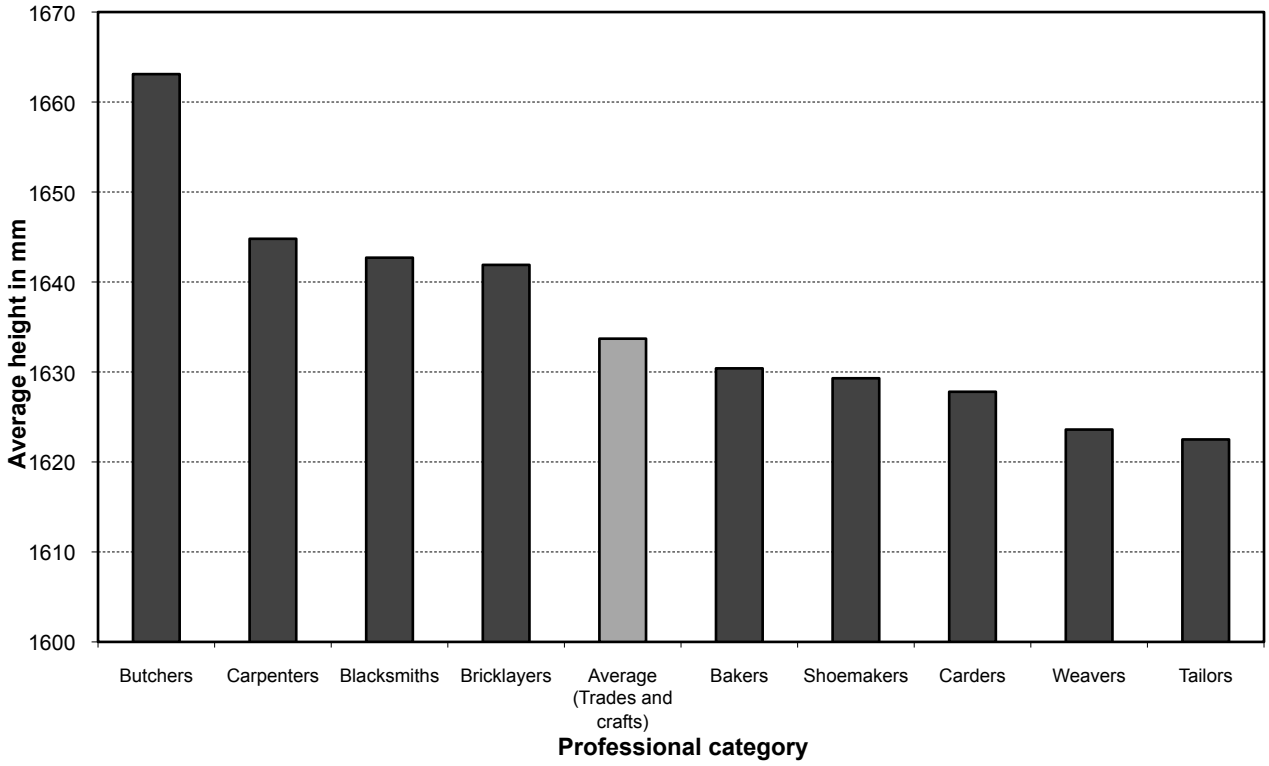
their income and payments in kind[34], representing between 60 and 75 percent of their total income according to some estimates (Ballesteros Doncel, 1999: 233; Sarasúa, 2004: 525)[35], could have given rise to relatively high real wages. Furthermore, these payments in kind—together with the frequent practice of pilfering (*la sisa*) among some types of servants (Sarasúa, 1994: 98)—helped to mitigate the effect of recurrent price increases and subsistence crises, which made it a highly attractive profession in those periods. However, we cannot ignore that many of these servants came from the poorest families (Sarasúa, 2006: 421), which could have had a permanent impact on their physical growth during the early years of their lives.

Finally, the low result for shepherds should be no surprise. This profession was similar in some ways to that of servants in terms of their employment stability (or at least their employment for long periods of time), the receipt of part of their wage in kind, their social class, and probably their family background. In any event, as specified in part of the information (*respuestas individuales*) of the *Catastro de la Ensenada,* shepherds were almost never owners of land or large flocks and instead were simply wage-earners working for farmers and squires (Donézar, 1984: 97). Furthermore, it is unlikely that they benefitted from the potential advantage that they could have obtained by consuming fresh milk (which would constitute a greater intake of animal proteins) since, for cultural reasons until the first decades of the twentieth century except in cases of illness, the consumption of fresh milk in Spain was almost non-existent (see e.g. Hernández Adell, 2012; Hernández Adell *et al.*, 2013; Collantes, 2014; Pérez Moreda *et al.*, 2015: 315-320; Pujol, 2007).

[34] Payments in kind that could take the form of food, accommodation, small plots of farming land, cattle fodder, clothes, or footwear.

[35] Despite their higher income stability, this "aristocracy of the poor" may not have been such an attractive profession. First, their work schedule was probably greater than that of day labourers (Sarasúa, 1994: 213), in other words, maybe their wage per hour was lower. Moreover, the fact that they came from the poorest classes of the rural community, and were often servants only during their youth indicates that even the "rural proletariat" valued the lack of freedom—as well as the abuse and humiliation that they were often subjected to (unpaid work, direct supervision, etc.). This latter problem became more evident with the emergence of new work opportunities in the towns and cities in the nineteenth century (Sarasúa, 1994: 229).

Figure 2. Average height of the main manufacturing and craft professions (average of adults born between 1768 and 1787)



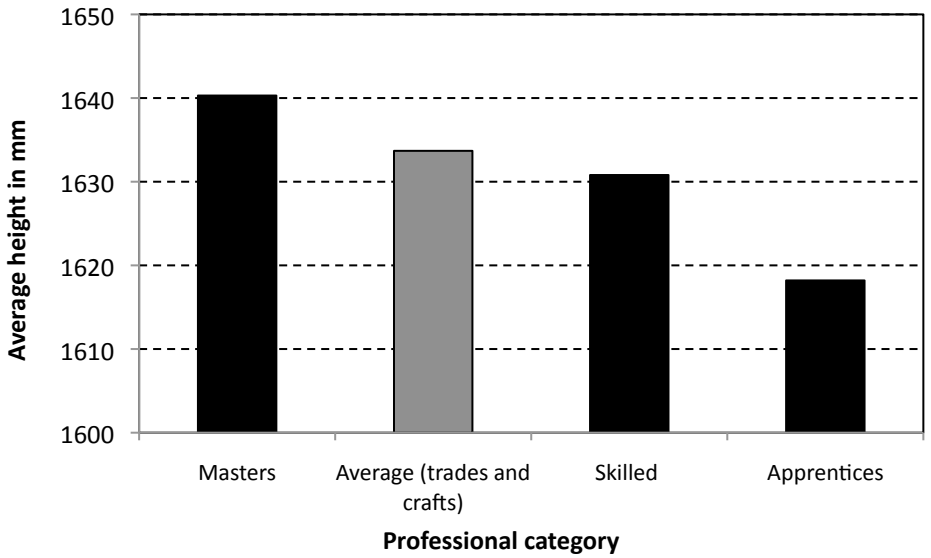
Source: Same as Figure 1.

Now we will turn our attention to the primary object of this study, the craft and manufacturing professions. As we can see in Figure 2, which shows the average height of the professions with the greatest presence in the *Padrones*, there were significant differences of up to four centimeters between the tallest (the butchers) and the shortest (the tailors) occupations. An initial hypothesis would try to explain the differences in terms of socio-economic level, measured by income, of each profession. In this sense, the information contained in the *Catastro de la Ensenada* regarding the "profits" (*utilidades*) of each profession in the province of Toledo (Donézar, 1984: 450) shows a gradient similar to that in Figure 2. However, although we do not have information about all of the professions, the relationship between income and average height could have been influenced by other factors. We could consider at least two: the easiness with which nutrients, particularly animal proteins, were accessed due to professional activity, which is highly evident in the case of butchers, and the pre-selection, in accordance with size—related to physical strength—of an individual for certain professions (Margo and Steckel, 1983: 172; Martínez Carrión, 1986: 85-86; Komlos, 2004: 170, footnote 22; Hernández García and Moreno, 2009: 158-160; Martínez Carrion y Cámara, 2015). It may not be a coincidence that those

professions—such as butchers, who were slaughterers as well as salesmen; carpenters; blacksmiths; and construction workers—that required greater physical strength were among the tallest, while those professions for which physical strength was hardly necessary, such as shoemakers, carders, weavers, and tailors, were the shortest. The height of the latter two professions was below the overall average of day labourers.

With respect to the results shown in Figures 1 and 2, the level of qualifications or skills within each profession seems to have also influenced nutritional status. As we can see in Figure 3, in those cases where in addition to the craft profession the level of qualification was recorded, the differences in average height were considerable. The masters (n=63) were slightly taller by about one centimeter than the skilled workers (*oficiales*) (n=69), who, in turn, were taller than apprentices (n=24) by almost one-and-a-half centimeters. However, due to the small number of observations, in this case these differences should be understood only as an order of magnitude, indicating the importance of professional skills and the income derived from this for biological standard of living.

Figure 3. Average height according to the level of qualification of craft professions (average of the adults born between 1768 and 1787)

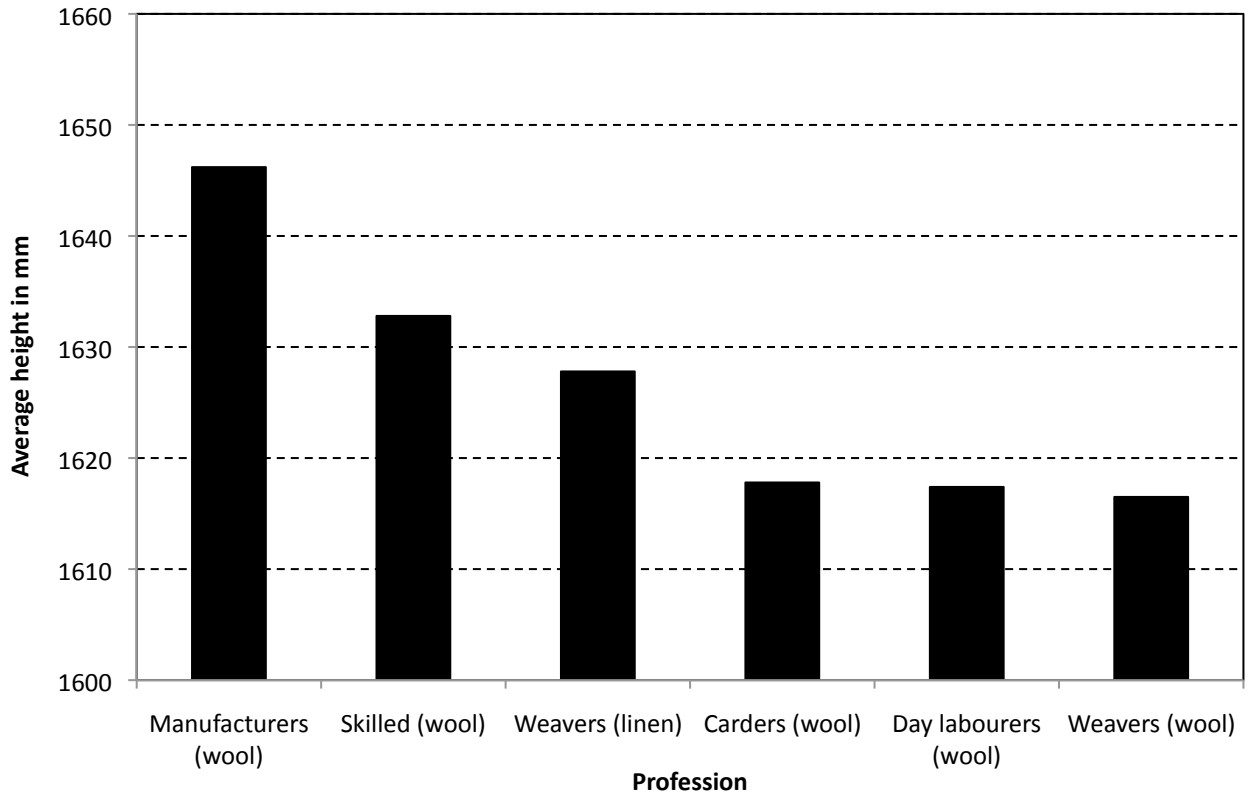


Source: Same as Figure 1.

Finally, if we consider the professions within the textile sector, the most important industry of central Spain at the time, in Figure 4 we can observe how ownership followed by qualification

were, again, key factors in determining nutritional status. Manufacturers and day labourers in the woolen industry, the majority of whom came from the town of Sonseca in the province of Toledo, living in similar environmental and epidemiological conditions show a difference in height of 3 centimeters. This is most likely due to the differences in levels of income between the owners and paid workers in the textile sector. Woolen weavers and carders had a similar nutritional status as day labourers. They came from the *Montes de Toledo* area and towns located in the eastern part of the current provinces of Madrid and Toledo. The linen weavers who came from the valley of the Tiétar river and the foothills of the *Sierra de Gredos* had a slightly higher level. Finally, once again, we can see the importance of the level of skills within a profession in the case of the woolen skilled workers. Although their level was a degree lower than owners (*fabricantes*), their average height was more than one centimeter taller than day labourers, weavers, and carders in the woolen industry.

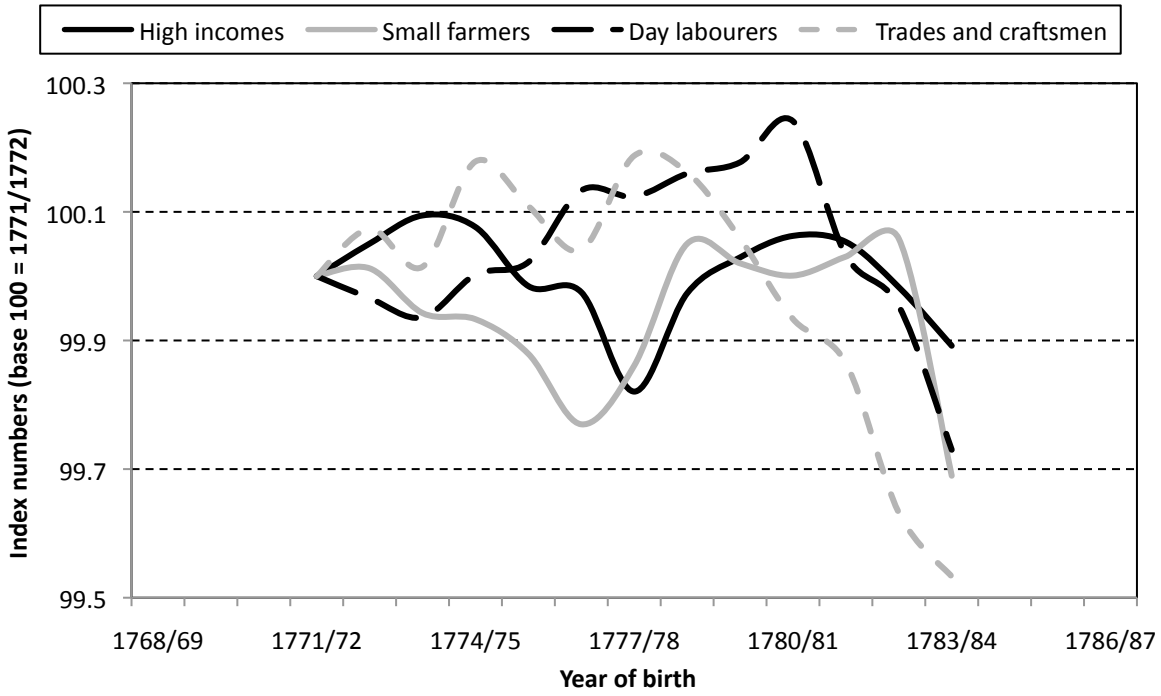
Figure 4. Average height of different professions within the textile sector (average of adults born between 1768 and 1787)



Source: Same as Figure 1.

After analyzing the differences in nutritional status in static form, in order to answer the questions posed in the introduction we should also study the comparative trend of the average height of the different groups. In other words, how did the economic situation affect each of the main professional groups? Were there winners and losers? Did the inequality between the different groups increase? How did the nutritional status of the manufacturing workers and craftsmen evolve compared to the rest? As we can observe in Figure 5, seven-year moving averages (7MA) have been used to highlight both the trends and the differences. All categories reveal a slightly negative balance (almost one centimeter in the most-affected category) during the period. The most negatively affected (and earliest) were industrial workers and craftsmen, followed by day labourers and small-scale labourers, and finally the highest income groups[36] (the category formed by squires and large landowners, farmers with three or more yokes, and highly skilled service sector workers). Therefore, the negative trend is common to all groups but the intensity is not the same. The inequality between the different groups increased and the most affected were the manufacturing workers and craftsmen.

Figure 5. Evolution of the average height of the main socio-professional categories (index numbers in seven-year moving averages)



Source: Same as Figure 1.

[36] I opted to include these three in the same category (high income groups) as the relatively small number of observations for each of them could generate erratic behaviour in their respective series.

The results are, on the whole, consistent with the overall decrease in height in the final years of the 1770s and the whole of the 1780s. This leads us to consider cross-cutting factors (even the high income groups suffered decline, although to a lesser extent) as the cause of the reduction in height. This reinforces the hypothesis of an exogenous epidemiological impact, in addition to economic consequences, produced by the fever epidemics (malaria of 1786-1787) and maybe the subsistence crises of 1803-1805 during the adolescent growth-spurt period. Therefore, although there was a greater relative deterioration in the final phase of the period among the industrial and craft professions, given the overall dynamics shared by the different series, it seems adventurous to deduce that in central Spain the manufacturing and craft industries were experiencing a decline that negatively affected the nutritional status of those working in that sector.

Conclusions

Among those born in the last third of the eighteenth century in central Spain there were important and significant differences in the nutritional status of the main socio-professional categories. In this context, the workers of the secondary sector, including those employed in textile manufacturing and all kinds of craft trades, had an intermediate position on the social scale, only slightly above the overall average. Within a group that was necessarily diverse in terms of its income, qualifications, and physical requirements, there were also important differences. Both on a general and an individual level, in the industrial sector, the differences could be mainly attributed to the economic income derived from each activity. Although the professional information available corresponds to the recruit and not his father, which *a priori,* would have had a greater impact during the physical growth phase in childhood, in a society with limited social mobility and a high level of parent-child relationships, the relationship observed should not be surprising.

In addition to this principal factor there are another two factors that were significant with respect to the average height of each profession. The physical constitution of workers could have been a factor that enabled access to certain professions requiring physical strength. Assuming a high correlation, on average, between the height of a person and his strength, it should not be surprising that in those craft trades that required greater physical strength the workers were taller than in those that did not require any physical strength. Finally, similar to other studies on other countries, in a preindustrial society in which chronic malnutrition of significant parts of the

population was the norm, greater access to the consumption of proteins represented a differential advantage for the nutritional status of some professions; this advantage is evident in butchers.

With respect to the evolution of the main professional series over the period, we can observe that there was an overall decline in the nutritional status in all categories and a slight increase in inequality. This seems to have the same origin for all groups, most likely related to the malaria epidemics of the mid 1780s and the subsistence crises at the beginning of the 1800s, although it had a greater impact on the manufacturing and industrial trades.

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