

# Height and political activism in rural Aragón (Spain) during the 20th century. A new perspective using individual-level data

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## ABSTRACT

This article explores the relationship between the political leanings of more than 1000 men born in the 1870–1970 s in 11 rural Aragonese villages and their biological well-being during childhood and adolescence, proxied by height. The aim is to test whether an individual was more likely to be left-wing if his level of biological well-being was lower and, therefore, with more incentives to fight against the social inequality that had negatively affected his family. Our results confirm that, for most of the study period, there was a strong relationship between shorter height and political activism<sup>1</sup> in left-wing parties and organizations.

## 1. Introduction

The study of the relationship between political issues and the social well-being of broad segments of the population is not new but has been addressed by prestigious scholars (Sen, 1999; Gimeno and Juan, 1999; Gradstein and Milanovic, 2004; Acemoglu and Robinson, 2006; Deaton, 2013). Similarly, there are also studies that examine the relationship between policy changes and biological well-being (Komlos and Kriwy, 2003; Costa-Font and Gil, 2008; Muntaner et al., 2011; Powell-Jackson et al., 2011; Chapman, 2018; Batinti et al., 2022). We also know that height is positively correlated with a country's economic development (Steckel, 1983, 2008) and even, the positive impact of democratic regimes on male stature has been proven<sup>2</sup> (Batinti and Costa-Font, 2022). Moreover, we know that in southern Europe a connection has been found between left-wing voters and membership of low-income 'popular' socio-economic groups (Fuentes, 1994, 2004; González, 2004; Aldunate, 2012; De la Cueva, 2012). However, we know very little about the historical relationship between a person's height (as a proxy for their biological well-being during childhood and adolescence) and their political preferences. This is a particularly important issue because the core of modern political economy theory is the association between income

and political preferences (Downs, 1957). Several studies have explicitly or implicitly assumed that income drives the political behavior of individuals (Korpi, 1983; Manza and Brooks, 1999), and some studies have attempted to demonstrate this relationship for recent times with positive, negative and neutral results (Nannestad and Paldam, 1997; Norris, 2004; Glaeser et al., 2005; Ansolabehere et al., 2006; Glaeser and Bryce, 2006; Lind, 2007; De et al., 2008; Soroka and Wlezein, 2008; Ura et al., 2008; Brunner et al., 2013). One way to approximate income at the individual level is through height, as demonstrated by a multitude of studies in historical anthropometry (Floud, 2004; Voth, 2004; Komlos and Baten, 2004; Steckel, 2008, 2019; Komlos, 2009; Salvatore et al., 2010; Komlos and Kelly, 2016; NCD-RisC, 2016, 2020). In a recent paper, Arunachalam and Watson (2018) show the connection between greater height and an increase in voting for conservative parties. However, anthropometric studies have also shown that in the West, height is a good indicator of income, especially on a historical level when small differences in income had effects on children's nutrition and health, so this variable could have lost part of its explanatory power to improvements in income and diet. Despite this, there are still no studies that extensively analyze the relationship between height (as a proxy for income) and political preferences on a historical level, so as to determine

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<sup>1</sup> We understand political activism as the political significance of the individual voluntarily participating in political parties, governments or associations of an unambiguous political tendency.

<sup>2</sup> But also, the transition from other regimes to democracy can lead to stagnation in biological well-being depending on the economic circumstances (Wroński, 2023).

how this relationship has evolved over time and the variation of its impact.

This article seeks to shed light on this question, based on the extended hypothesis that left-leaning individuals could be shorter, having suffered greater deprivation during their childhood and adolescence. This would lead them to be more sensitive to the ideas put forward by the traditional European left-wing parties which, during the twentieth century, placed great emphasis on the fight against inequality and the promotion of the poorest classes as their main objectives (Bobbio, 1996). Studies at the aggregate level in Spain have tended to explain inequality as the fruit of economic rather than political forces (Prados de la Escosura, 2008). However, we consider is that politics not only has an impact to a greater or lesser extent on inequality, but that inequality itself could have had an impact on the political positioning of rural Spaniards throughout the twentieth century. This is particularly interesting because we do not have individual micro-data studies that have tested this hypothesis in the very long term in Spain, or in any other country. Therefore, we have accepted knowledge at the macro level (or with individual samples for the last decades) which, however, has not been tested at the micro level in the long term to ensure the validity of the assumptions and their evolution over time.

The use of height as a proxy for biological well-being during childhood and adolescence is a common technique in anthropometric history (Floud, 2004; Voth, 2004; Komlos and Baten, 2004; Steckel, 2008, 2019; Komlos, 2009; Salvatore et al., 2010; Komlos and Kelly, 2016; NCD-RisC, 2016, 2020). This is because human body proportions and measurements, especially height, are the result of a combination of genetic, environmental, and socio-economic factors (Eveleth and Tanner, 1990; Silventoinen, 2003; McEvoy, Peter, 2009; Grasgruber et al., 2014; Grasgruber and Eduard, 2020; Hatton, 2014; NCD-RisC, 2016; Candel-Martínez et al., 2022). As an indicator of net nutritional status, height accounts for the energy input produced by food consumption and the energy expenditure produced by illness, work and environmental conditions right from pregnancy, with the circumstances during childhood and adolescence being decisive. In this sense, the variability of growth processes is strongly influenced by health, nutrition and socio-economic factors (Tanner, 1981; Bogin, 2001; NCD-RisC, 2016; Perkins et al., 2016). Thus, although the human body is capable of deploying compensatory growth mechanisms in adolescence, it has been proven that situations of severe malnutrition caused by an inadequate or insufficient diet can alter the normal process of physical growth, delaying it and affecting the final adult height (Martorell, 2010; Bogin et al., 2018).

Height could be conditioned by scarring effects that would condition the sample. On the one hand, there are effects that have a negative impact on height, such as the diseases experienced by the individuals, which affected their growth and reduced the height attained (Marco-Gracia and López-Antón, 2021; FMarco-Gracia and Puche-Gil, 2021). On the other hand, if the highest mortality rates occurred among children with the worst living conditions, then the survival of the tallest would be proportionally higher, conditioning the average height of the period (Alter, James, 1989; Alter, 2004; Black et al., 2008; Bozzoli et al., 2009). However, for mortality to bias the sample, it would be necessary for the genetically shortest individuals to die. As mortality is a function of living and health conditions rather than genetics, it is living and health conditions that explain the average height outcome in a society (Moradi, 2010). In any case, the scarring effects of mortality continue to be debated (Deaton, 2007; Klasen, 2008; Moradi, 2010).

The aim of this study is to analyze whether there was a relationship between an individual's political activism (at least from the point of view of individuals who participated in municipal governments, political parties, and organizations) and their level of biological well-being during childhood and adolescence (measured as their height at the time of entering military service at the age of 21). For this purpose, we have used information for 1046 conscripts from eleven rural Spanish villages (specifically from the region of Aragon) who politically

positioned themselves by actively participating in local political life. In order to study this relationship, we have run different logit models controlling for several factors such as decade of birth and municipality<sup>3</sup> as well as taking into account socio-economic and family variables. Similarly, a recent study found a consistent relationship between levels of agrarian inequality and voting trends in Spain (Domènech and Sánchez-Cuenca, 2022).

As we have explained, to carry out this analysis we have used a sample of 1046 men, with information drawn from military conscription records. The data refer to their height at an approximate age of 21 years and we know their political category and their life trajectory. The parish archives have also been useful, and we have worked with the baptismal, marriage and death records for the 11 villages analyzed, making sure that all those who performed compulsory military service had reached the age of majority. The period of study analyzed, corresponding to the birth cohorts of 1870–1969, coincided with a period of Spanish economic and social modernization, reflected in a gradual change in the productive structure and the advance of urbanization (Nicolau, 2005; Escosura, Leandro, 2017). These 11 villages were selected as they belong to a group of municipalities that form a homogeneous area for which data are available (part of the Spanish parish archives were destroyed during the Civil War or due to other conservation problems) but also because they are representative of inland agricultural Spain. They exhibit patterns typical of most of the peninsular interior (small villages with population concentrated in nuclei with long distances from one municipality to another, a specialization in cereal production, a low educational level of most of the population, migrations to urban areas in the second half of the twentieth century, etc.). Therefore, we can assume that its population is neither exceptional nor tends to create more leaders, given that our objective is not to study national elites but what was happening at the local level in the rural world, who approached left-wing or right-wing positions and the characteristics of these individuals.

In any case, the sample has several limitations, including the following. First, the small sample size does not allow us to explore smaller sub-periods. Second, the study only focuses on the male population, which could be limiting the extrapolation of our results. Last but not least, the sample is composed of individuals who survived until age 21. This may have certain risks, as recent literature has warned that sample selection bias and other forms of bias could distort causal results (for an overview of this issue, see Schneider, 2020).

This study is innovative for several reasons. First, to the best of our knowledge, for the first time a large historical life course database with height information is used to study the relationship between biological well-being and the political preferences (activism) of individuals. This is especially important because although politic economics has historically assumed that right-wing individuals come from more socioeconomically favorable environments than left-wing individuals, there are no studies that, using all individuals from the same localities, have tested this hypothesis controlling for other socioeconomic and family factors at the historical level. Therefore, we have examined this relationship at unprecedented levels by taking the population of entire villages where a large proportion of the men (slightly more than 25%) participated in political activism. All of the individuals analyzed belonged to the working class, so we not just documenting the inequality penalty suffered by the laborers. Second, it develops an individual-level political activism variable that can be replicated as the same sources can be used in future studies that relate political activism to other individual-level variables. This field has been little explored, especially in southern Europe. Finally, this study contemplates a country with a fascinating political situation throughout the twentieth century (huge social

<sup>3</sup> Including these birth period and village variables in the models allows us to control for social, economic, environmental and geographic factors for which we do not have alternative variables, making the results more robust.

mobilization during the Second Republic, a Civil War, a long dictatorship for 40 years and a subsequent recovery of a full democracy) that offers us a diverse view of the main players of the social movements that shook Europe during the twentieth century (we will discuss later how these regime shifts can also be associated with contextual biases that we cannot control).

## 2. Area and data

### 2.1. Area

The study area comprises 11 rural localities (Alfamén, Botorrita, Codos, Cosuenda, Jaulín, Longares, Mezalocha, Mozota, Muel, Tosos and Villanueva de Huerva) of Aragón, an inland region located in northeastern Spain (Fig. 1), made up of the provinces of Huesca, Zaragoza and Teruel. The border area is less than 20 km from the region's capital Zaragoza, covering an area of approximately 500 km<sup>2</sup>, with a decreasing population (8000 inhabitants in 1860 and 5600 in about 1980) due to rural-urban migrations. These localities were selected because they form a homogeneous area, with an agriculture and population distribution typical of inland Spain, and because they have both parish and military data. The study area has been limited to 11 municipalities due to the availability of data and the costly and time-consuming methodology used.<sup>4</sup> The population lived mainly in nuclear households and worked in agriculture (mostly rain-fed crops) and sheep farming. The standard of living of a large number of the population was close to subsistence levels (Marco-Gracia, 2018).

Coinciding with the first wave of globalization, a process of modernization and economic growth began in Aragon that continued throughout much of the twentieth century. This growth was not consistent throughout the region, with Zaragoza at the head and rural areas in the rear (Germán, 2000). The economic modernization of Aragon suffered a severe setback with the Civil War (1936–1939) and did not reach its pre-war levels until the 1960s (Germán, 2012).

At the demographic level, the average fertility rate hovered around six or seven children per family until the early twentieth century and declined thereafter following the fertility transition. Infant and child mortality rates were very high, showing that only half of infants reached the age of five. As in the country as a whole, mortality rates began to decline towards the middle/end of the nineteenth century due to the lower incidence of epidemic crises and infectious diseases transmitted by water and food (Marco-Gracia, 2017). The average century height of men was around 160 centimeters, so at the anthropometric level it follows that biological well-being was low, since said height was well below European levels or heights recorded in other regions of Spain (Martínez-Carrión et al., 2016; Hatton and Bray, 2010).

### 2.2. Data

We have analyzed four types of data: height data drawn from military conscription records; individual demographic data from parish registers (up to 1950), surveys (from 1950); socio-economic data on occupation and literacy drawn from censuses, population lists and parish registers; individual data on political activism in parties, syndicates and organizations (this data and the classification will be explained in the next subsection); and data on political results at local, regional and national levels.

We have used the height data for military conscription

<sup>4</sup> We attempted to extend the study area with data from new localities nearby (in the province of Zaragoza). However, none of the localities fulfilled the double requirement of preserving individual military data from the nineteenth century and preserving the parish archives in the long term (many Aragonese parish archives were destroyed during the Spanish Civil War, including all the localities bordering the study area to the east).

corresponding to those who enlisted between 1870 and 1969 in the 11 aforementioned villages (or born in these villages and enlisted in the province of Zaragoza). Around 95% of the data were obtained from the records kept in the municipal archives of each village. To complete the sample, we requested a copy of the available conscriptions in the Historical Military Archive of Guadalajara. The total sample of individuals who participated in political parties, syndicates, or political organizations (who we know of) included 1046 complete life courses. These included not only those who participated in the villages in the study but also in the entire province of Zaragoza, who were originally from these villages.<sup>5</sup> In total, we have height data for 4450 individuals, so 23.5% of the men in the sample participated in politics. Moreover, we should bear in mind that we have only included men who were not professional politicians and who never earned a monthly salary directly from their political activism.<sup>6</sup> We have no evidence to suggest that the physical level of the people who participated in politics was different to that of those who did not. As we can see in Fig. 4, there were no major differences in height between the two groups. In fact, those who did not participate in politics remained at an intermediate height between left-wing and right-wing individuals throughout the whole period, without these differences being statistically significant. Therefore, we can consider that the main differences between these individuals and the rest lie in their politicization and their desire to participate actively in the development of their locality and in any changes that could occur.

In addition, in Spain, from 1830 a recruitment system was implemented in which only fugitives, migrants and the dead were not measured, which ensures the measurement of all the militiamen of that generation, even those individuals who evaded "service" (payment in cash, quota of soldiers and replacement) or who were rejected (short stature or chronic diseases) were measured (Puell de la Villa, 1996; Verdejo and Javier, 2004).

Although the age of conscription was 21, there were exceptions,<sup>7</sup> which is why we have homogenized the average height at the age of 21 years following the methodology of Ayuda and Puche-Gil (2014), calculating the 50th percentile of the years (19, 20 and 21) adding 1.2 cm and 0.4 cm at the height of 19 years and 20 years, respectively.<sup>8</sup> As expected, height growth was higher in the 19 years old age group, as they had a greater chance of growing taller with the adolescent growth spurt. Our results are such in different Spanish regions (Muñoz and Josep, 2011; Ayuda and Puche-Gil, 2014). In general, the distribution of the height data is close to normal for the whole period, although we can observe some imperfections due to the low sample size, and the height-heaping tendency exercised by rural doctors. We have tested the null hypothesis of normality of average height, and we cannot reject the null hypothesis for a significance level of 5%.

The complete ecclesiastical records of the 11 villages analyzed here

<sup>5</sup> In any case, losing the individuals who migrated out of the province of Zaragoza could be introducing selection biases. However, we have no evidence that migrants could identify with either the tallest leftists or the shortest rightists. Nor are we aware of previous research that validates this hypothesis. Therefore, we do not know what the political preferences of outbound migrants were, but they are unlikely to have a strong impact on how biological well-being is related to political preferences.

<sup>6</sup> Only three individuals from the study area have been classified as professional politicians and excluded from the sample. This decision is attributed to their exceptional cases, as they possessed high levels of education and had primarily pursued their political careers as professional politicians outside the study area. Nonetheless, their inclusion would not have a substantial impact on the results.

<sup>7</sup> Between the years 1856 and 1885, the age for military conscription was set at 20. This age was lowered to 19 from the second call-up in 1885 until 1899. It was then raised again to 20 between 1901 and 1905, and subsequently increased to 21 from 1907 to 1939.

<sup>8</sup> There are alternative ways of standardization in the Spanish case, such as those of Martínez Carrión and Moreno-Lázaro (2007) or Cámara (2009).

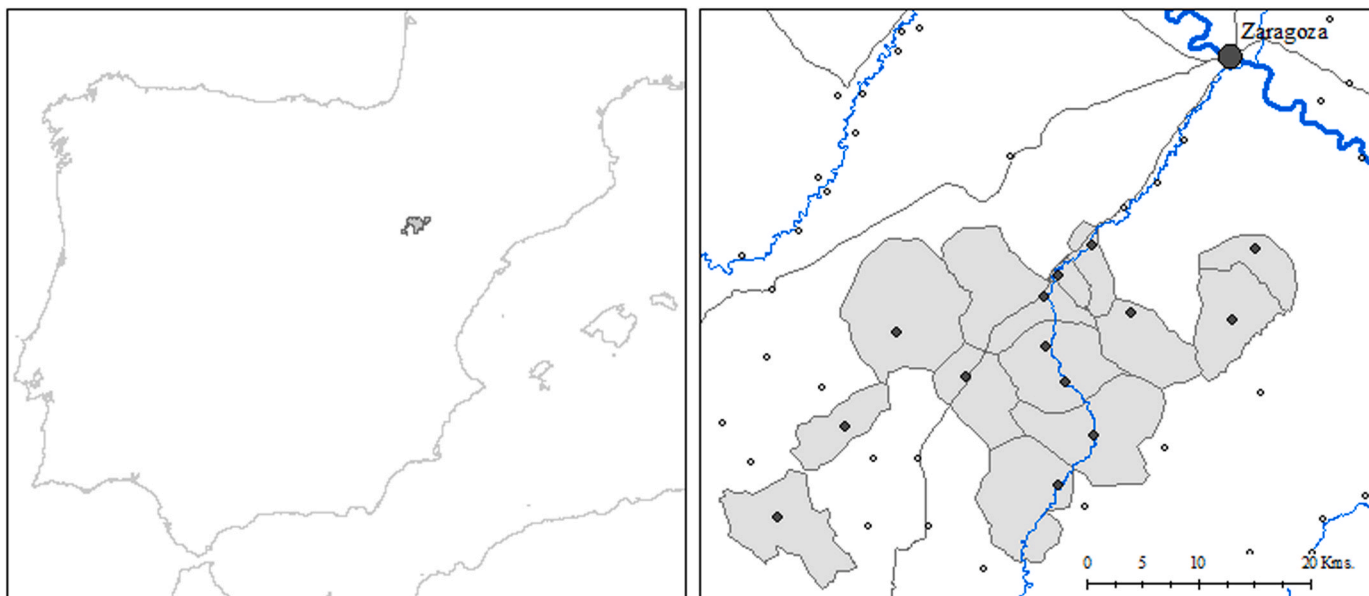


Fig. 1. Area of study: Middle Huerva (Aragón, Spain).

Source: Own elaboration. Note: Dark dots indicate the villages studied (except Zaragoza, the provincial capital) and the corresponding shaded areas refer to their municipal boundaries.

provide us with reliable and very rich information in relation to baptisms, marriages and burials that occurred from the sixteenth century to 1950, enabling family and demographic analysis. For dates after 1950, the source used is family interviews, a total of 1074 (although we do not know the political leanings or stature of all of them), and the database has been built according to the family reconstruction method of Fleure and Henry (1956), including all individuals who were born and baptized in the analyzed churches or who migrated to them and were registered.

With the occupation and literacy data of the conscripts analyzed, their fathers were extracted from population lists (1857 and 1860), electoral censuses (1890, 1894, 1900, 1910, 1920, 1930, 1934, 1945, 1951, and 1955), and the parish registers, linking them to population records for each individual.<sup>9</sup>

### 2.3. Political activism

Information about deliberate participation in political parties, syndicates or political organizations has been extracted from different sources from 1929 to 2019.<sup>10</sup> During the Second Spanish Republic (1931–1936), and in the previous years, it was obtained from the political position declared by the candidates in the local elections of 1931. Starting in 1934, especially after the October revolt,<sup>11</sup> the civil governors decided to dismiss some councilors with the aim of introducing new councilors who favored their ideology. Therefore, this study considers that these new councilors (basically in 1934 and 1936) formed part of the same political ideology as the aldermen who appointed them (as long as they did not participate in governments or organizations of the

opposite ideology). The area of analysis remained under the rebel-controlled government throughout the Spanish Civil War (1936–1939),<sup>12</sup> so all those people who were repressed by the new system have been considered as belonging to left-wing groups (as demonstrated by several studies, i.e., see Ledesma, 2005).

More than 500 individuals faced reprisals in the study area. The majority had been involved in local governments or were members of political organizations. However, approximately 10% did not fit this description. Most individuals underwent a "political responsibility" trial (which can be accessed openly on the [dara.aragon.es](http://dara.aragon.es) website) and acknowledged their ties to left-wing politics, having engaged in left-leaning demonstrations at public gatherings, strikes, or other public events.<sup>13</sup> The number of left-wing party voters in all of the villages surpasses that of those who faced reprisals. Therefore, a significant number of left-leaning and right-leaning individuals could not be included in our database. This imbalance between political beliefs (approximated by number of voters) and political participation (approximated by number of reprisals) during the Second Republic could potentially bias our results if non-politically active individuals had different levels of biological well-being. However, determining the political beliefs of every individual in the study area at each moment is impossible.

We have obtained the data, from 1936 to 1978, of those who participated in local politics as councilors. All of them were related to the "Traditionalist Spanish Falange and the J.O.N.S." fascist movements,

<sup>9</sup> The data appear randomly depending on the parish priest.

<sup>10</sup> While there are sources predating 1929 that mention political involvement, we have encountered few individuals from the study area recorded as members of leftist organizations. This is clearly enhanced by the boom in political and social participation that took place during the Spanish Second Republic. Furthermore, in many cases, the availability of their height data was a challenge (as data preservation in military archives significantly improves for those born in the 1890s).

<sup>11</sup> Revolutionary general strike in Spain in 1934 promoted by the left-wing parties, mainly the socialists, with important political and social consequences that further polarized society.

<sup>12</sup> The local governments of these villages lacked decision-making power over the dominant faction in the area. Instead, this depended on the military forces' capabilities of each side to assert control over the territory and, consequently, determine the frontline positions in dispute. We only have records from villages that aligned with the rebel faction from the outset of the war. This is because the parish archives of nearby villages that supported the loyalist side were destroyed by militiamen due to their anticlerical beliefs (parish records were associated with the historical control exerted by the Catholic Church).

<sup>13</sup> In an effort to ensure the representativeness of the data, we engaged in discussions with elderly individuals from all the villages in the sample. Their responses did not suggest that the reprisal-targeted individuals were not genuinely of left-wing ideologies; however, they did acknowledge the existence of more left-leaning individuals who were not subjected to reprisals.

so we included them as participants in right-wing parties for this research. Since the first democratic local elections in 1979, the individuals have been classified according to the political tendency of the party that they supported in local elections.<sup>14</sup> In addition, we have accessed information on the individuals who participated in the leftist UGT and CNT unions thanks to the information contained in pre-existing studies (Peiró, 2011, 2022) and the classification of the board of directors of each locality in which the union was found in the *Causa General* (the file that the dictatorial ultraconservative government opened in each municipality to purge political responsibilities, which includes the different leftist groups in the municipality and the formation of the town council. It can be found in the Provincial Historical Archive of Zaragoza, box J/006017(000001). We have also used an extensive list of people who were repressed in the region for strongly supporting leftist positions (see: Casanova et al., 1992; Royo, 2003; [connombreyapellidos.es](http://connombreyapellidos.es) [last time visited: August 13, 2022]). We only considered as part of the sample the individuals who supported any party or organization during the study period. If the individual participated, in separate instances, in a left-wing and a right-wing party, he was excluded from the sample (twenty-three cases), maybe because he changed his mind over time.

Thus, we consider left-wing individuals to be those who stood for the 1931 municipal elections (including the repeated election after the proclamation of the Second Republic, where in the study area town halls were even taken over by left-wing forces to establish new elections with clear left-wing candidates), the mayors and councilors who in 1936 accepted the post imposed by the Governor of the leftist Popular Front (and who did not participate in any right-wing government), those who formed part of the governing boards of the left-wing trade unions UGT and CNT, those who were part of the governing boards of left-wing parties such as the *Partido Republicano Radical Socialista* (PRRS) during the Second Republic, those who were repressed due to their progressive positions during the Civil War and the post-war period, and individuals who had stood for councilor from the municipal elections of 1979 for the parties *Partido Socialista Obrero Español* (PSOE), *Izquierda Unida* (IU) and *Chunta Aragonesista* (CHA). Regarding the changes of councilors in 1933, we have only taken those candidates who declared themselves as belonging to left-wing parties (not assuming that all the individuals imposed by the Governor were right-wing).

In contrast, we consider as right-wing individuals those who during the Second Republic acknowledged their conservative tendency in the 1931 elections, those who accepted to serve as councilors in their respective town councils after the changes imposed by the civil governor in 1934 (after the October Revolution) and in 1936 (after the beginning of the Spanish Civil War), those who during or before the Second Republic formed part of the governing board of parties of a conservative tendency, those who accepted the post of counselor during the fascist Franco dictatorship and did not participate in any left-wing formation afterwards, and those individuals who from the local elections of 1979 onwards formed part of the local lists of *Unión de Centro Democrático* (UCD), *Partido Popular* (PP), *Partido Aragonés* (PAR) and *Ciudadanos* (Cs). Regarding the changes of councilors in 1933, we have only taken those candidates who declared themselves as belonging to right-wing parties (not assuming that all the individuals imposed by the Governor were right-wing).

As we have observed, the Spanish political context has had an influence on our sample. We possess more data on left-leaning individuals for the younger and middle-aged generations during the Second Republic (from 1931 to 1936, in the case of the studied villages) and the

Democracy period (from 1977 onwards). Meanwhile, right-leaning men are more abundant during the Francoist dictatorship and the early years of Democracy. We have worked with birth cohorts to distribute the sample of left-leaning and right-leaning individuals throughout the study period. Furthermore, our selection of sub-periods attempts, to some extent, to differentiate in terms of historical stages. Despite these efforts, contextual factors that encouraged or discouraged individuals from participating in politics, which are entirely unrelated to our sample selection, could potentially bias our results. It is possible that right-leaning individuals who were more inclined to engage in politics during the Second Republic (when left-wing ideas predominated in the early years) were those who were better off (with higher levels of biological well-being) and had less fear of losing their standard of living. On the other hand, individuals who participated in the democratic elections of 1979 for left-wing parties might have had worse living conditions and greater incentives to try to change the system, even taking risks. Although our available data do not reflect this situation (neither do right-leaning individuals born in the early study cohorts correspond to the tallest, nor do the older left-leaning individuals during the first elections exhibit extremely low heights), these contextual factors reflect the political reality and are inherent to the history of Spain.

#### 2.4. Variables

In Table 1 we can observe the distribution of our sample for several variables, including the average height and the standard deviation. To find possible dissimilarities between the localities, both at an environmental and economic level, we have controlled by *village of birth* (around 90% of the recruits in the data set are the same as those in the residence data). To analyze the improvement of living conditions from the perspective of the social, economic and political context, and to gain an idea of the demographic modernization, the *decade of birth* is a good control indicator. *Literacy* helps us understand the effect of access to education on political preferences and it is a good approximation of the economic investments made by parents. The Spanish literacy rate rose from 27% to 73% between 1860 and 1930 (Núñez, 2005). In fact, in our area of analysis, the inhabitants born in the 1930s were the first generation to reach full literacy (Marco-Gracia, 2018).

If we wish to determine the standard of living of individuals, *occupation* is a very useful approximation (Blum, 2013). For this reason, we have used the occupation of the fathers as an indicator of the socio-economic status of the militiamen's families during their infancy and adolescence. We have segmented the recruits into five occupational categories: farm laborers and unskilled laborers; farmers; artisans (pottery, blacksmiths, tailors, etc.); qualified occupations that require a higher level of education (doctors, teachers, veterinarians, notaries, bankers, etc.); and 'Others', which includes the rest of the professionals for which the skill level cannot be identified, covering a range of occupations, such as military personnel, drivers of diverse vehicles, etc.

The data provided by the Spanish military recruits on the appeals presented by the militiamen to avoid compulsory military service has been added to this study, taking into account only those that were accepted. In addition, we have included the parity variable as a proxy for the mother's age and the stage of marriage. In socio-economic contexts where individuals had living standards close to subsistence levels, such as those prevailing in the early stages of this study, the stage of marriage may be strongly connected to the economic situation of the couple, with the first years after the wedding being the most difficult economically.

Table A1 in the Appendix shows the distribution of the data for each subperiod. Table A2 displays the descriptive statistics categorized by time period and the political organization to which the individual belonged.

In addition, we must take into account the selection effects of the rural-urban migrations that characterized the second half of the twentieth century in Spain (Heckman, 1979; Wahba, 2015). If the shortest individuals among the left-wingers migrated to the city (mainly to

<sup>14</sup> The following parties' candidates were considered to be on the left: *Partido Socialista Obrero Español* (PSOE), *Izquierda Unida* (IU) and the *Chunta Aragonesista* (CHA). The following parties' candidates were considered to be on the right: *Unión de Centro Democrático* (UCD), *Partido Popular* (PP) and the *Partido Aragonés -Regionalista-* (PAR).

**Table 1**  
 Characteristics of the sample in relation to the average height, birth cohorts 1870–1969, 1046 observations.

	Variables	Cases	%	Average height cm	Standard deviation
Political position	Right-wing	499	47.7	166.7	0.281
	Left-wing	547	52.3	164.3	0.254
Locality of residence	Alfamén	134	12.8	167.0	0.507
	Botorrita	83	7.9	166.1	0.856
	Codos	77	7.3	164.4	0.739
	Cosuenda	103	9.8	164.7	0.597
	Jaulín	50	4.8	167.9	0.876
	Longares	141	13.5	165.2	0.432
	Mezalocha	79	7.3	166.9	0.694
	Mozota	57	5.5	166.0	0.763
	Muel	60	5.7	166.3	0.720
	Tosos	98	9.4	164.4	0.485
	Villanueva de Huerva	167	16.0	165.0	0.516
Birth decade	1870	16	1.5	162.9	2.566
	1880	34	3.3	163.0	0.789
	1890	173	16.6	163.3	0.359
	1900	361	34.6	164.6	0.318
	1910	135	12.9	166.0	0.517
	1920	84	8.0	166.9	0.776
	1930	86	8.2	167.5	0.676
	1940	66	6.3	167.1	0.645
	1950	56	5.3	168.7	0.746
	1960	35	3.3	171.0	0.950
Literacy	Illiterate	44	4.20	163.8	0.733
	Literate	705	67.4	166.0	0.369
	Unknown	297	28.4	165.3	0.231
Father's occupation	Low skills employee	567	54.2	164.8	0.250
	Farmer	175	16.7	167.0	0.440
	Artisan	33	3.2	167.0	1.087
	Upper class	11	1.0	168.7	1.865
	Other or unknown	260	24.9	165.5	0.411
Appeals for exemption	No appeal (fit to serve)	986	94.2	165.6	0.195
	Physical appeals	48	4.6	163.8	0.999
	Social appeals	12	1.2	162.3	1.572
Parity	1	490	46.9	164.7	0.263
	2	176	16.8	166.1	0.500
	3	124	11.8	166.6	0.500
	4	77	7.4	166.2	0.829
	5 or more	179	17.1	166.0	0.470

Source: Conscription and call-up records; historical municipal archives from municipalities composing the anthropometric sample and conscription records of the Military Archive of Guadalajara (Spain).

nearby Zaragoza), this could have biased our results, generating a false sense of equality in stature between left-wing and right-wing individuals. However, we cannot control for this aspect given that political participation in the city is more professional and we have no information on party membership. In addition, we must take into account another limitation associated with the data. The earliest data on political activism go back to the 1930s. With these figures we can refer to cohorts of generations (according to the date of birth of the individuals) to compare them, but some of the individuals of these generations had already died. This could lead to a selection bias associated with the mortality process itself if individuals of a certain political position or stature group tended to die younger. However, although we know that shorter individuals died earlier than the rest in the study area (Francisco J. Francisco J. Francisco J. Marco-Gracia, Puche-Gil, 2021; Francisco J. Francisco J. Marco-Gracia, Puche-Gil, 2021), it is perhaps too much to assume that this biases the results given that the political activism-height trends remain relatively constant for the different birth cohorts and the biases would possibly have a greater impact on the sample size than on the differences found with the different analyses.

### 3. An overlook of the historical period and the distribution of the sample's statures

Not all the historical periods experienced throughout the twentieth century in Spain favored the political activism of citizens in the same way, especially those who had a low level of education and lived in rural areas. The Second Spanish Republic (1931–1936) was particularly prone to political and revolutionary activity, as were the preceding years to a lesser extent (Germán, 1984; Casanova et al., 1992; Peiró, 2011, 2022; Casanova and Gil, 2012). During the short period of the Republic, there was a succession of left-wing and right-wing governments, but also revolutionary attempts to impose non-democratic regimes. During these years, for the first time in many municipalities, mayors and councilors from lower socio-economic groups came to form part of the local government. At the same time, militancy in parties, trade unions or organizations with a strong political character became common among a large part of the population (approximately 25% of the men in the study villages were active in politics and politicized organizations and this is not an exception in Spain as a whole). The fact that 25% of individuals became politically significant at the local level gives us a clear perspective that we are not dealing with a minority of individuals who dared to be social leaders in order to make a profit. In fact, none of them derived direct benefits from their participation (at least through the legal channels that we can control). The findings show that one in four subjects attempted to improve the living conditions of their family and neighbors on the basis of their political ideas and activism. Therefore, this is not an issue that affected a minority but a large part of society.

The municipalities under analysis were no exception when it came to political activism, especially of a left-leaning nature. Although there had been minor instances of leftist activism in the villages before the start of the Second Republic, it was only with the advent of the new regime in 1931 that new groups and organizations emerged. The two most popular movements in the region were the socialist movement (including socialist parties, then considered far-left, and the establishment of unions, the most prominent being the *Unión General de Trabajadores* -General Union of Workers - UGT) and, to a lesser extent, the anarchist movement. Among these eleven villages, the inclination was closer to the socialist movement than the anarchist one. There were 198 members of UGT compared to just 12 from CNT (*Confederación Nacional del Trabajo* - National Confederation of Labor), the main anarchist group in the area, concentrated in the villages of Botorrita and Mozota. However, even within these initial stages, the villages were characterized by a more moderate left-leaning movement, with various groups of the *Partido Republicano Radical Socialista* -Radical Socialist Republican Party- (moderate left) forming in larger villages such as Alfamén. During the period of slightly over five years that the Republic lasted, left-wing votes gradually shifted from moderate options to more left-leaning ones (like the socialist parties). In some of these villages, there were also right-leaning movements to counter the strength gained by the left, leading to the formation of local branches of right-wing formations that would eventually rise to power in subsequent periods.

Nevertheless, this area cannot be considered to have been politically homogeneous. The elections of 1936, the most polarized of the period, serve as a good indicator of each village's political preferences. In the province of Zaragoza, the right-leaning parties won the elections. This was aided by the victories in the villages of Jaulín, Longares, Villanueva de Huerva, and Cosuenda. However, in Alfamén, Botorrita, Mezalocha, Mozota, Muel, Tosos, and Codos, the left-leaning parties garnered the most votes.

The huge political activity associated with the Second Republic had consequences in terms of social polarization. This polarization led some groups to extremist and anti-democratic positions, and finally to the coup d'état by the fascist military and the outbreak of the Spanish Civil War (1936–1939), which gave rise to the strong repression (including tens of thousands of cases murder) of people with a different political tendency.

In the study area alone, over 500 individuals suffered reprisals (not all of them are included in the database, for instance, if they were women). The majority of these cases involved hefty monetary fines that helped sustain the initial stages of the regime. To make things worse, several dozen neighbors (especially mayors and council members from the last local left-leaning governments) were forcibly taken from their homes and executed due to their ideology in the early weeks of the Spanish Civil War, without the right to a trial. Only the residents of Alfamén were spared from experiencing local political figure executions (although political figures from neighboring villages such as Cosuenda were executed within Alfamén’s municipal boundaries). Another group of individuals from the study area were executed later or imprisoned due to their political prominence during the Republic or their actions in the early stages of the Civil War. Therefore, siding with the rebel faction at the beginning of the war did not exempt anyone from political reprisals, although it did prevent the war front from crossing any of the villages in the study in all cases (although it came very close in some instances).

With the triumph of the fascist putschists in the Spanish Civil War, the period of political effervescence came to an end, as the strong repression continued against individuals with left-wing tendencies, and the existence of political parties, trade unions or organizations other than the official one of the new regimes was forbidden (Casanova et al., 1992). The municipal governments were selected by the competent authority, formed by individuals who clearly exhibited ultraconservative tendencies and who were mostly from the higher socio-economic groups in the locality. It was not until 1975, with the death of the dictator Francisco Franco, that a period of transition to democracy began, leading to the first free democratic elections in over 40 years in 1977. These elections, and all those that have taken place at local, regional or national level since then, have been open to all parties regardless of their political tendency (Colomer, 2004).

In the study area, generally speaking, the first local elections of 1979 were met with caution by a significant portion of the population due to the repression that followed the 1936 coup for individuals who had displayed political involvement. In some municipalities such as Jaulín, Botorrita, or Mozota, there were no party-affiliated candidates; instead, residents formed apolitical groups to avoid explicit political identification. In the larger towns, party-affiliated candidacies did emerge, both from the right and the left, yet they leaned toward moderate parties, with only one candidacy per tendency. As the years went by and Spanish democracy became firmly established, the fear of repression subsided, leading to a proliferation of political candidacies from both the left and

the right. Local support for new parties increased, and the number of residents eager to form part of electoral lists grew.

As mentioned earlier, the electoral outcome of the 1936 Spanish Congress elections served as an approximation of the villages’ political preferences during the Second Republic. The 1977 results, following 40 years of dictatorship, offer a snapshot of the return to democracy in these villages. In all of these villages except Alfamén and Cosuenda, the winning party in the 1977 elections was the moderate right-wing party that was in government and had undergone a political transition from the dictatorship, the *Unión de Centro Democrático*–Union of the Democratic Centre- UCD. In Cosuenda, another regionalist moderate right-wing option also won. Only in Alfamén did a left-leaning movement, the socialists, secure victory. In the elections of 1982, when the socialists obtained an absolute majority in the country, they only won in three of the villages in this study (Alfamén, Codos, and Muel). However, the socialist triumph and the stabilization of Spanish democracy facilitated greater voting diversity starting from the 1986 elections. By that year, options leaning towards the left emerged victorious in more than 50% of the studied villages under study.

Fig. 2 is a faithful reflection of the historical period we have recounted (in addition to the archival preservation problems). It shows the distribution of individuals in the sample who participated in politics according to their decade of birth. Our observations reveal that those individuals who actively participated in politics during the Second Republic were born mainly in the 1900 s and, to a lesser extent, in the 1890 s and 1910 s. After the Second Republic (and those born in the 1900 s) and, possibly due to the strong repression (and the non-existence of free elections), the sample of individuals participating in politics strongly reduced, with an average of less than 100 individuals per decade. With the recovery of municipal elections in 1979, the number of individuals who participated freely in politics increased. However, in many localities (especially in the smaller ones) it took so long for left-wing groups to form and participate freely that they largely consisted of those too young to include in our study period. Moreover, it should be remembered that due to the fear of a new conflict, it took time for left-wing candidates to emerge in most villages. It was common in the first decades after the Franco dictatorship for left-wing individuals to stand on independent lists without party affiliation (and therefore they are not included in our political categories). The evolution of the sample shows that up to those born in the 1910 s there were subjects linked to left-wing groups and the opposite was true from the 1920 s onwards. This is because until the Second Spanish Republic, there was a boom of

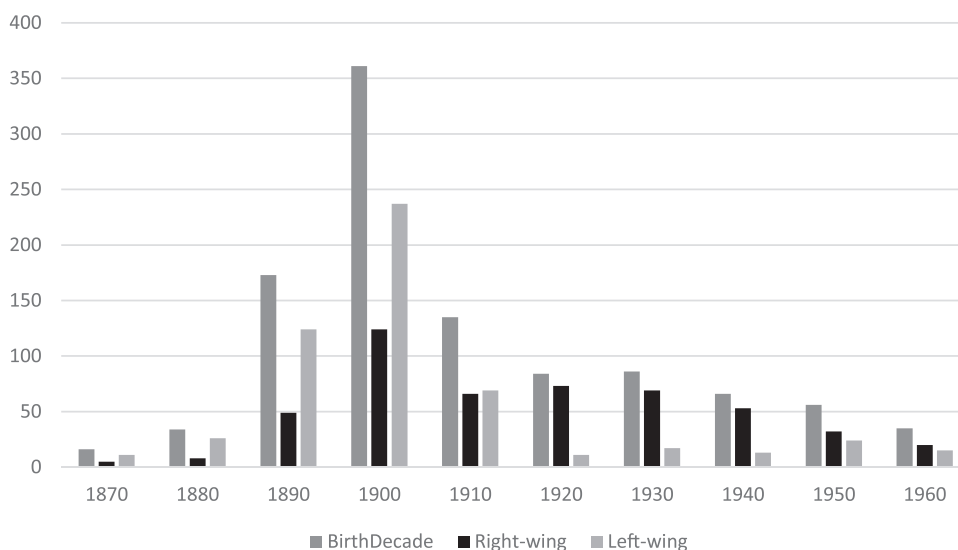


Fig. 2. Distribution of individuals who participated politically in the reference villages by decade of birth, birth cohorts 1870–1969. Note: 1046 observations. Source: Parish and municipal registers.

individuals who participated in left-wing groups, and this was reduced with the Civil War and the dictatorship. After the return of Democracy there was also an increase in left-wing parties, especially in the late twentieth and early twenty-first centuries.

In Fig. 3, we can observe how the same 1046 individuals are distributed by height range. Fig. 2 shows that the most common height range was between 165.1 cm and 170.0 cm, followed by slightly shorter individuals (160.1–165.0 cm) and, just below, individuals between 170.1 and 175.0 cm and 155.1–160.0 cm. The tests carried out confirm that our data are close to normal, although with slight imperfections given the small sample size and the long study period.

In Fig. 4 we can see the evolution of average height in the study area by decades of birth as a function of the individual's political significance (or non-participation in parties or associations). The results show that the average height of left-wing individuals remained approximately one centimeter shorter than right-wing individuals until the 1950 s and 1960 s birth cohorts. Meanwhile, the rest of the population seems to have intermediate heights, generally closer to those of left-wing individuals. Therefore, Fig. 4 seems to point to a height penalty for left-wing individuals (we will explore this question in the Results section). Fig. 4 also helps us to contemplate the importance of the change in average height that took place over the study period: while individuals born in the 1870 s hardly exceeded 162.0 cm on average, individuals born in the 1960 s almost reached 170.0 cm. In other words, in barely a century the average height had increased by eight centimeters, and all this despite the terrible Civil War (1936–1939) and the harsh post-war period.

#### 4. Methodology

This article is based on a combination of descriptive and regression analyses. The descriptive analyses focus on the study of the evolution over time of the relationship between political position (right or left-wing) and height. In these descriptive analyses we attempt to introduce the perspective of the temporal evolution of height. The objective is to determine the evolution of this relationship in the long run.

In addition, we have conducted regression analyses to investigate the relationship between the height and political preference (right or left wing) of the conscripts and their fathers, controlling for several significant factors such as socioeconomic status or family size. We have conducted logit regressions to establish the relationship between an individual's political activism and his height (in addition to other independent variables). We have used them because we wish to know the effect of height and other variables on the individual's political activism,

so we need models that allow us to use a categorical variable as the dependent variable. In this case, we have used probabilistic models with political activism as the dependent variable, taking a value of zero for individuals who participated in right-wing organizations and a value of one for individuals who participated in left-wing organizations. We have developed three sets of logit regression models (Tables 2 to 4) with political activism as the dependent variable. The models can be expressed as follows:

$$P_i \text{ (left\_wing = 1)} = \frac{1}{1 + e^{-(\alpha + \beta_1 * X_{i1} + \beta_2 * X_{i2} + \dots)}} + \epsilon$$

where  $P \text{ (left\_wing=1)}$  is the dependent variable described in the previous paragraph, for an individual  $i$ ,  $\beta_n$ , is the parameter,  $X_n$  denotes the variables described in the previous section used in each model and  $\epsilon$  is the error term. In addition, to analyze the joint significance of the independent variables, we have performed a likelihood ratio test and found that the test statistics follow a  $\chi^2$  distribution, which supports the explanatory power of the model.

#### 5. Results

In this section we study the relationship between the political tendency of individuals who participated in politics throughout the twentieth century in the 11 reference villages and their height using logit regressions (Tables 2 to 4).

First, in Table 2 we analyze the relationship between the political tendency of the individuals who were politically active (classified as explained above and being the dependent variable) and their height. As independent variables, we have taken into account height (both as a continuous variable and categorized by quartiles depending on the model), the paternal occupation, the individual's literacy, whether they made allegations of physical or social problems in order to avoid military service (and were accepted) and the individual's birth order. In addition, we have controlled for any fixed effects that may be associated with decade of birth and locality of origin (in this case, in models 3, 4 and 5). Thus, model 1 exclusively analyzes the relationship between political activism and height (as continuous variable) controlling for decade of birth fixed effects. Model 2 is very similar to model 1 but with the height categorized by quartiles to detect who was most affected. Model 3 builds on model 2 and includes a control for village of birth fixed effects. Model 4 builds on model 3 but also includes socioeconomic variables that affect the individual's development during childhood and adolescence, namely the father's occupation and his literacy. Model 5 also includes all the variables mentioned at the beginning

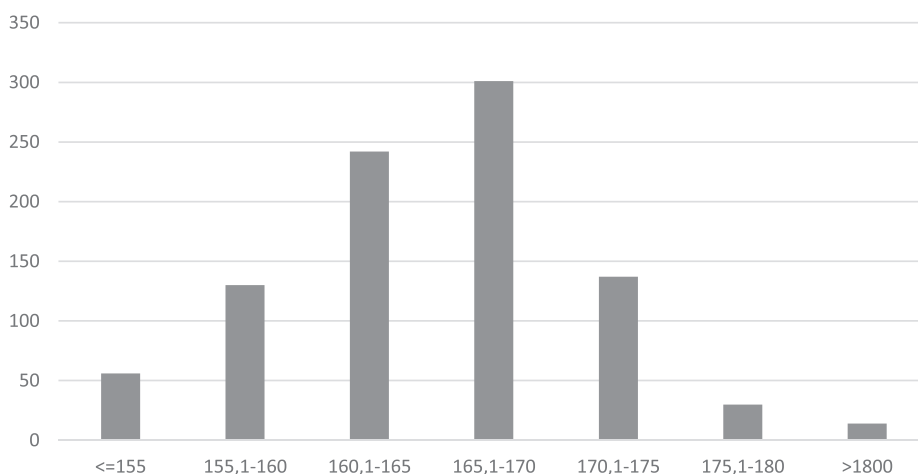


Fig. 3. Distribution of heights of politically significant individuals by height ranges, birth cohorts 1870–1969. Note: 1046 observations. Source: Parish and municipal registers.



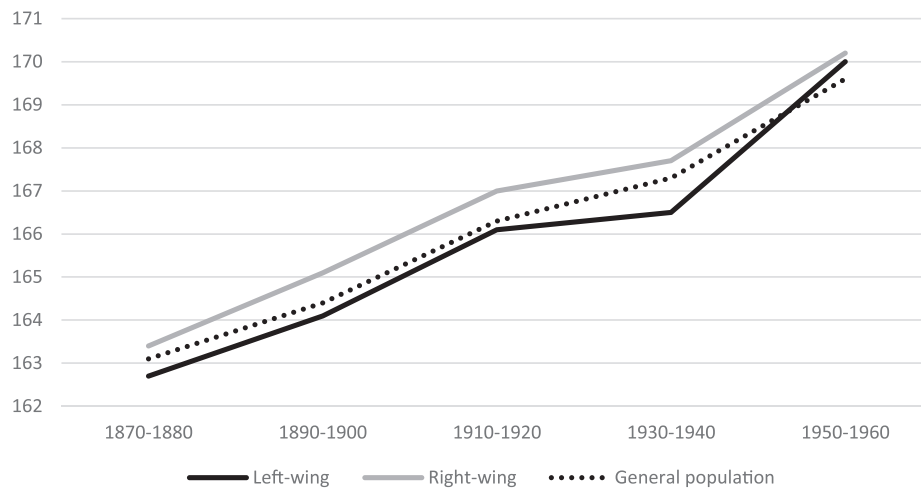


Fig. 4. Evolution of the height of left-wing, right-wing and politically non-meaningful individuals by decade of birth, birth cohorts 1870–1969. Source: Parish and municipal registers. Note: Sample of 499 right-wing individuals, 547 left-wing individuals and 3404 other people.

Table 2  
Likelihood of being left-wing in relation to height in rural Aragon, birth cohorts 1900–1969.

		(1)	(2)	(3)	(4)	(5)
Height	(Continuous variable)	-0.039 * ** (0.01)				
Height category	Less than 161.3		0.749 * ** (0.20)	0.725 * ** (0.21)	0.785 * ** (0.21)	0.795 * ** (0.22)
	161.3–165.6		0.290 (0.20)	0.299 (0.20)	0.314 (0.21)	0.288 (0.21)
	165.7–169.0	(ref.)				
	Over169.1		0.214 (0.20)	0.239 (0.20)	0.262 (0.21)	0.255 (0.21)
Father's occupation	Low-skilled employee	(ref.)				
	Farmer				-1.023 * ** (0.23)	-1.033 * ** (0.24)
	Artisan				0.076 (0.44)	0.192 (0.44)
	Upper class				-1.370 (0.73)	-1.428 (0.73)
	Other or unknown				-1.012 * ** (0.21)	-1.002 * ** (0.21)
Literacy	No	(ref.)				
	Yes				-1.045 * ** (0.43)	-1.007 * ** (0.44)
	Unknown				-0.590 (0.46)	-0.607 (0.47)
Appeals for exemption	No appeal (fit to serve)	(ref.)				
	Physical appeals					-0.222 (0.36)
	Social appeals					0.510 (0.70)
Birth order	1	(ref.)				
	2					0.039 (0.24)
	3					-0.181 (0.27)
	4					-0.413 (0.31)
	5 or more					0.580 (0.25)
	Village fixed effects		NO	NO	YES	YES
Decade of birth fixed effects		YES	YES	YES	YES	YES
Intercept		5.910 * ** (2.03)	-0.956 * ** (0.46)	-1.397 * ** (0.53)	-0.344 (0.67)	-0.352 (0.67)
Sample size		1046	1046	1046	1046	1046
R-sq		0.147	0.150	0.177	0.217	0.226

Source: Parish and municipal registers.

Notes: se denotes robust standard error. \* Statistical significance at 10% level, \*\* at 5% level. \*\*\* at 1% level.

**Table 3**  
Likelihood of being left-wing in relation to height in rural Aragon by sub-periods, birth cohorts 1870–1969.

		1870–1909 (1)	1910–1939 (2)	1940–1969 (3)	1870–1909 (4)	1910–1939 (5)	1940–1969 (6)
Height	(Continuous variable)	-0.030 ** (0.02)	-0.073 *** (0.02)	0.001 (0.03)			
Height category	Less than 161.3				0.760 *** (0.26)	1.188 *** (0.43)	-0.746 (0.67)
	161.3–165.6				0.126 (0.26)	0.556 (0.42)	-0.242 (0.62)
	165.7–169.0	(ref.)					
	Over 169.1				0.425 (0.30)	0.005 (0.40)	-0.244 (0.45)
Father's occupation	Low-skilled employee	(ref.)					
	Farmer	-1.021 *** (0.34)	-1.284 *** (0.39)	-0.452 (0.43)	-0.927 *** (0.34)	-1.283 *** (0.40)	-0.470 (0.44)
	Artisan	-0.495 (0.83)	-1.711 (1.10)	1.749 ** (0.70)	-0.178 (0.86)	-1.591 (1.10)	1.801 ** (0.70)
	Upper class	-0.471 (1.51)	-1.370 (0.73)	-1.506 * (0.89)	-0.672 (1.52)	-1.428 (0.73)	-1.554 * (0.90)
	Other or unknown	-0.802 *** (0.22)	-0.734 ** (0.36)	-1.672 * (0.84)	-0.765 *** (0.22)	-0.790 ** (0.36)	-1.689 * (0.86)
Literacy	No	(ref.)					
	Yes	-0.837 (0.49)	-1.050 (0.81)		-1.009 (0.49)	-1.238 (0.81)	
	Unknown	-0.772 (0.52)	0.114 (0.84)		-0.934 (0.52)	-0.121 (0.84)	
Decade of birth fixed effects	YES	YES	YES	YES	YES	YES	YES
	Intercept	5.476 ** (2.78)	12.172 *** (4.22)	0.877 (5.67)	0.124 (0.67)	-0.288 (0.90)	1.291 (1.42)
	Sample size	584	305	157	584	305	157
	R-sq	0.056	0.229	0.163	0.066	0.230	0.169

Source: Parish and municipal registers.

Notes: *se* denotes robust standard error. \* Statistical significance at 10% level, \*\* at 5% level. \*\*\* at 1% level.

**Table 4**  
Likelihood of being left-wing in relation to height in rural Aragon by occupation, birth cohorts 1870–1969.

		(1) Low skilled employee	(2) Farmer	(3) Others
Height category	Less than 161.3	1.511 ** (0.62)	-0.001 (0.70)	0.665 ** (0.27)
	161.3–165.6	1.395 ** (0.61)	-0.138 (0.66)	0.243 (0.27)
	165.7–169.0	(ref.)		
	Over 169.1	-0.01 (0.51)	-0.482 (0.63)	0.642 (0.30)
Appeals for exemption	No appeal (fit to serve)	(ref.)		
	Physical appeals	0.692 (0.99)	-1.483 (1.02)	0.081 (0.54)
	Social appeals	0.681 (2.04)	0.713 (3.12)	0.819 (0.87)
Birth order	1	(ref.)		
	2	-0.359 (0.56)	0.293 (0.58)	-0.016 (0.36)
	3	-0.459 (0.62)	0.656 (0.88)	-0.150 (0.35)
	4	0.517 (0.90)	-0.312 (0.89)	-0.745 * (0.41)
	5 or more	0.993 (0.68)	0.742 (0.75)	0.499 (0.33)
Village fixed effects	NO	NO	YES	
Decade of birth fixed effects	YES	YES	YES	
	Intercept	-0.187 (1.27)	-16.170 (12.75)	-1.250 * (0.72)
	Sample size	244	143	616
	R-sq	0.408	0.213	0.193

Source: Parish and municipal registers.

Notes: *se* denotes robust standard error. \* Statistical significance at 10% level, \*\* at 5% level. \*\*\* at 1% level.

of this paragraph (with height categorized by quartiles).

The results of the five models confirm with a significance of more than 99% that among the individuals studied there is a relationship between being short and participating in left-wing political parties or associations. According to the results of model 1, for every cm shorter the probabilities increase by three percent. This is an important difference considering that, for example, it is approximately the average increase in height that occurred in the study area between those born in the 1870 s and 1900 s (30 years). Even more interesting is the result of models 2–5, since they confirm the existence of this relationship between height and political activism but only for the shortest quartile of individuals. That is, it is the shortest individuals who are most likely to end up in a left-wing party (with probabilities increasing by 75%) and the only ones who show significant results (at 99%). As we will discuss later, this is possibly due to the fact that it is the individuals who experienced the worst material conditions during their childhood and adolescence (suffering a negative penalty in their height) who may have had more incentives to participate in left-wing organizations in order to try to change the system and reduce the social inequalities that had deprived them. With respect to the results by paternal occupation, we found that the children of farmers are the most likely to remain in right-wing parties with coefficients greater than 1. Farmers were a particularly conservative group as most of the left-wing proposals in the first half of the twentieth century were related to the redistribution of land, so they feared being negatively affected. The children of individuals with unknown occupations show similar results to those of farmers, which leads us to believe that to a large extent this unknown occupation is linked to land ownership. The variables on allegations to avoid military service and birth order do not present significant results, so these factors may not be decisive in the configuration of political identity. Meanwhile, literacy had a negative correlation with being left-wing. That is, a literate individual was more likely to be right-wing.

In Table 3, we have replicated the models of Table 2 (introducing height as a continuous variable in the first three and height categorized

by quartiles in the last three) but we have split the sample by sub-periods. The aim is to discover whether the impact of the individual's political activism affected all generations equally or whether the impact varied according to political conditions. The first sub-period corresponds to those men born between 1870 and 1909. These individuals were to primarily become politically prominent during the Second Spanish Republic (1931–1936), a period of great social upheaval, or in the years immediately preceding it. These were turbulent years that ended with the Spanish Civil War (1936–1939). The second sub-period selected corresponds to the men born between 1910 and 1939. Although some of them were already politically active in the period of the Second Republic, these individuals mainly participated in the municipal governments in the first democratic elections. This was in spite of the strong disincentives to participation by left-wing parties and organizations, given the severe repression they experienced during the Spanish Civil War (1936–1939) and the following post-war decades. These factors could have been fundamental in their decision to participate in future elections. Finally, the last group corresponds to the men born between 1940 and 1969, who stood for the first elections in 1977 and were relatively young, without having suffered directly from the worst period of repression under Francoism. They made up the majority of the democratic municipal governments during the final decades of the twentieth century. The literacy variable is not included in the model for the last subperiod because all individuals were literate.

The results in [Table 3](#) are consistent with those obtained in [Table 2](#) and confirm that there is a strong connection between the shortest 25% of individuals and a higher probability of having participated politically in left-wing parties. The odds even double for the intermediate period (born between 1910 and 1939). The result is particularly interesting when the study is conducted by sub-periods. First, this variable is significant for those born before 1940 (both as a continuous variable and by category). This could be due to the improvements in general living standards that improved the biological well-being of individuals, allowing them to reach the height to which they were destined regardless of socio-economic status, given that the vast majority of the population had attained the basic income levels to maintain an acceptable diet and proper care. In other words, it is possible that militancy in parties of the left or right was the result of living standards in childhood. However, the height variable is no longer a valid proxy with improvements in hygiene and diet. For example, in the 1950s, children in the study area began to drink glasses of milk in schools as part of the American aid program ([Trescastro-Lopez et al., 2013](#). For more information on the importance of this protein factor see [Baten and Blum, 2014](#)). At the same time, since the 1920s, but especially in the second half of the twentieth century, farms transitioned towards agrarian capitalism and new farms emerged in the study area, such as those that produced cow's milk for the cities, which could indirectly benefit the welfare of local consumers by giving them access to products that were previously unavailable (in relation to the relative height position of farmers see [Tollnek and Baten, 2017](#)). This idea is developed further in the Discussion section. It could also be the consequence of the smaller sample size of left-wingers of those born in the 1940s onwards (in total, 52 left-wing men and 105 right-wing men). However, the consistent tendency in the study area for height differences to disappear among those born in the second half of the twentieth century (see [Marco-Gracia and López-Antón, 2021](#); [Marco-Gracia and Ángel, 2021](#)) would more likely indicate improvements in living standards. Second, but no less important, the coefficient is much higher for those born in the subperiod 1910–1939 than for men born in the subperiod 1870–1909 (in all models the probability almost doubles, i.e., 0.760 vs. 1.188). In this sense, it is important to highlight that the Spanish Civil War and repression may have strongly discouraged the political participation of left-wing individuals (and limited it to the periods in which the left-wing parties could participate - until 1936 and from 1979 onwards), meaning only those who had suffered in their childhood and adolescence a more unfavorable situation. Again, the explanation for this scenario will be

discussed later in the Discussion section.

In [Table 4](#), we have replicated the models of [Table 3](#) but according to the individual's own professional category, differentiating between low-skilled employees (model 1, 496 observations), farmers (model 2, 350 observations) and the rest (model 3, 200 observations). We have removed the paternal occupation as an independent variable due to the risk of an overlap between the paternal occupation and the individual's occupation, which would bias the results. The results by socio-economic group are clear. Individuals in the poorest socio-economic group (low-skilled employees, which includes a large proportion of agricultural laborers) are those who show a clear statistically significant relationship between being left-wing and being short. In fact, the results confirm that being a low-skilled employee and having a height below the average was strongly linked to a higher probability of belonging to left-wing parties and organizations, not only in the shortest quartile (with a coefficient of 1.511) but also in the second quartile (1.395). In fact, the height penalty in some decades of the study reaches around 3 cm in this socioeconomic category. The farmers do not show significance in any case and the coefficients are negative. Finally, in the remaining professions, as in the case of low-skilled workers, there is a higher probability that individuals in the shortest quartile are left-leaning (with a significance of 95%) but with coefficients in the middle of the lowest socioeconomic group. Again, we find a higher probability of belonging to left-wing parties among shorter individuals. The rest of the variables are of no great interest for the purpose of this paper.

In addition to the above models, [Table A3](#) in the Appendix analyzes the effect of the father's political activism on the height of the son in the same sample. The objective is to determine whether the father's active participation in politics was able to eliminate the negative effects of social inequality in his family and, therefore, on the biological well-being of the individual studied. The results are compelling and show that, despite the father's efforts to change the system, there is still an intergenerational persistence of low living standards. The children of left-wing individuals were, on average, approximately 2.5 cm shorter than right-wing individuals. Once again, we find a strong penalty associated with the political trend that took several decades to even out until the second half of the twentieth century. This is to be expected given that the main measures to improve living standards are likely to be taken by national rather than local governments, but we wanted to confirm this through analysis. In any case, the results should be taken with caution because of our lack of knowledge of the father's true influence and the political changes that have taken place.

[Table A4](#) of the Appendix analyzes the relationship between height and political leaning, while distinguishing left-wing individuals into moderate left and far-left categories (see the Appendix for a more detailed description). Unfortunately, this differentiation is not feasible for the right-wing due to the scarcity of subjects associated with the extreme right in the study area (except during the period of the Civil War and Francoist dictatorship when it was the only political option available). The results confirm the initially proposed trends for the first subperiod, demonstrating that all left-leaning individuals exhibit significantly shorter statures. Moreover, this pattern is even more pronounced among those on the far left of the political spectrum. The differences are not significant in the case of the intermediate sub-period (due to the scarcity of far-left individuals) or for the last sub-period (as observed across all analyses).

## 6. Discussion

Our regressions in [Tables 2, 3 and 4](#) confirm that men who were shorter in stature than their contemporaries were more likely to be politically active in a left-wing party, trade union or political organization. Descriptive statistics have already clearly corroborated this trend in [Fig. 4](#). Thus, our results seem to confirm our initial hypothesis. Therefore, the main contribution of this article is to confirm at the individual level the relationship between political activism and stature

controlling for socioeconomic and family factors. Not only do we find differences in stature because right-wing and left-wing politicians come from different socioeconomic groups, but we can observe differences within the same socioeconomic group between subjects according to their political tendency.

In light of our results, it may be inferred that the unskilled group, which constitutes the shortest category, displayed a stronger inclination towards left-wing ideologies compared to other individuals. Conversely, farmers and landowners belonging to higher social categories and who were taller than unskilled workers exhibited greater height and a tendency towards right-wing preferences. This suggests that height could potentially encapsulate aspects of income and socioeconomic status. As a result, this paper validates the correlation between socioeconomic status and height, where political leanings emerge as a consequence of socioeconomic circumstances. However, our findings in Table 4 reveal that individuals with shorter stature across each socioeconomic category also tended to align more strongly with left-leaning political preferences. For instance, within the poorest group, individuals with leftist views constitute 65% of the dataset. However, when focusing on the shortest 25% of individuals, this percentage increases to 75%. Conversely, among the tallest 25%, leftist tendencies decrease to 60%, and among the top 10% of tallest individuals, they drop to below 50%. These disparities also persist across other socioeconomic groups. For example, among the shortest 25% of farmers, who are characterized by conservative tendencies as previously discussed, slightly over 20% of individuals held leftist ideologies. However, this percentage is just 5% among the top 25% of farmers.

The connection between height and the likelihood of being a left-wing activist weakened drastically with individuals born (approximately) from around the 1940s, who experienced in their childhood or adolescence during the strong Spanish development from the 1960s onwards. Moreover, as we have discussed above, in the 1950s feeding children became a fundamental priority, supported by American humanitarian aid (Trescastro-Lopez et al., 2013). All of this could have facilitated a fall in the levels of malnutrition among children and, as a result, reduced the close relationship that existed between social class and height (Martínez-Carrión et al., 2016). If living conditions improve sufficiently for all individuals to receive adequate food and care in a sufficiently hygienic context, height is no longer a good indicator of socio-economic differences (Germán, 2012; Marco-Gracia, Ángel, 2021).

There are alternative explanations for the end of the connection between short height and a greater likelihood of being a left-wing activist. One of them was proposed by Young (1958) and Piketty (2019, p. 865–66), stating that traditionally low-skilled workers felt identified with the ideas expressed by left-wing parties. Gradually, however, and especially from the 1970s onwards, left-wing parties tended to identify better with the more academically educated social groups, losing representativeness among lower-skilled workers who would be seduced in more recent decades by populist and extremist parties because they feel poorly represented by the traditional left. We can only infer this transformation to a limited extent from the available data, as the rural environment tends to be more traditional and resistant to the establishment of new political parties. In any case, both explanations (the change in electoral representativeness and nutritional improvements) may be complementary.

To isolate the effect of occupation, we have developed different models in Table 4. The results are compelling. The relationship between height and political preferences was found mainly among individuals in the lowest socio-economic group (low-skilled employees). In fact, the leftists in this group had, on average, a height penalty of almost 3.5 cm. This is an important difference considering that with all the hygienic, medical, and nutritional improvements during the century under review, height gain in the study area did not reach an extra 10 cm. Similarly, the relationship is not confirmed (at the 90% of significance level) for the farmers. They seem to be a particularly conservative group. This

leads us to believe that the poorest may have been attracted by the leftist ideas of fighting inequality. However, in the rest of the socio-economic groups this distribution is not necessarily so clear.

In a recent article, Linares-Luján and Francisco (2022) successfully identified a height penalty among all agricultural workers. Our own findings also reveal a shorter stature among agricultural laborers and farmers. However, our results only establish a significant connection with left-leaning organizational affiliations among those of lower socioeconomic status.

Finally, another point of possible complementary interest is the results in Table A3 of the Appendix. This table studies the relationship between the individual's height as a dependent variable (it is a proxy for living standards during childhood and adolescence) and the political activism of his father for the same sample as an independent variable. Again, we find a negative left-wing political activism penalty of 2.5 cm, even controlling for the socioeconomic category of the father. The children of fathers who participated in local politics continued to suffer a height penalty.

## 7. Conclusions

In this article, we have examined the relationship between a man's height and the likelihood that the same individual would have participated in politics for left-wing or right-wing parties or groupings. Our starting hypothesis was that individuals who had experienced a more deprived childhood and adolescence, and therefore with a shorter height would be more likely to have a preference for the left-wing political positions. Our results at the individual level clearly confirm this hypothesis. Individuals who participated in left-wing parties or associations (or who were elected by the left-wing Provincial Governor to serve in the local government) were, on average, more than one centimeter shorter than their right-wing counterparts. However, the significance of these differences by political tendency (and even the differences in average heights) disappears with those born from the second half of the twentieth century onwards. This was possible as a result of a general improvement in living standards which meant that height was no longer a good indicator of social differences. These results are also important because they not only confirm the relationship between height and political activism (which affects 25% of men) in the very long term, but also because we can confirm that within the same socioeconomic category there are differences in biological well-being as a function of political tendency. Our findings have indicated that, within the major socioeconomic groups, there is a tendency for right-leaning political preferences to increase as height increases. Therefore, our results not only indicate that right-wing individuals came from the better-off socioeconomic groups but also from the better-off families in the lower socioeconomic groups.

To summarize, from the results we can conclude that historically, and especially in the troubled first half of the twentieth century, left-wing individuals who were active in local politics and social life (not necessarily MPs and upper class) most likely came from families that had suffered more deprivation, and their motivations for active participation may have been related to combating the social inequality they had suffered.

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## CRediT authorship contribution statement

During the preparation of this work the author(s) used ChatGPT in

order to check grammar and spelling of some paragraphs of the article in English. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

**Data Availability**

Data will be made available on request.

**Declaration of Competing Interest**

None.

**Appendix**

TABLE A1. Distribution of observations by subperiod, literacy and father’s occupation.

**Table A1**  
Characteristics of the sample in relation to the average height, 1046 observations.

	Variables	Cases	%	Average height cm	Standard deviation
<b>SUBPERIOD 1870–1909</b>					
Political position	Right-wing	170	29.1	164.5	0.401
	Left-wing	414	70.9	163.5	0.281
Literacy	Illiterate	37	6.4	164.1	0.576
	Literate	409	70.0	163.8	0.280
	Unknown	138	23.6	163.8	0.497
Father’s occupation	Low skills employee	390	66.9	163.8	0.285
	Farmer	45	7.7	164.0	0.793
	Artisan	2	0.3	156.8	4.700
	Upper class	2	0.3	168.2	0.590
	Other or unknown	145	24.8	164.1	0.445
<b>SUBPERIOD 1910–1939</b>					
Political position	Right-wing	208	68.2	167.4	0.461
	Left-wing	97	31.8	164.9	0.624
Literacy	Illiterate	7	2.4	168.3	1.144
	Literate	214	70.0	166.4	0.445
	Unknown	84	27.6	166.8	0.756
Father’s occupation	Low skills employee	117	38.4	166.6	0.550
	Farmer	74	24.3	166.1	0.748
	Artisan	9	2.9	168.3	0.807
	Upper class	4	1.2	172.0	2.013
	Other or unknown	101	33.2	166.6	0.755
<b>SUBPERIOD 1940–1969</b>					
Political position	Right-wing	121	77.1	168.4	0.606
	Left-wing	36	22.9	168.7	0.763
Literacy	Illiterate	0	0.0	-	-
	Literate	82	52.2	169.3	0.640
	Unknown	75	47.8	167.7	0.700
Father’s occupation	Low skills employee	60	38.2	167.8	0.780
	Farmer	56	35.7	169.3	0.716
	Artisan	22	14.0	168.2	1.891
	Upper class	5	3.2	169.4	2.381
	Other or unknown	14	8.9	168.7	1.390
<b>LITERATE</b>					
Political position	Right-wing	357	50.6	166.5	0.312
	Left-wing	348	49.4	164.0	0.331
Father’s occupation	Low skills employee	362	51.4	164.9	0.318
	Farmer	113	16.0	166.8	0.581
	Artisan	20	2.8	167.2	0.975
	Upper class	6	0.9	168.5	3.072
	Other or unknown	204	28.9	165.3	0.439
Birth decade	1870	10	1.4	161.5	2.504
	1880	26	3.7	162.3	1.011
	1890	122	17.3	162.7	0.434
	1900	253	35.9	164.5	0.371
	1910	81	11.5	165.8	0.743
	1920	69	9.8	166.1	0.704
	1930	64	9.1	166.8	0.804
	1940	27	3.8	168.8	0.907
	1950	38	5.4	168.9	1.078
	1960	15	2.1	171.4	1.178
<b>ILLITERATE</b>					
Political position	Right-wing	10	22.7	163.6	2.198
	Left-wing	34	77.3	163.8	0.721
Father’s occupation	Low skills employee	27	61.4	164.7	0.692
	Farmer	1	2.3	166.5	-

(continued on next page)

Table A1 (continued)

	Artisan	0	0.0	-	-
	Upper class	0	0.0	-	-
	Other or unknown	16	36.3	161.5	1.527
Birth decade	1870	1	2.3	169.0	-
	1880	8	18.2	161.8	0.617
	1890	14	31.8	163.4	0.656
	1900	13	29.6	162.1	1.930
	1910	6	13.6	167.1	1.130
	1920	2	4.5	172.0	0.000
	1930	0	0.0	-	-
	1940	0	0.0	-	-
	1950	0	0.0	-	-
	1960	0	0.0	-	-
<b>LOW SKILL EMPLOYEES</b>					
Political position	Right-wing	197	34.7	165.3	1.790
	Left-wing	370	65.3	164.1	0.300
Literacy	Illiterate	27	4.8	164.7	0.692
	Literate	362	63.8	164.9	0.318
	Unknown	178	31.4	164.7	0.454
Birth decade	1870	2	0.4	167.5	1.500
	1880	11	1.9	161.0	1.485
	1890	124	21.9	162.0	0.420
	1900	248	43.7	164.5	0.376
	1910	70	12.3	166.6	0.577
	1920	14	2.5	165.7	1.941
	1930	29	5.1	166.9	1.273
	1940	26	4.6	165.1	1.211
	1950	26	4.6	169.3	1.301
	1960	17	3.0	169.1	1.187
<b>FARMERS</b>					
Political position	Right-wing	126	72.0	167.4	0.575
	Left-wing	49	28.0	166.0	0.672
Literacy	Illiterate	1	0.6	166.5	-
	Literate	113	64.6	166.8	0.581
	Unknown	61	34.9	167.5	0.747
Birth decade	1870	6	3.4	162.0	2.640
	1880	4	2.3	160.0	0.000
	1890	1	0.6	166.5	-
	1900	36	20.6	165.1	1.014
	1910	23	13.1	164.1	1.640
	1920	19	10.9	165.6	1.231
	1930	36	20.6	168.3	0.877
	1940	23	13.1	168.9	1.198
	1950	16	9.1	169.9	0.835
	1960	11	6.3	169.4	1.790

Source: Conscription and call-up records; historical municipal archives from municipalities composing the anthropometric sample and conscription records of the Military Archive of Guadalajara (Spain).

TABLE A2. Distribution of observations by political group.

Table A2  
Characteristics of the sample in relation to the average height, 1046 observations.

	Variables	Cases	%	Average height cm	Standard deviation
<b>FIRST-PERIOD SOCIALIST (INCLUDING THE UGT ORGANIZATION)</b>					
Literacy	Illiterate	3	1.5	162.9	0.447
	Literate	131	66.2	166.3	3.666
	Unknown	64	32.3	164.8	0.743
Father's occupation	Low skills employee	141	71.2	163.7	0.470
	Farmer	11	5.6	165.4	1.069
	Artisan	3	1.5	165.6	1.921
	Upper class	1	0.5	176.0	-
	Other or unknown	32	21.2	162.0	0.790
<b>ANARCHIST</b>					
Literacy	Illiterate	0	0.0	-	-
	Literate	8	66.6	166.4	0.752
	Unknown	4	33.4	165.5	1.658
Father's occupation	Low skills employee	4	33.3	164.0	0.577
	Farmer	1	8.3	162.0	-
	Artisan	1	8.3	168.0	-
	Upper class	0	0.0	-	-
	Other or unknown	6	50.0	167.9	0.416
<b>REPRESSED MEN</b>					
Literacy	Illiterate	28	8.8	164.2	0.573
	Literate	184	57.7	164.4	0.448
	Unknown	107	33.5	164.4	0.562

(continued on next page)

Table A2 (continued)

Father's occupation	Low skills employee	252	79.0	164.4	0.365
	Farmer	18	5.7	166.7	0.930
	Artisan	2	0.63	151.0	8.000
	Upper class	0	0.0	-	-
	Other or unknown	47	14.73	164.2	0.782
RIGHT-WING PEOPLE DURING THE SPANISH SECOND REPUBLIC					
Literacy	Illiterate	4	2.3	163.5	0.377
	Literate	129	75.9	164.8	0.458
	Unknown	37	21.8	163.8	0.843
Father's occupation	Low skills employee	95	55.9	163.3	0.529
	Farmer	19	11.2	163.6	1.015
	Artisan	0	0.0	-	-
	Upper class	1	0.6	169.5	-
	Other or unknown	55	32.3	167.1	0.597
LOCAL GOVERNMENT DURING THE FRANCOISM					
Literacy	Illiterate	5	1.6	167.2	1.745
	Literate	233	76.4	166.5	0.361
	Unknown	67	22.0	167.7	0.837
Father's occupation	Low skills employee	112	36.7	165.9	0.482
	Farmer	69	22.6	166.5	0.765
	Artisan	0	0.0	-	-
	Upper class	13	4.3	167.8	0.834
	Other or unknown	111	36.4	167.7	0.597
PARTIDO POPULAR (PP) OR UNIÓN DE CENTRO DEMOCRÁTICO (UCD) – RIGHT-WING PARTY					
Literacy	Illiterate	0	0.0	-	-
	Literate	63	62.4	168.9	0.734
	Unknown	38	37.6	168.8	1.058
Father's occupation	Low skills employee	38	37.6	169.0	1.020
	Farmer	30	29.7	170.0	1.081
	Artisan	8	7.9	167.5	1.425
	Upper class	2	2.0	164.5	7.500
	Other or unknown	23	22.8	168.5	1.230
PARTIDO ARAGONÉS (PAR) – RIGHT-WING PARTY					
Literacy	Illiterate	0	0.0	-	-
	Literate	60	59.4	166.7	0.820
	Unknown	41	40.6	168.2	1.029
Father's occupation	Low skills employee	32	31.7	166.6	1.273
	Farmer	43	42.6	168.0	0.960
	Artisan	4	4.0	169.3	2.939
	Upper class	1	1.0	175.0	-
	Other or unknown	21	20.7	166.2	1.251
PARTIDO SOCIALISTA OBRERO ESPAÑOL (PSOE) – LEFT-WING PARTY					
Literacy	Illiterate	0	0.0	-	-
	Literate	52	55.3	167.4	0.828
	Unknown	42	44.7	167.2	1.028
Father's occupation	Low skills employee	36	38.3	166.6	1.298
	Farmer	24	25.5	167.6	0.932
	Artisan	11	11.7	169.6	1.995
	Upper class	7	7.5	168.0	1.813
	Other or unknown	16	17.0	166.7	1.732
OTHER LEFT-WING PARTIES					
Literacy	Illiterate	0	0.0	-	-
	Literate	7	70.0	170.6	1.917
	Unknown	3	30.0	166.0	1.732
Father's occupation	Low skills employee	6	60.0	170.0	2.000
	Farmer	2	20.0	164.7	1.250
	Artisan	1	10.0	-	-
	Upper class	1	10.0	-	-
	Other or unknown	0	0.0	-	-

Source: Conscription and call-up records; historical municipal archives from municipalities composing the anthropometric sample and conscription records of the Military Archive of Guadalajara (Spain).

TABLE A3. Father's political postion.

In the Appendix we have conducted five ordinary least squares (OLS) linear regressions with heteroskedasticity-robust estimations to study the effect on height of the father's political activism (can we observe an increase in children's well-being if the father is participating or participated in politics? did realizing social inequality and trying to fight it have direct effects on his family?). We have taken height as a dependent variable. Obviously, despite the father having power in the local government, the measures that he could take were limited but could perhaps be more effective than expected. Perhaps, even through political activity and discussing ideas, the father could become more aware of some of the problems associated with low living standards and try to combat them at the family level in the case of his children. The models can be expressed as follows:

$$y_i = \beta_1 * X_{1i} + \beta_2 * X_{2i} + \beta_3 * X_{3i} + \dots + \epsilon$$

We have developed four hierarchical OLS linear regressions with heteroskedasticity-robust estimation models. In these models, the dependent variable is the height of the conscript. In the first model we only include the political tendency and control for the decade of birth. In the second model, we build on the first one, but also control for the village of birth. In the third model, we build on the second model, and introduce variables linked to the father's occupation and the individual's literacy. Finally, in the fourth model we have also included the claims to avoid military service and the

individual's birth order. This is a simple analysis, but it tests some ideas for the first time in the research.

**Table A3**  
Determinants of height in relation to the political position of the father in rural Aragon, birth cohorts 1870–1969.

		(1)	(2)	(3)	(4)
Father's political position	Right-wing	(ref.)			
	Left-wing	-2.541 * ** (0.92)	-2.385 * * (0.94)	-2.684 * ** (0.96)	-2.660 * ** (0.95)
Father's occupation	Low-skilled employee	(ref.)			
	Farmer			-0.443 (0.94)	0.231 (0.95)
	Artisan			-0.673 (2.15)	-0.012 (2.12)
	Upper class			2.460 (1.97)	2.674 (1.93)
	Other or unknown			-0.067 (2.15)	0.574 (1.03)
Literacy	No	(ref.)			
	Yes			5.239 * (2.66)	6.739 * ** (2.65)
	Unknown			6.332 (2.83)	8.539 (2.82)
Appeals for exemption	No appeal (fit to serve)	(ref.)			
	Physical appeals				-4.734 * ** (1.90)
	Social appeals				-1.573 (3.66)
Birth order	1	(ref.)			
	2				-0.688 (0.98)
	3				1.034 (1.04)
	4				3.175 * ** (1.38)
	5 or more				2.229 * (1.23)
Village fixed effects	NO		YES	YES	YES
Decade of birth fixed effects	YES		YES	YES	YES
	Intercept	169.491 * ** (1.56)	165.277 * ** (1.94)	160.862 * ** (2.97)	159.239 * ** (2.93)
	Sample size	320	320	320	320
	R-sq	0.175	0.267	0.288	0.338

Source: Parish and municipal registers.

Notes: *se* denotes robust standard error. \* Statistical significance at 10% level, \*\* at 5% level. \*\*\* at 1% level.

The results are compelling and demonstrate that, despite the father's efforts to change the system, there is still an intergenerational persistence of low living standards. The children of left-wing individuals were, on average, approximately 2.5 cm shorter than right-wing individuals. Once again we find a strong penalty associated with the political trend that took several decades to even out until the second half of the twentieth century. This is to be expected given that the main measures to improve living standards are likely to be taken by national rather than local governments, but we wanted to confirm this through analysis. In any case, the results should be taken with caution because of our lack of knowledge of the father's true influence and the political changes that have taken place. Regarding the rest of the results of the variables in the model, we find that the father's occupation ceases to be significant when we introduce the variable on political tendency (although this could also be the consequence of the small sample size available). Literacy shows a very positive correlation with height (between 5 and 7 cm), perhaps due to the fact that parents who could not afford the small co-payments to take their children to school (or preferred them to go to work) were also those who could not afford to provide them with an adequate diet. Physical requests (accepted) to evade military service also seem to have had a negative impact of almost 5 cm on stature, possibly as a result of a less adequate diet among sons and families who could not fully access the labor market. Finally, birth order could have had a positive effect as a consequence of the family's own improved economic situation as it reached maturity, although these results should be taken with great caution and confirmed in future studies.

TABLE A4. Right, left and far-left positions.

In Table A4, we build upon the model in Table A3, but instead of using the father's political positioning, we have included the individual's political leaning, separating left-leaning individuals into "left" and "far-left" categories. For those born before 1925, we have classified those previously considered as left-leaning and associated with anarchist organizations (CNT, only 12 individuals) or socialists (UGT - PSOE, 198 individuals) as "far-left." Meanwhile, for those who participated in local democratic elections starting from 1977, we have designated individuals who stood as candidates for Izquierda Unida and Chunta Aragonesista as "far left." In the villages studied, no candidates from other extreme left or extreme right formations ran for office. Overall, in Table A4, we have examined four models with height as the dependent variable and political participation as an independent variable. We have also included the father's occupation, literacy, and appeals for exemption as independent variables. Additionally, we have controlled for birth village and birth decade. The first model corresponds to the entire study period, while models 2–4 correspond to each of the sub-periods proposed in the previous tables.



**Table A4**  
Determinants of height in relation to the political position of the father in rural Aragon, birth cohorts 1870–1969.

		(1)	(2)	(3)	(4)
Father's political position	Right-wing	(ref.)			
	Left-wing	-0.981 ** (0.45)	-0.558 * (0.59)	-2.203 ** (0.96)	0.061 (1.20)
	Far-left-wing	-2.081 *** (0.55)	-1.824 *** (0.64)	-1.303 (1.60)	-1.805 (2.40)
Father's occupation	Low-skilled employee	(ref.)			
	Farmer	0.366 (0.57)	0.988 (0.98)	-0.262 (1.05)	1.459 (1.16)
	Artisan	0.503 (1.09)	-3.641 (2.14)	1.653 (2.04)	1.073 (1.93)
	Upper class	0.924 (1.83)	2.230 (4.14)	4.966 (6.33)	0.664 (2.52)
	Other or unknown	0.182 (0.51)	-0.038 (0.75)	0.004 (1.00)	0.303 (1.64)
	Literacy	No (ref.)			
	Yes	0.100 (0.94)	0.547 (1.02)	2.099 (2.31)	
	Unknown	0.490 (1.01)	1.105 (1.17)	-0.684 (2.44)	
Appeals for exemption	No appeal (fit to serve)	(ref.)			
	Physical appeals	-2.632 ** (0.88)	-0.289 * (1.22)	-5.420 ** (1.60)	-3.974 (2.45)
	Social appeals	-1.819 (1.73)	-2.241 (2.33)	-2.793 (3.10)	-0.268 (6.28)
Village fixed effects	YES	YES	YES	YES	
Decade of birth fixed effects	YES	YES	YES	YES	
	Intercept	162.954 *** (1.64)	162.655 *** (1.82)	166.260 *** (2.78)	163.374 *** (4.76)
	Sample size	1046	584	305	157
	R-sq	0.172	0.116	0.165	0.135

Source: Parish and municipal registers.

Notes: *se* denotes robust standard error. \* Statistical significance at 10% level, \*\* at 5% level. \*\*\* at 1% level.

The results significantly show that individuals on the far left appear to be notably shorter. However, when conducting sub-period analysis, we find that this association is only significant for the first sub-period. This could be due to the minimal sample size of far-left individuals in the second sub-period and the loss of significance in the third sub-period, consistent with the results of previous models.

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