Revista de Historia Económica / Journal of Iberian and Latin American Economic History (2025), **43**, 217–238
doi:10.1017/S0212610925100554

CAMBRIDGE UNIVERSITY PRESS

ARTICLES/ARTÍCULOS

Within-family educational inequalities in 20th-century Spain

Miguel Requena

Departamento de Sociología II, Universidad Nacional de Educación a Distancia, Madrid, Spain
Email: mrequena@poli.uned.es

(Received 2 August 2023; revised 22 February 2024; accepted 29 February 2024; first published online 6 August 2025)

Abstract

This paper assesses the change over time of within-family inequality in the educational outcomes of Spaniards by measuring the effects of birth order on the number of years of formal education attained in families of different sizes. The analysis is based on data from the 1991 Sociodemographic Survey, adopts the perspective of cohort analysis, and looks at those born in the first six decades of the 20th century. The data reveal that the effects of both the number of siblings and, above all, birth order increased over the cohorts. This means that educational inequalities within Spanish families tended to grow in contrast to inequalities between families in a period of great expansion of the education system. Although the Spanish experience may have differed from that of other developed countries, it fits well within the theoretical framework of conditional dilution of parental resources associated with the number of siblings and birth order.

Keywords: educational attainment; educational expansion; number of siblings; birth order; cohorts

JEL classifications: I2; J1; N3

Resumen

Este artículo evalúa el cambio en el tiempo de la desigualdad intrafamiliar de los resultados educativos de los españoles. Para ello se miden los efectos del orden de nacimiento en el número de años de educación formal conseguidos por los hermanos nacidos en familias de tamaño diferente. El análisis se basa en los datos de la Encuesta Sociodemográfica de 1991, adopta la perspectiva del análisis de cohortes y observa a los nacidos en las seis primeras décadas del siglo veinte. Los datos revelan que los efectos tanto del número de hermanos como, sobre todo, del orden de nacimiento aumentaron con el paso de las cohortes. Eso significa que, en un periodo de gran expansión del sistema educativo, las desigualdades educativas dentro de las familias españolas tendieron a crecer a diferencia de lo que ocurrió con las desigualdades entre familias. Aunque la experiencia española puede haber sido diferente de la de otros países desarrollados, encaja bien en el marco teórico de la dilución condicional de los recursos parentales asociada al número de hermanos y el orden de nacimiento.

Palabras clave: logro educativo; expansión educativa; número de hermanos; orden de nacimiento; cohortes

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https://doi.org/10.1017/S0212610925100554 Published online by Cambridge University Press

1. Introduction

The expansion of the education systems is one of the main correlates of the processes of sociocultural modernization and economic development that have taken place in all advanced societies for at least the last 150 years. As is well known, Spanish society underwent a dramatic educational enlargement during the 20th century. In terms of supply, the education system grew following a trend toward continuous expansion; in terms of demand, there were sustained advances in access to formal education for increasing fractions of the population. Four main milestones marked the trajectory of change (Requena and Bernardi, 2005): the almost entire eradication of illiteracy, the full schooling of children, the extension of compulsory education, and the unprecedented increase in access to university education in the country. The educational panorama in Spain at the beginning of the 20th century was that of a country with a predominantly rural base, archaic in its economic and productive structure, underdeveloped in terms of its cultural facilities, and fragmented by flagrant social inequalities. At the start of the last century, more than half of the Spanish population was illiterate. The school experience was alien to almost half of the boys, who began their working lives at a very early age, and even more alien to girls, traditionally excluded from access to formal education. Spain was, at that time, a backward country in terms of its educational level compared to other European countries. Thanks to the change, the Spanish population reached an aggregate educational level similar to that of these countries by the end of the century.

The secular process of human capital growth in the Spanish population has been extensively studied by the specialized literature (Núñez, 1992; Reher, 1997; Viñao, 2004). Many of its characteristics have been dealt with in depth and are beginning to be well understood. Among others, for example, regional disparities in the rates of growth of literacy and schooling (Beltrán Tapia and De Miguel Salanova, 2021; Reher, 2022), the impact of institutions and public policies on the educational expansion process (Viñao, 2012) or the contribution of the increase in human capital to the country's economic growth (Prados de la Escosura and Rosés, 2010). The impact of educational expansion on inequality has also deserved the attention of scholars in various fields, such as income or class inequalities (Carabaña, 1983), gender inequality (Flecha, 2014), educational inequality itself (Bernardi and Requena, 2007), or social mobility (Carabaña, 1999; Beltrán Tapia and De Miguel Salanova, 2021). These analyses of the relationship between educational expansion and inequality have mainly focused on inequalities between (individuals from different) families. Results from these studies indicate that expanding education in Spain led to a reduction in educational and other forms of inter-family inequality (Ballarino *et al.*, 2009).

Nevertheless, one aspect overlooked in this literature is how educational expansion affected inequalities within families, particularly between siblings. The intra-family dimension of inequalities can be very relevant for understanding people's socioeconomic position. According to Conley (2004), a significant part of the observed socioeconomic inequality in contemporary societies occurs between siblings from the same families. More generally, abundant evidence has been found in different historical periods and societies that dissimilar cognitive, psychological, behavioral, social, and economic outcomes are conditioned by sibship size and sibling position. Despite this wide evidence, in Spain, very few studies have considered the unequal social and economic outcomes achieved by siblings from the same families;[1] and even fewer studies have considered, at the same time, the two crucial factors that shape sibling inequality: birth order and number of siblings. Carabaña

[1] Pujadas et al. (2018) found that in the Barcelona area in the 16th and 17th centuries, first-married siblings were the maximal inheritors of parental status in all social groups, but especially among farmers and artisans. On the other hand, Ramón Muñoz and Ramón Muñoz (2016) found no evidence that number of siblings affected

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(2004) reported on the extent to which the number of siblings depressed educational levels and showed how this negative association increased over time in 20th-century Spain. In a later work, the same author (Carabaña, 2013) demonstrated that the number of siblings was a relevant factor in the transition to upper secondary education. Requena (2022) has recently considered jointly how birth order and number of siblings influenced the educational attainment of those cohorts born in the first six decades of the 20th century. Reported findings from this study confirm the negative association of birth order and number of siblings with educational attainment among the observed population: both the number of siblings and birth order have been essential and relatively independent factors reducing the educational attainment of Spaniards and producing inequality between siblings. This latter work, however, does not provide a detailed analysis of the change over time in the associations between family position and educational attainment in families of different sizes.

This paper aims to address that task, filling the corresponding gap in the literature. Its main objective is to analyze whether the observed effect of family size and position on educational attainment in Spain has changed over the 20th century, precisely when the significant expansion of the educational system took place. Did inequality between siblings in Spain grow with the expansion of the education system? Was family position and size more or less determinant of educational outcomes due to the modernization of education? Although the literature on family position and educational outcomes is abundant, there are no systematic studies available that analyze the change over time of these effects. In principle, as formal education becomes more societally relevant because of the expansion of the education system, inequalities within families will be more pronounced. The effects of family position on educational outcomes and intra-family inequalities may become more visible when educational expansion provides access to formal education not only to a small, privileged minority but to most people. On the other hand, the expansion of education systems could have counteracted the impact of birth order and number of siblings on educational outcomes. In a recent study on the Swedish case (Barclay, 2018), it was found that during periods of educational expansion, younger siblings tend to spend longer in the educational system than older siblings.

To answer these questions, data from the Sociodemographic Survey (SDS) will be used (INE, 1993), and the cohort analysis approach will be adopted. The rest of this article is organized as follows. First, the background to the issue under analysis and the potential relevance of change over time are shown. Then, the interest of the Spanish case is presented and defended. Next, the data and methods used for the analysis are detailed. Afterward, the main findings are reported and, finally, the main conclusions are stated.

2. Background

The number of siblings and birth order can have consequences of many different kinds: cognitive, behavioral, psychological, demographic, social, and economic; but the educational effects stand out. There is a large body of evidence that family size and position are good predictors of educational outcomes in different countries and historical periods. At least in developed societies, the number of siblings and birth order are inversely related to educational attainment. The fewer siblings there are and the lower their ordinal position among the siblings, the greater and better the educational outcomes. Siblings from small families are more likely to achieve higher levels of education than siblings from large families. Later-born siblings perform worse academically than their earlier-born siblings (Barclay, 2015;

biological standards of living as measured by the stature of men born in an industrial town of Barcelona between 1860 and 1920.

https://doi.org/10.1017/S0212610925100554 Published online by Cambridge University Press

Black *et al.*, 2005; Blake, 1989; Conley, 2004; DE Haan, 2010; Hauser and Wong, 1989; Iacovou, 2007; Kuo and Hauser, 1997). Some of these studies, particularly those using within-family fixed effects models, allow for a causal interpretation of the relationship between birth order and educational outcomes. Regarding the causes, a recent study (Isungset *et al.*, 2022) has shown that the educational gradient associated with birth order is not dependent on biological differences present at birth. The cognitive advantages of older children—visible at very early ages (Lehmann *et al.*, 2018)—are due to differences in parental behavior in terms of quality time spent with children (Price, 2008), disciplinary strategies (Hotz and Pantano, 2015), early maternal attitudes, and behaviors (Lehmann *et al.*, 2018), and parental investments as measured by the quality of the family environment (Pavan, 2016).

Three main theories have tried to explain the negative effect of family size and position on educational outcomes. The sociological theory of the dilution of family resources (Blake, 1981, 1989) predicts that the allocation to each child of family money, energy, time, attention and care of parents, and other goods (such as space at home) is a negative function of the number of siblings: young children and/or those with more siblings are at a disadvantage compared to older children and/or those with few siblings because competition for family resources is necessarily greater among the former. The confluence theory (Zajonc and Markus, 1975) argues that the intellectual development of siblings—and, by implication, their educational outcomes—depends on the family cognitive environment, which, measured by the average mental age of all members of the household, necessarily decreases with the arrival of each new child in the family. The economic theory of human capital (Becker and Tomes, 1976; Hanushek, 1992) argues that the quality of children—measured by their educational attainment or future income—depends on the investments their parents make in them. Due to financial constraints, parents will choose between fewer children to invest more or more children to invest less. This trade-off between quality and quantity of children implies that the more children the parents have, the lower their average quality will be.

These theoretical frameworks are neither contradictory nor incompatible, offering complementary perspectives on the educational effects of sibling position and family size. However, all three frameworks may be too simplistic to understand how and why the relationship between family size and sibling outcomes varies over time and space, particularly if sibling outcomes are not solely or primarily dependent on the resources provided by their parents. Another possibility is that the connection between parental resources and child outcomes is mediated by factors that change from one historical or sociocultural context to another. Different scenarios may change the provision of non-familial resources for children. As a result of these processes, economic circumstances, cultural norms, demographic realities, social practices, or institutional settings set the range of variation in which family configuration operates and may induce different outcomes among siblings. The conditional resource dilution model (Downey, 2001; Gibbs *et al.*, 2016) explicitly recognizes that these non-family resources can counteract the impact of family resource dilution. The association between children's educational attainment and family size and position may be conditioned by non-family sources of resources. It may also happen that families with unequal social standing can mobilize resources for their children's educational outcomes in different ways. Better-off families, for example, may seek to mitigate the negative effects of birth order or number of siblings by implementing compensatory strategies for children who are otherwise more likely to attain lower levels of education. Some studies (Grätz, 2018) suggest that the negative effects of higher birth orders on educational attainment are concentrated in families with low socioeconomic status. Still, evidence to the contrary has also been found (Härkönen, 2014). Spanish parents in high socioeconomic statuses were able to limit the effects of dilution of resources induced by the number of siblings, but not the dynamics of the dilution associated with the birth order (Requena, 2022).

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Things are more complicated in the developing world, where the conditioning of educational outcomes by family size and position may operate differently and more complexly than in developed countries. While there are studies that find clear negative educational effects of birth order—for example, in Mexico (Esposito *et al.*, 2020)—in other contexts the impact may be more intricate: for example, in sub-Saharan Africa (Kravdal *et al.*, 2013; Tenikue and Verheyden, 2010), Vietnam (Anh *et al.*, 1998), or Indonesia (Maralani, 2008; Feng, 2021). There are other Asian, African, and American cases—India (Kumar, 2016), Kenya (Buchmann, 2000), Botswana (Chernichovsky, 1985), Brazil (Marteleto and DE Souza, 2012)—where a positive relationship between a number of siblings and educational attainment has been found. However, even in developed countries, historical and social contexts matter (Bras *et al.*, 2010). For example, community networks often linked to ethnic/religious groups may mediate the association between sibship size, family position, and educational outcomes. In some ethnic groups, where parental resources are complemented by extended family resources, size and position in sibling groups do not play a negative role in educational achievement (see Gibbs *et al.*, 2016 for different religious groups in the United States; or Shavit and Pierce, 1991 for Arabs and Jews in Israel). Political institutions can play their part, as revealed by specific differences between Italy and France (Ferrari and Dalla Zuana, 2010). Weak or non-existent effects of family size on sibling outcomes in adulthood have been observed in countries with long social democratic traditions, where generous and universalistic social benefits are available (Park, 2008; Xu, 2008).

3. Change over time and the Spanish case

The theoretical framework of conditional resource dilution invites consideration of changes over time in the relationship between a number of siblings, birth order, and educational outcomes. If the impact of family configuration on educational attainment depends on the circumstances in which families live, change over time offers a good opportunity to evaluate this theoretical framework and to pinpoint the contextual factors that may modify the basic relationship between family and education. The historical context of demographic transition, social modernization, and economic development seems particularly attractive in this respect as it implies changes that affect both the structure of families and their shifting societal circumstances. Without being exhaustive, two aspects of modernization processes are particularly relevant here. One is the expansion of education systems and the policies that made it possible. Another is the transformation of families in terms of their size, which followed the demographic transition and other related societal processes. These transformations raise important questions. For this study, the crucial one is how, if at all, the relationship between the number of siblings and ordinal position and education changes in the new context of small family sizes and expanded education systems typical of post-transitional populations.

The evidence accumulated on how the associations between intra-family characteristics and schooling changed over time due to modernization processes is not entirely conclusive. Gibbs *et al.* (2016) detected a decline in the association between the number of siblings and educational attainment during the first half of the 20th century in the United States and attributed this waning to the development of welfare policies supporting public education. Increasing public spending on educational programs reduced the constraints on families' access to education and reduced the extent of the dilution of family resources among American families. China is another interesting case suggesting the same type of contextual influences. Lu and Treiman (2008) found significant fluctuations in the effect of the number of siblings on educational attainment depending on educational policies. While egalitarian policies (during early communism and the Cultural Revolution) tended to reduce the effect of a number of siblings, competitive policies (in the pre-communist

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era and during post-Mao economic reform) increased it.[2] This argument is consistent with Park's (2008) study on the important role that public policies supporting childcare, universal child benefits, and large public spending packages on education and families play in mitigating the educational disadvantages of large families. To support the thesis, Park offers data on 20 OECD countries with different types of welfare regimes from the Program for International Student Assessment (PISA) database. The case of Hong Kong, previously analyzed by Post and Pong (1998), is relatively similar and supports this thesis.

On the other hand, evidence from Thailand (Knodel *et al.*, 1990; Knodel and Wongsith, 1991) and Taiwan (Hermalin *et al.*, 1982; Parrish and Willis 1993) shows increasingly negative relationships between family size and educational attainment throughout socioeconomic development. Marteleto (2010) found that in Brazil number of siblings was inversely related to adolescent's educational attainment and this inverse relationship became stronger for adolescents born after the demographic transition. Siblings from large families who grew up in the post-transitional environment of small families experienced greater relative disadvantage than their counterparts in the pre-transition cohorts. The overall reduction in family size did not contribute to reducing the disadvantage of siblings from large families, but instead increased it. At least in Brazil, the demographic transition seems to have intensified educational differences between siblings. An equally interesting case is Peninsular Malaysia, where Sudha (1997), using data collected in the mid-1970s and late 1980s, found among younger generations a negative effect of the number of siblings on educational attainment that reversed the positive effect observed among older generations. However, when decomposing the analysis by ethnic groups, the author found that this negative effect for the whole population was only found among the Chinese and Indian subgroups, but not among the Malays, the beneficiaries of the state affirmative action policies for education. In other words, subsidizing the education of ethnic Malay families mitigated the dilution of resources among them.

The difficulties limiting the comparability of these studies stem mainly from the fact that they use different methodological designs and non-equivalent data. One obvious reason for the disparity between the cases, in addition to the large cultural and economic distance between the countries compared, is the different moments of expansion of their respective education systems. Take, for example, the case of the United States and Brazil. While the range of variation of the American cohorts analyzed by Gibbs and co-authors (2016) goes from 9.8 years of schooling at the beginning of the 20th century to 13.8 for those born in 1970–1979, the two Brazilian cohorts compared by Marteleto (2010) increased their years of education from 3.4 (born in 1963) to 4.7 (born in 1983). It is quite clear that the degree of expansion of the Brazilian education system in the 1960s was far from the American educational outcomes at the beginning of the century.

Another different limitation of these studies, also due to the characteristics of the available data, is that they only took into account family size, but not birth order. The two dimensions are closely related, but they are not the same and for both theoretical and empirical reasons need to be disentangled (Rodgers *et al.*, 2000; Booth and Kee, 2009; DE Haan, 2010; Iacovou, 2007). In a more recent study on the impact of educational expansion on the Swedish population, Barclay (2018) considered both the number of siblings and birth order and estimated fixed-effect models (within-family comparisons). His paper finds that, although the net effect of birth order on educational attainment is negative, when educational opportunities increase as a result of system growth, this negative impact is cancelled out and even reversed by positive secular trends toward educational expansion. When opportunities for education expand, later-born siblings do better.

[2] The reality is certainly more complex because the consequences of policies are different for girls and boys and for rural and urban areas.

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Table 1. Average years of education, number of siblings, and birth order by birth cohort in Spain

		Years of education			Number of siblings			Birth order		
Birth Cohort	N	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
<1910	5,847	3.85	3.55	0.92	4.79	2.32	0.48	2.54	1.72	0.68
1910–4	5,028	4.29	3.56	0.83	4.76	2.35	0.49	2.68	1.75	0.65
1915–9	7,916	4.58	3.61	0.79	4.88	2.35	0.48	2.71	1.78	0.66
1920–4	10,579	4.92	3.59	0.73	4.82	2.38	0.50	2.69	1.78	0.66
1925–9	11,398	5.08	3.80	0.75	4.69	2.26	0.48	2.71	1.74	0.64
1930–4	10,951	5.34	3.99	0.75	4.46	2.25	0.51	2.67	1.78	0.66
1935–9	8,212	5.78	4.15	0.72	4.35	2.27	0.52	2.76	1.83	0.66
1940–4	7,829	6.67	4.26	0.64	4.16	2.19	0.53	2.49	1.70	0.68
1945–9	8,891	7.42	4.34	0.58	4.05	2.18	0.54	2.49	1.69	0.68
1950–4	10,181	8.46	4.59	0.54	3.98	2.17	0.55	2.40	1.62	0.67
1955–9	13,775	9.69	4.53	0.47	3.91	2.12	0.54	2.34	1.57	0.67
1960–4	14,931	10.99	4.29	0.39	3.86	2.07	0.54	2.37	1.59	0.67
1965–6	5,241	11.70	4.30	0.37	3.75	1.91	0.51	2.39	1.59	0.66
Total	120,779	6.88	4.65	0.68	4.25	2.23	0.53	2.53	1.70	0.67

Values represented as means, standard deviations (SD), and coefficients of variation (CV). 1991 Sociodemographic Survey (Instituto Nacional de Estadística).

The Spanish 20th century provides a good context for assessing how the process of resource dilution is conditioned by changing historical circumstances. Throughout the century, Spanish society underwent a process of social, economic, political, and cultural modernization of considerable consequences. The economic and productive structure changed radically with the transition from an agrarian to an industrial and service economy (Nicolau, 2005). Economic growth (Prados de la Escosura, 2017), although discontinuous, substantially raised the material standard of living of the people. Health standards improved, mortality was reduced, and longevity increased (Pérez Moreda *et al.*, 2015). Fertility also declined after a moderate baby boom and the country ended up entering a regime of very low fertility (Reher and Requena, 2015; Requena, 1997; Requena and Salazar, 2014). The health transition and the fertility transition completed the demographic transition.

Two important correlates of the processes of economic development and social modernization in the country were (1) the decrease in family size because of the sharp drop in fertility and (2) the tremendous expansion of the educational system (Table 1). Families lost, on average, 22% of siblings. The increase in the educational attainment of Spanish population was impressive (Núñez, 1992; Viñao, 2004; Bernardi and Requena, 2007). According to the SDS data (Table 1), the average number of years of education grew steadily across cohorts since the beginning of the century. Cohorts born in the mid-1960s multiplied their years of education by a factor of 3.[3] Despite the fact that Spain's social history during the

[3] Male cohorts born in the mid-1960s multiplied their years of education by a factor of 2.6; women's educational progress was even greater: the equivalent female cohorts multiplied their years of education by 3.3.

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20th century involved a great deal of complexity, educational change was dramatic and took place continuously, without setbacks. In terms of intergenerational change, the process of educational expansion did not stop as a consequence of the Civil War or Franco's dictatorship.

The tremendous structural changes that the economy, society, politics, and culture underwent in 20th-century Spain offer an ideal context for assessing historical changes in the relations between family size or sibling position and educational achievement. According to Öberg (2017), this is one of the possible tasks that should be done to advance in the field given the model of conditional resource dilution.

4. Data and methods

Data for this study come from the SDS, a multipurpose survey conducted by the Spanish Statistical Office (Instituto Nacional de Estadística, INE) in 1991 to complement and validate the results of the census of that year (INE (Instituto Nacional De Estadística), 1993; Zárraga, 2009). The SDS contains a big deal of information on households, relatives (parents, siblings, partners, and children), places of residence and mobility, housing characteristics, education, and economic activity of the Spanish population. Data are collected from individuals, not from whole families, meaning that detailed information on all members of the sibling group is not available; however, for each individual interviewed, it is possible to know how many siblings he/she had and what his/her birth order was. Although the data collection design was cross-sectional, the SDS was a life cycle survey that, through retrospective questions, records a rich information about the demographic, family, residential, educational, and work trajectories of the Spanish population. Besides reporting basic socio-demographic information, informants provided the levels of education they achieved and the number of years they spent in education. They also reported the number of siblings they had and the year of birth of all of them.

The whole SDS sample is made up of 157,100 people over the age of 10 and under the age of 91 who lived in Spain during the last quarter of 1991, when the information was collected. An analytical reduced sample was chosen for this study. This reduced sample is limited to cohorts born between 1901 and 1966 (i.e., population aged 25 to 91 at the time of the survey), under the realistic assumption that by the age of 25 the selected cohorts had completed all their education and that changes in their education levels after that point were not relevant or non-existent. Another reason for excluding cases from the sample is the nature of siblings. Only natural siblings of both parents were considered in the analysis—excluding half-siblings (1.53%), stepsiblings (0.23%), and adopted children (0.02%)—to make the sample more homogeneous and minimize additional confounding factors. The same birth order was assigned to twin siblings. At the end, the operational sample contained 120,779 individuals, with 63,039 women and 57,740 men.

The two main independent variables are birth order and number of siblings.[4] The dependent variable is the number of years of formal education completed, measured from the informant's statement about the years he/she studied without counting interruptions.[5] Now, given the process of educational expansion experienced by the generations observed in this study, the dependent variable (years of education) is a moving target. So it is desirable to have a specification of educational attainment that somehow controls for its steady growth across cohorts (see Table 1). The solution adopted has been to standardize years of

[4] Birth order was built from the information provided by the interviewees of the year in which they themselves and all their biological siblings were born. Number of siblings is computed by simply adding all the siblings reported and includes the informant.

[5] As shown in Requena (2022), years of study maintains a high level of correlation with educational level attained (Spearman $\rho = 0.916$, $P = 0.0000$, for a categorization of educational attainment into 12 levels).

https://doi.org/10.1017/S0212610925100554 Published online by Cambridge University Press

education with z-scores normalization by year of birth and sex. The transformed dependent variable will be the number of standard deviations from the mean years of education attained separately for women and men born in the same year.

As control variables to be included in the regression models, the year of birth of the informant, the duration in years of the interval subsequent to his or her birth, if cohabitation with the father ended before the age of 16, the age of father and mother at the time of birth, and the education of the father and mother (seven categories: no education, less than primary, primary, lower secondary, upper secondary, university first stage, university second stage) were considered. The social class of family of origin is measured by the occupation of the father when the informant was 16 years old (six categories: bourgeoisie, white-collar workers, urban petty bourgeoisie, farmers, urban working class, and agricultural workers). Finally, the region of residence (five categories: North, Centre-North, Centre, East and South) is included in the models as a population control variable to consider the territorial heterogeneity of the country and, in particular, the well-known and very persistent disparities in the aggregate education level of the different Spanish regions. Table 2 presents descriptive statistics corresponding to the analytical sample used.

Given the type of dependent variable (years of education), several linear ordinary least square regression models have been estimated with birth order and number of siblings as the main independent variables, in addition to a vector with all the controls considered. However, this type of exercise must address the need to avoid confusion between birth order and number of siblings and estimate their effects separately (Kessler, 1991; Iacovou, 2007; Booth and Kee, 2009). A first element of confusion arises from the intrinsic relationship between the two variables. Obviously, the probability of occupying a certain order among children depends crucially on the number of siblings. This means that there is never complete independence between these two dimensions. The probabilities of occupying low orders (earlier-born children) are greater in small families, and vice versa, and the linear correlation between the two dimensions oscillates around 0.65 in conditions of low fertility (that is, low average number of siblings and low average birth order). This also means that although the correlation between number of siblings and birth order is not perfect, when these are considered in relation to third variables, compositional effects and spurious associations can occur between the two factors and the result of interest. In addition, due precisely to the functional form of the relationship between the two variables, it can be expected that, ceteris paribus, the cumulative differences in resources that siblings receive from their parents depending on birth order are smaller as the number of siblings is greater and, therefore, that the associations of the number of siblings or birth order with social outcomes are nonlinear (Blake, 1981; Downey, 1995).

As Iacovu (2007) argued, given the non-linearity of the relations of family size with the resources to be received by children, it is necessary to always analyze the associations of size and family position separately and allow for non-linearities when modelling these associations (Booth and Kee, 2009). To disentangle the effects of number of siblings and birth order, the specification of relative birth order devised by Booth and Kee (2009) will be used. This birth-order index is defined as $B = \phi / A$, i.e. the ratio of each sibling's absolute birth order (ϕ) to each family's average birth order, A, calculated as $(N + 1)/2$, where N is the total number of siblings. As the authors point out, by deflating the absolute birth order (ϕ) by the average birth order in each family (A) the initial correlation between ϕ and N is substantially reduced. By construction, this birth order specification effectively removes the correlation between number of siblings and birth order,[6] purges family size from birth

[6] In the used SDS sample, the correlation between absolute birth order and number of siblings is $r = 0.639$ ($P = 0.0000$); by contrast, the correlation between the birth order index and number of siblings is $r = -0.031$ ($P = 0.2835$).

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Table 2. Descriptive statistics. Analytical sample, N = 120,779. Means and proportions

	Mean	SD	Years of education	Mean	SD
Men	0.478	0.500	*All*	7.36	4.81
Women	0.522	0.500	*Men*	7.88	4.93
Age in 1991	49.23	16.54	*Women*	6.88	4.65
Fathers' age in 1991	80.72	17.11			
Mothers' age in 1991	77.49	16.94	*Father present*	7.55	4.84
Subsequent interval	7.468	7.232	*Father absent*	6.13	4.48
Father absent	0.136	0.343			
Sibship Size			*Sibship Size*		
1	0.059	0.235	1	8.30	4.93
2	0.177	0.382	2	8.87	4.88
3	0.206	0.404	3	8.20	4.81
4	0.174	0.379	4	7.40	4.80
5 +	0.384	0.486	5 +	6.05	4.42
Birth order			*Birth order*		
1	0.346	0.476	1	8.11	5.02
2	0.261	0.439	2	7.64	4.83
3	0.166	0.372	3	7.05	4.60
4	0.100	0.300	4	6.46	4.44
5 +	0.128	0.334	5 +	6.05	4.27
Father's education			*Father's education*		
No education	0.412	0.492	No education	5.00	3.73
Less than primary	0.307	0.461	Less than primary	7.52	3.95
Primary	0.169	0.375	Primary	9.32	4.55
Lower secondary	0.041	0.199	Lower secondary	11.12	4.92
Upper secondary	0.028	0.164	Upper secondary	12.69	4.93
University, first stage	0.020	0.139	University, first stage	13.54	5.27
University, second stage	0.024	0.153	University, second stage	14.95	4.79
Mother's education			*Mother's education*		
No education	0.463	0.499	No education	5.18	3.81
Less than primary	0.307	0.461	Less than primary	8.01	4.17
Primary	0.171	0.377	Primary	10.05	4.74
Lower secondary	0.034	0.180	Lower secondary	12.56	4.99

(*Continued*)

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Table 2. (*Continued.*)

	Mean	SD	Years of education	Mean	SD
Upper secondary	0.012	0.107	Upper secondary	14.65	4.59
University, first stage	0.011	0.104	University, first stage	14.12	5.18
University, second stage	0.003	0.053	University, second stage	17.02	3.88
Class of Origin			*Class of Origin*		
Bourgeoisie	0.082	0.274	Bourgeoisie	12.76	5.32
White-collar workers	0.059	0.236	White-collar workers	10.62	5.15
Urban petty bourgeoisie	0.146	0.353	Urban petty bourgeoisie	7.90	4.54
Farmers	0.220	0.414	Farmers	5.95	3.89
Urban working class	0.321	0.467	Urban working class	7.73	4.20
Agricultural workers	0.172	0.377	Agricultural workers	4.41	3.64
Region			*Region*		
North	0.189	0.391	North	8.05	4.47
North Centre	0.146	0.353	North Centre	8.06	4.31
Centre	0.155	0.362	Centre	8.00	5.01
East	0.280	0.449	East	7.37	4.55
South	0.230	0.421	South	6.86	4.78

Source: Sociodemographic Survey (Instituto Nacional de Estadística, 1993).

order, and the results of estimations using it are analogous to fixed, within family effects models.

5. Results

Table 1 presents the data defining the basic context for understanding the change inter-cohorts in the association between family configuration and educational attainment. Cohorts born in the first six decades of the 20th century increased their years of education threefold, while reducing the number of siblings they grew up with by about 30%. However, while the distribution of years of education became increasingly uniform over cohorts, the distribution of the number of siblings maintained or even increased its dispersion across cohorts. As the century progressed, Spaniards studied for more and more years and educational inequality decreased. They also grew up in increasingly smaller families, but these families did not become more similar.

Table 2 summarizes the descriptive statistics of the sample used. The left-hand column presents the distributions of the independent variables; the right-hand column presents the distributions of the dependent variable (years of formal education completed). This

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right-hand column shows the associations that define the main patterns of educational inequality among these cohorts. Considering all cohorts, men were ahead of women by one year of education, but the female cohorts born in the 1960s balanced the disadvantage and eventually turned it around. Absent fathers (if the co-residence with the father ended before the child's sixteenth birthday) reduced the total time spent in education by 1.4 years. In terms of social inequalities, the three variables defining the socio-economic status of the family of origin (father's education, mother's education and parent's class of origin) show a clear gradient in the educational outcomes of these cohorts in the expected direction: the higher the socio-economic status of the parents or the family of origin, the more time spent in education and consequently the better the qualifications obtained. Children of farmers accumulated more years of schooling than children of day laborers, but less than children of urban working-class parents, a relatively anomalous but well-known result (Carabaña, 1999). Moreover, the SDS data reflect well the north-south territorial gradient of educational outcomes in Spanish regions: people in the northern regions of the country had better educational outcomes than those in the south (Beltrán Tapia *et al.*, 2021; Reher, 2022).

All these educational inequalities can be considered as inequalities between families. In terms of bivariate relationships, the difference between the educational attainment of children in families with two siblings and children in families with five or more children is almost three years (2.8). With the exception of only children—who performed slightly worse than children with one sibling—the more siblings, the fewer years of education. Special attention should be also paid to differences within families. As for birth order, the pattern is clear and without exception: the higher the birth order, the lower the educational attainment; moreover, if the relationship were perfectly linear, being born after another sibling represented an average loss of half a year of education. Given the high degree of correlation between birth order and number of siblings, it is also important to examine how birth order is associated with educational attainment within families of different sizes (Figure 1). These data show that both birth order and number of siblings were relevant factors in educational attainment in 20th-century Spain.[7] Only children have poorer educational performance than the eldest of two siblings, the best performing child of all birth orders observed. Birth order is inversely related to years of education in families of two, three, and four siblings. In families with five or more siblings, the elder sibling outperforms their lower-order siblings, but no other significant difference emerges. It must be stressed that these relationships observed in the Spanish case—and, in particular, complexity in families with large sibship sizes—are consistent with other studies conducted in developed countries using comparable data (Booth and Kee, 2009; Iacovou, 2007; Van Ejick and DE Graaf, 1995).

Figure 2 presents these same relationships disaggregated for the six decennial cohorts into which the sample used was split. The figure allows, firstly, to appreciate without difficulty the educational expansion that Spanish society experienced throughout the 20th century. Invariably, each cohort achieved better educational results than the preceding cohort and worse than the subsequent cohort, regardless of the number of siblings or the order of birth. What is important now, however, is that some of the basic associations between number of siblings and birth order are observed in virtually all cohorts. An important caveat is in order here: associations are becoming more distinct and clearer

[7] We know from a previous study on the same population (Requena, 2022) that, when examining educational attainment associated with birth order in families with different numbers of siblings, the patterns are relatively similar among men and women, with female outcomes always lower than male outcomes regardless of the sibsize or birth order. Only in larger families (5 +) clear differences between men and women can be observed. Basically, women show no differences associated with birth order.

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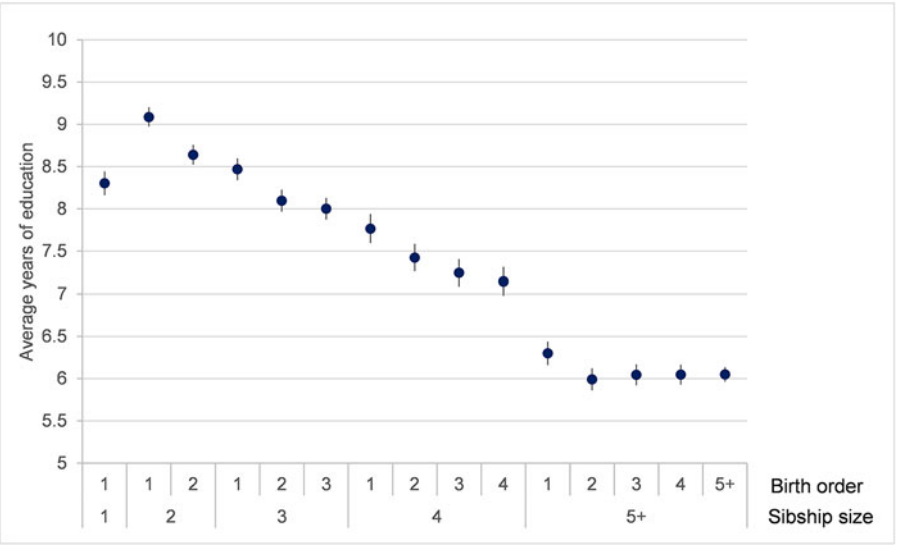

Figure 1. Average years of education by sibship size and birth order, with 95% CI. Spanish cohort born 1900–1966. *Sources*: Sociodemographic Survey (Instituto Nacional de Estadística, 1993).

in the younger cohorts. In the 1910–1919 cohort, an inverse relationship between number of siblings and average years of education can be seen, but this negative relationship does not hold for all birth orders. In fact, the inverse birth-order relationship with educational attainment can be only clearly observed from the cohort born in the 1930s onward. In the cohorts born later, the number of years of education attained becomes negatively ordered by number of siblings and birth order. At first glance, while the effects of number of siblings were more or less constant, those of birth order became stronger over the cohorts.

Figure 3 presents the same data, but educational attainment is operationalized using a different metric. Educational achievement is now measured in standard deviation units from the mean years of education of individuals of the same sex born in the same year. By z-normalizing educational attainment, the effect of the constant expansion of the educational system, as well as the different pace of expansion between men and women, is cancelled out and the possible educational impact of the number of siblings and birth order is estimated under the counterfactual, but in this case reasonable, assumption that there was no inter-cohort change in the educational attainment of the Spanish female and male populations. In fact, the differences depicted in the figure oscillate around the value of 0 for all cohorts. The entire modelling exercise presented below uses standardized years of education as the dependent variable ($\bar{x} = 0; s = 1$), and the results should be interpreted in units of standard deviation.

Table 3 provides the estimates of three regression models, with sequential inclusion of covariates, for the years of education of these cohorts standardized by sex and birth cohort. All three models reveal the significant impact of birth order and family size on educational outcomes. In the model without covariates (1) and in the model with birth cohort only (2), the impact of number of siblings is larger than that of birth order.

When controlling for the other covariates, birth order becomes more important than the number of siblings: while each additional sibling subtracted 0.06 standard deviations of years of education, being born after another sibling reduced final educational attainment

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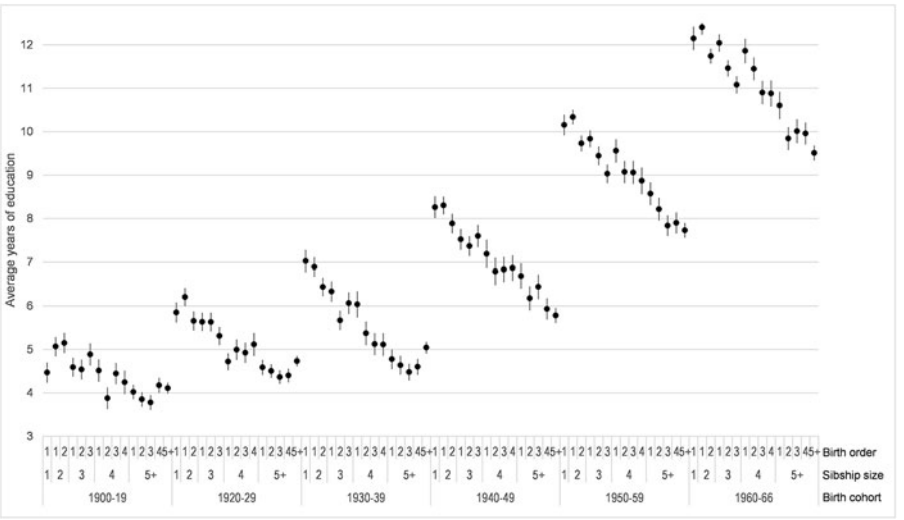

Figure 2. Average years of education by sibship size, birth order, and birth cohort, with 95% CI. Spanish cohort born 1900–1966.
Source: Sociodemographic Survey (Instituto Nacional de Estadística, 1993).

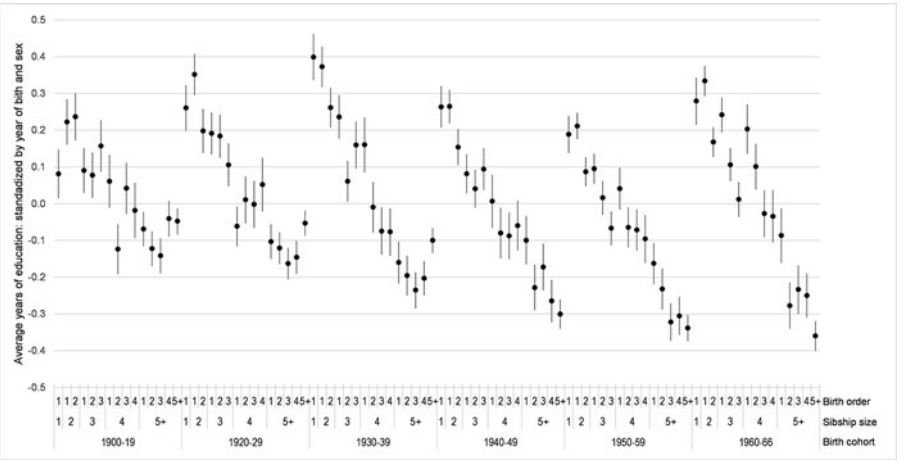

Figure 3. Average years of education (standardized by year of birth and sex) by sibship size and birth order, with 95% CI. Spanish cohort born 1900–1966.
Sources: Sociodemographic Survey (Instituto Nacional de Estadística, 1993).

by 0.08 standard deviations. It should be stressed that the behavior of the covariates tends to be as expected, as can be seen, in particular, in the estimated coefficients for the variables referring to social position (father's education, mother's education, and social class of origin), to the different regions or the absent father.[8]

Finally, to assess the change over time in the impact of the number of siblings and birth order on educational attainment, an additional regression model has been estimated that

[8] Note that the estimated coefficients for birth cohorts and for females (versus males) are small as a result of normalization.

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Table 3. OLS regression coefficients for standardized years of education

	Model 1			Model 2			Model 3		
	β		SE	β		SE	β		SE
Birth-order index	−0.065	***	(0.007)	−0.065	***	(0.007)	−0.081	***	(0.009)
Number of siblings	−0.073	***	(0.001)	−0.075	***	(0.001)	−0.058	***	(0.001)
Birth cohort									
1900–1919									
1920–1929				0.014		(0.011)	0.022		(0.012)
1930–1939				0.004		(0.011)	0.040	**	(0.014)
1940–1949				−0.071	***	(0.011)	−0.102	***	(0.016)
1950–1959				−0.112	***	(0.011)	−0.182	***	(0.020)
1960–1966				−0.029	*	(0.011)	−0.150	***	(0.023)
Sex (=female)							−0.006	***	(0.001)
Fathers' age in 1991							0.005	***	(0.001)
Mothers' age in 1991							0.001		(0.001)
Subsequent interval							0.002	***	(0.001)
Father absent (=yes)							−0.068	***	(0.008)
Father's education									
No education									
Less than primary							0.134	***	(0.010)
Primary							0.281	***	(0.013)
Lower secondary							0.503	***	(0.018)
Upper secondary							0.721	***	(0.019)
University, first stage							0.874	***	(0.023)
University, second stage							1.103	***	(0.023)
Mother's education									
No education									
Less than primary							0.243	***	(0.010)
Primary							0.346	***	(0.013)
Lower secondary							0.434	***	(0.019)
Upper secondary							0.548	***	(0.027)

(*Continued*)

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Table 3. (*Continued.*)

	Model 1		Model 2		Model 3		
University, first stage					0.624	***	(0.027)
University, second stage					0.827	***	(0.051)
Class of Origin							
Bourgeoisie							
White-collar workers					−0.166	***	(0.015)
Urban petty bourgeoisie					−0.412	***	(0.013)
Farmers					−0.624	***	(0.013)
Urban working class					−0.554	***	(0.012)
Agricultural workers					−0.892	***	(0.014)
Region							
North							
North Centre					0.031	**	(0.010)
Centre					−0.049	***	(0.009)
East					−0.128	***	(0.008)
South					−0.168	***	(0.008)
Intercept	0.377	(0.009)	0.426	(0.012)	0.256	***	(0.046)

Source: Sociodemographic Survey (Instituto Nacional de Estadística, 1993).

includes interactions of both variables with birth cohort, besides controls for the remaining covariates. Figure 4 shows the results of the model post-estimation, specifically the average marginal effects of number of siblings and birth order for the six cohorts.[9] The small but significant effect of the number of siblings grew with the change over time from the cohort born before 1920 onward. Among families of children born in the early 1960s, each additional sibling reduced the number of years of education by 0.08 standard deviation units, meaning that between cohorts born between 1960 and 1966 and those born before 1920, the effect had more than doubled. On the other hand, the birth-order effects are minor and not statistically significant among cohorts born in the 1910s, 1920s, and 1930s. However, among those born in the 1940s and, above all, in the 1950s and 1960s, birth-order conditions educational outcomes considerably more strongly than sibship size. In cohorts born in the first half of the 1960s, each change of one position in the sibling age hierarchy decreased years of education by 0.16 standard deviation units; in these cohorts, the birth-order effect was more than five times the effect recorded for cohorts born at the beginning of the century. At

[9] The table with the full regression detail is not shown here but is available on request from the author.

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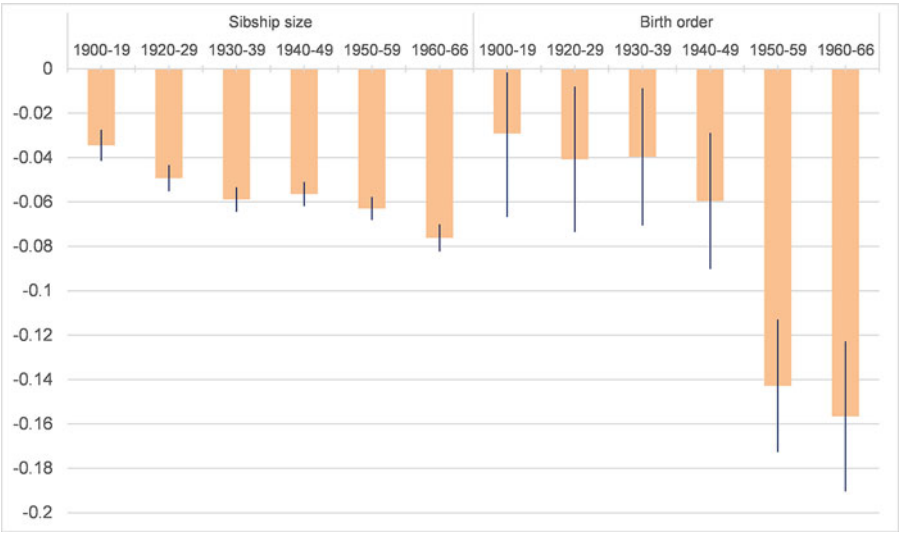

Figure 4. Average marginal effects of sibship size and birth order on standardized years of education by birth cohort, with 95% CI. Spanish cohort born 1900–1966.
Sources: Sociodemographic Survey (Instituto Nacional de Estadística, 1993).

the end of the processes of demographic transition and educational expansion, birth order is a more important determinant of educational outcomes than the number of siblings.

6. Discussion

This paper assesses the change over time of within-family inequality in the educational outcomes of Spaniards by measuring the effects of birth order on the number of years of formal education attained in families of different sizes. Although very little research has been done so far in Spain on this topic, the literature has established the impact of the number of siblings (Carabaña, 1999, 2004) on educational outcomes among the cohorts born in the first six decades of the 20th century, as well as the need to separate the effects of family size and birth order to understand these processes (Requena, 2022) fully. Another study has found a significant degree of continuity of these inequalities in educational outcomes associated with birth order in families of different sizes that extends to cohorts born in the 1980s (see Requena, 2024). All these findings, although scarce, invite us to wonder about the degree of persistence over time of within-family educational inequality associated with birth order. So far, no one has analyzed in detail the historical evolution of these mechanisms behind within-families inequalities and how the role of family size and birth order in the educational attainment of Spaniards changed over time. This is the main purpose of this study. To undertake it, the approach adopted is that of inter-cohort change analysis, and the data used come from the 1991 Sociodemographic Survey (INE, 1993; Zárraga, 2009).

The turbulent societal contexts in which these cohorts lived are well known. During the period under analysis, Spain underwent tremendous economic, demographic, social, political, and cultural changes. Economic development, demographic transition, and social and cultural modernization dramatically changed the country. Economic development substantially improved the material standards of living in the country. Demographic transition reduced mortality and fertility to unprecedented levels. Social and cultural modernization greatly expanded the educational system. Because of these changes, the cohorts observed

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in this study grew up in smaller families than their parents and gradually but steadily increased, without reversals, their endowments of educational human capital. However, the expansion of the education system does not necessarily mean that educational inequalities decrease, and in fact, historical experiences of education growth in different societies have produced mixed results (Bernardi and Requena, 2007). Interestingly, Spain is a clear case where the expansion of the education system was compatible with the reduction of educational inequalities (Ballarino *et al.*, 2009). The level of between-families inequality in educational attainment declined significantly with the expansion of the system in Spain. This can be seen in Table 1 from the inter-cohort change in the coefficients of variation of the average years of education. The dispersion in the distribution of years of education clearly decreased over cohorts.

Did the expansion of the education system in Spain imply a parallel reduction in sibling inequalities within families? Two conclusions can be drawn from the Socio-demographic Survey data. First, educational differences associated with the number of siblings and birth order are easily discernible in all the cohorts observed. Regardless of which phase of the educational expansion process these cohorts experienced in their learning years, educational differentials associated with family size and birth order are visible in the expected direction: the smaller the family size, the more years of education attained; and the higher the birth order, the lower the educational attainment. In a society such as Spain's, these differentials should be considered a very consistent and persistent regularity, a long-standing pattern capable of manifesting itself in very different historical periods. Second, after *z*-normalizing educational attainment—measuring it in units of standard deviation concerning the mean number of years of formal education by sex and year of birth to control for the process of educational expansion—the effects on educational attainment of both the number of siblings and birth order tended to increase across cohorts. The increase in the effect of sibship size across cohorts was slight but relatively constant. The impact of birth order was also small and statistically insignificant in cohorts born at the beginning of the century; however, starting with those born in the 1930s, it began to increase rapidly and steadily across cohorts. The change in educational inequalities between siblings associated with birth order can thus be answered conclusively: educational inequality within families dependent on birth order did increase with the expansion of education in Spain.

Spanish results can be interpreted within the model of conditional dilution of family resources associated with more siblings and high birth orders. According to the model (Downey, 2001; Gibbs *et al.*, 2016), children's educational outcomes do not depend exclusively on parental resources because the availability of non-family assets can counteract the dilution processes. Dilution relies not only on the number of siblings but also on other factors such as economic circumstances, cultural norms, demographic realities, social practices, or institutional settings where educational attainment occurs. Although this model is up-and-coming, very few studies have analyzed the change over time of the association between the number of siblings and birth order. A study on China (Lu and Treiman, 2008) showed how the effects of the number of siblings on educational attainment depended on educational policies. In the case of the United States, secular increases in state-sponsored investments in education reduced the impact of sibship size on educational attainment over time (Gibbs *et al.*, 2016).

The Spanish results point in the opposite direction: in Spain, unlike what is reported for the United States, the secular change indicates an increase, not a decrease, in the role of both the number of siblings and birth order in educational attainment. Results relatively similar to those found in Spain have been reported for urban areas in Indonesia throughout socioeconomic development among cohorts born between 1948 and 1977 (Maralani, 2008). Thailand (Knodel *et al.*, 1990; Knodel and Wongsith, 1991), Taiwan (Hermalin *et al.*,

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1982; Parrish and Willis 1993), and Brazil (Marteleto, 2010) are also similar. The disparity between the United States and Spain is remarkable considering that the cohorts analyzed were mostly born in the same years (1900s–1960s). However, some differences complicate the comparison between Spain and the United States. Firstly, the US study did not consider birth order (nor did the aforementioned China study), with all the estimation problems that this implies. Secondly, although the cohorts compared were born in the same years, the phases of expansion of the American and Spanish educational systems in which these cohorts were educated were very different, as well as the speed of expansion: while the cohorts born in the first decade of the century in the United States reached an average of 9.83 years of education, the Spanish cohorts achieved 3.85; for those born in the 1960s, the respective in the United States and 11.70 in Spain. Although the differences between the two countries were significantly reduced, initial levels in Spain were far below those in the United States. Thirdly, the education systems of the two countries and especially access to higher education levels were very different (Dill, 2022).

It is beyond the scope of this paper to test the specific mechanisms that could explain the increasingly negative relationship between birth order and educational attainment in the observed cohorts in Spain. The expansion of the education system, which contributed to decreased educational inequalities between families, failed to mitigate inequalities within families because the differentials associated with birth order grew. This means that other factors may have acted in the opposite direction to expanding the education system. As pointed out by the proponents of the conditional family resource dilution model (Gibbs *et al.*, 2016), in addition to public investments in education, community structures, and extended family networks can substantially buffer the dilution of parental resources. Both factors became less prominent during Spanish socioeconomic development in the 20th century due to intense urbanization, massive internal migration (Silvestre, 2002), and extensive family changes connected with the demographic transition (Reher, 1996). A consequential aspect of these transformations is the change in family size. In the Spanish cohorts born in the first two decades of the century, only 11% of families had two siblings; in those born in the 1960s that proportion had risen to 23%. Seventy percent of the families of the generations at the beginning of the century had four or more children, a proportion that had fallen to only 47% of families in the 1960s. As noted above, the process of parental resources dilution is not linear because with the birth of a new sibling, a child who already has several siblings will lose less in terms of paternal inputs than a child with fewer siblings. Suppose small families, in which dilution is more pronounced, tend to become increasingly prevalent. In that case, it is possible that by a simple demographic composition effect, birth order will become increasingly important in educational outcomes.

In short, the results presented in this paper about the Spanish case do not contradict but reinforce the theoretical framework of conditional dilution of family resources. But they also imply an essential caveat. The societal context in which the dilution associated with sibship size and sibling position occurs matters. However, the elements that condition it respond to a complex etiology in which very diverse factors may intervene.

Acknowledgements. None declared.

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Cite this article: Requena M. (2025) Within-family educational inequalities in 20th-century Spain. *Revista de Historia Económica / Journal of Iberian and Latin American Economic History* 43(2), 217–238. https://doi.org/10.1017/S0212610925100554

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