



# Inequality and education in pre-industrial economies: Evidence from Spain



Francisco J. Beltrán Tapia<sup>a,\*</sup>, Julio Martinez-Galarraga<sup>b</sup>

<sup>a</sup> Department of Historical Studies, NTNU, Norwegian University of Science and Technology, Bygg 6, Dragvoll, 6443 Trondheim, Norway

<sup>b</sup> Departament d'Anàlisi Econòmica, Universitat de València, Av. dels tarongers, s/n 46022 València, Spain

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## ABSTRACT

This article contributes to the debate on institutions and economic development by examining the historical link between land access inequality and education. Using information from the 464 districts existent in mid-19th century Spain, this paper confirms that there is a negative relationship between the fraction of farm labourers and male literacy rates. This result does not disappear when a large set of potential confounding factors are included in the analysis. The use of the *Reconquest* as a quasi-natural experiment allows us to rule out further concerns about potential endogeneity. In addition, controlling for different sources of spatial dependence does not explain away this result either. By analysing the rural–urban divide and the gender-specific information on the number of schools and teachers, as well as schooling enrolment rates, this paper also explores the mechanisms behind the observed relationship. As well as supply factors, our results show that demand effects also played a significant role in explaining the negative impact of inequality on education.

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## 1. Introduction

The relationship between inequality and human capital formation is at the core of current debates linking institutions and economic development. Recent studies, for instance, claim that the literature linking institutions to economic development is actually mostly capturing the effect of human capital (Glaeser et al., 2004; Gennaioli et al., 2013). Acemoglu et al. (2014), on the contrary, argue that a distinct effect of institutions, proxied by the rule of law index, persists even when educational levels are included in the analysis. In addition, extractive institutions are generally depicted as those that generate an unequal distribution of resources and therefore concentrate economic and political power in the hands of the elite (Acemoglu and Robinson, 2012). In this regard, growing research evidences that land access inequality negatively impacts educational attainments, implying that institutions, apart from other potential channels, would be affecting long-run economic prosperity through its impact on human capital accumulation. An unequal distribution of resources is associated with extractive institutions which, in order to perpetuate the status quo, restricted the masses from accessing education (Engerman and Sokoloff, 2000; Lindert, 2003; Easterly, 2007).

The industrialisation process seems to have reinforced the link between land inequality and education by gradually increasing the return to education and the demand for human capital, especially in later stages of development (Galor, 2011). Industrialisation fostered migration from rural to urban areas and, while the emerging capitalist elite was in favour of supporting educational policies that would promote human capital accumulation, the interests of large landowners lay precisely on reducing the mobility of their rural labour force to keep wages low and therefore would oppose educating the masses. Where an unequal distribution of land ownership prevailed, economic and political power disproportionately accumulated in the hands of the landed elites, thus constituting a limitation to the implementation of educational policies.

\* Corresponding author.

E-mail address: [julio.martinez-galarraga@uv.es](mailto:julio.martinez-galarraga@uv.es) (J. Martinez-Galarraga).

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This institutional account of the link between inequality and human capital has found wide empirical support.<sup>1</sup> Research focusing on the United States during the second half of the 19th and early 20th century evidences that land inequality had an adverse effect on public investment in education (Galor et al., 2009; Ramcharan, 2010; Go and Lindert, 2010; Vollrath, 2013). Similarly, while the Prussian landed elites seem to have opposed to mass education, the interests of upper-castes in British India appear to have contributed to low public spending on primary schooling (Cinnirella and Hornung, 2016; Chaudhary, 2009). Mariscal and Sokoloff (2000) also show that inequality in political power in Latin America is associated with lower levels of schooling enrolment and literacy rates. The latter also argue, together with Acemoglu and Robinson (2000) and Gallego (2010), that the extension of the suffrage promoted mass schooling.

However, there has been less work done on a less institutional, and more demand-based, account of the historical link between land access inequality and education. Galor and Zeira (1993) highlight that an unequal distribution of resources, exacerbated by the presence of credit constraints present in developing economies, limits the lower classes' capacity to invest in human capital. Explaining, for instance, the disparities in educational levels across early modern Europe, Reis (2005) does not consider that the powerful landed nobility acted as a constraint to the spread of literacy. Instead, this author refers to the heavy burden that the cost of education imposed to the bottom part of the population. Employing data from 19th century Prussia, Cinnirella and Hornung (2016) find that the supply of schools and teachers was not the key mechanism explaining the link between landownership concentration and schooling enrolment rates. Peasants with higher servile duties appeared to have had scarce resources and few incentives to invest in education.

This paper makes a three-fold contribution to this debate. On the one hand, this is the first study than empirically tests the relationship between land inequality and education using the Spanish case as a historical laboratory. By employing information at the district level (464 observations), this paper shows that the degree of land access inequality, measured as the proportion of farm labourers over the population engaged in agriculture, had an adverse impact on male literacy rates in mid-19th century Spain. The inclusion of a large set of potential confounding factors does not affect our results. In order to rule out further concerns about potential omitted variables and reverse causality, we rely on the *Reconquest* as a source of exogenous variation. The long process of expansion carried out by the Christian Kingdoms between the 9th and the 15th centuries took place in different stages, which shaped the type of institutions characterising the occupied territory and, in turn, influenced the distribution of land. Using this episode as an instrument for land inequality in mid-19th century Spain confirms the existence of a causal relationship between this variable and educational outcomes. In addition, accounting for different sources of spatial dependence does not explain away these results either.

On the other hand, this article further explores the mechanisms behind the observed relationship so as to disentangle the potential effect of supply and demand factors. In this regard, we compare the general results to those obtained by restricting the analysis to the more rural districts. Likewise, we gather information on the number of schools and teachers, as well as on schooling enrolment rates, and analyse the relationship between land inequality and these variables. Our results show that while supply factors mattered, a significant part of the effect of inequality on education can be linked to demand factors. Holding income constant, more unequal societies suffer lower median incomes. In poor economies, such as pre-industrial Spain, this constraint and the limited possibilities for upward mobility prevented wide segments of the population to invest in education.

Lastly, this is, to our knowledge, the first attempt to incorporate the gender dimension to this debate by examining the historical relationship between inequality and education for both men and women, thus enhancing our understanding of the channels through which this link works. Given that the value attached to men's and women's education, as well as the opportunity cost of boys' and girls' labour, was significantly different, examining differences by gender provides crucial insights about the link between land inequality and education. We thus exploit the gender composition of the data, which enables distinguishing between male and female literacy levels, the number of boys', girls' and mixed public schools, the number of male and female schoolteachers, and boys' and girls' schooling enrolment rates. We find that the demand factors that helped fostering boys' access to education had a much smaller effect on girls'.

Summing up, land access inequality thus affected economic development via its adverse impact on education. This influence however does not only run through "institutions", as understood by the "extractive institutions" hypothesis, but also via demand effects. The rest of the paper is organised as follows. The next section reviews the literature. While Section 3 presents the data and the methodology employed, Section 4 reports the results of the empirical analysis. Section 5 exploits the *Reconquest* as a source of exogenous variation in order to better identify the causal relationship between access inequality and education. Section 6 accounts for different sources of spatial dependence and Section 7 explores the mechanisms at play by incorporating information on schooling enrolment and the stock of teachers, as well as by comparing the results of the analysis to those obtained focusing on the more rural districts. Section 8 provides some concluding remarks.

## 2. Conceptual framework

### 2.1. Education in pre-industrial Europe

In pre-industrial societies, investing on education was motivated by a wide array of factors. Given that human capital had a limited role in the economy,<sup>2</sup> Galor (2011, 473) argues that disparities in educational levels were mostly driven by social, cultural, political

<sup>1</sup> There are also exceptions. Clark and Gray (2014) do not find that the rural social structure played a role in explaining variation in literacy levels in mid-19th century rural England.

<sup>2</sup> Mitch (1992) shows that only a tiny fraction of the English labour force was employed in occupations demanding literacy skills during the first stages of the Industrial Revolution.

and institutional factors such as “religion, enlightenment, social control, moral conformity, socio-political stability, social and national cohesion, and military efficiency”. As industrialisation progressed throughout the 19th century, individuals and governments realised that literacy was an important skill and massively invested on it. However, the idea that economic factors, including inequality, did not matter for education during the pre-industrial period seems at odds with historical evidence.

Households in early modern Europe were increasingly allocating resources to education and this substantial rise in literacy came hand in hand with long-term economic growth (Houston, 2002; Reis, 2005). By 1800, more than 60 per cent of the male population in North-Western Europe were able to read and write.<sup>3</sup> These skills were crucial in urban areas where complex market interactions were prevalent (De Vries and Van der Woude, 1997). In rural areas, literacy was a vehicle for upward social mobility and a means to decipher official documents, such as legal charters, leases and titles of ownership, among others<sup>4</sup> (Reis, 2005, 204–205). In addition, being able to read and write was considered an appreciated article of consumption (Mitch, 1992).<sup>5</sup>

The increase in literacy was not the result of efforts concerted by the state or the church but arose from a bottom-up spontaneous process (Reis, 2005). Although public support to mass schooling would only take place from the 19th century onwards, schools were nonetheless quite important in early modern Europe. They were financed either by local councils, the church or the families themselves by paying a fee (or a combination of the three). Private tuition at home and self- or family-education were also important vehicles for acquiring literacy skills. Literacy rates in southern Europe were much lower, in line with its relative economic standing.<sup>6</sup> Higher incomes therefore appear not only to have provided incentives to invest in education, but also the means to do so.

## 2.2. Education in pre-industrial Spain

The Spanish case fits the experience of countries in Southern Europe. Although Spain enjoyed a period of prosperity during the 16th century, it was subsequently surpassed by the more dynamic regions of North-Western Europe (Allen, 2003; Álvarez-Nogal and Prados de la Escosura, 2013). Real wages stagnated during the 17th and 18th centuries and, by mid-19th century, the Spanish economy clearly lagged behind other European regions. Educational levels accordingly remained low: in 1860, only 20.1 per cent of the population was able to read and write,<sup>7</sup> a figure in sharp contrast to what was happening in other European regions (Pamuk and Van Zanden, 2010, 229). The means to acquire reading and writing skills were analogous to those in the rest of Europe: the school, the parish and the family. In this regard, the school was not the only alternative but it was the most important. In her analysis of Inquisition trials’ records between 1540 and 1661, Nalle (1989, 75) finds that around two thirds of the defendants reported having become literate at school. Only 14 and 16 per cent of the respondents testified they had been taught by a village priest or by a family member (or a friend), respectively.<sup>8</sup>

The literature has extensively analysed the causes behind Spanish backwardness in terms of literacy (Viñao, 1990, 1999; Núñez, 1992, 2003, 2005; Sarasúa, 2002a). The lack of institutional support, either religious or public, appears to have been crucial. On the one hand, and in contrast to Protestantism, the Catholic Church did not promote the diffusion of literacy by rejecting popular reading of religious texts until mid-19th century.<sup>9</sup> In addition, religious orders did not develop a network of schools as they did in other Catholic countries such as France (Viñao, 1990, 582). On the other hand, the state and municipal councils generally failed to foster schooling. In 1797, only around 23.3 per cent of the population aged 6–13 attended school (Viñao, 1990, 581). During the Old Regime, schools were funded by local councils and the contributions of the families.<sup>10</sup> It was only in mid-19th century when the liberal government began to timidly intervene on the educational sphere.<sup>11</sup>

The *Moyano Act* (1857) established compulsory schooling, an education that would be free for those who could not afford it.<sup>12</sup> Its results, however, were disappointing. Compliance to compulsory schooling was rather limited.<sup>13</sup> Moreover, the funding of schooling continued to be left in the hands of local councils, so their financial difficulties, together with their attitudes to education, contributed

<sup>3</sup> While in England and Scotland male literacy rates were 60 and 65 per cent, respectively, figures in the Netherlands, northern France and parts of Germany reached even higher values (Reis, 2005, 202).

<sup>4</sup> The farmers’ possibilities to face the threat, or the opportunity, open by enclosure, for instance, crucially depended on their ability to read the legal documents that accompanied the process (Nilsson et al., 1999). Literacy was also relatively high in rural areas where local decisions were made collectively via local assemblies (Reis, 2005).

<sup>5</sup> Having the ability to read and write ‘was an indispensable means to deriving enjoyment through their consumption for its own sake’, either for one-self or as a collective activity (Reis, 2005, 212).

<sup>6</sup> In Piedmont (Italy), for instance, average literacy was around 25 per cent (Reis, 2005, 202).

<sup>7</sup> The historical evidence indicates that literacy grew during the 16th century but it languished or even deteriorated during the 17th century (Kagan, 1981; Benassar, 1985; Nalle, 1989; Viñao, 1999). Although figures should be taken with caution, literacy rates, measured as the ability to sign one’s name, were around 9 per cent in 1500 and increased to 40 per cent in 1600. By 1700, however, only 20 per cent of the population was literate, a figure which hardly changed until the late 18th century (Allen, 2003).

<sup>8</sup> Neither the influence of religious orders or the working context seems to have had any influence. Autodidacts were also extremely rare.

<sup>9</sup> The Spanish Inquisition prohibited the printing, selling or possession of vernacular versions of the Bible, catechisms or other religious summaries between 1551 and 1782 (Viñao, 1990, 581).

<sup>10</sup> Student fees were paid in cash or in kind (Sarasúa, 2002a). The contribution of local councils to teachers’ wages was usually in cash but it could sometimes be in kind, usually board and keep.

<sup>11</sup> This public stimulus was partly moral and political. Public authorities (including the Church) started to see the school as a handy vehicle to indoctrinate civic and religious virtues to the masses (Viñao, 1990; Sarasúa, 2002a).

<sup>12</sup> Compulsory education was restricted to children aged 9–12. The *Rivas* and *Pidal Acts* in 1836 and 1845, respectively, preceded the *Moyano Act*. However, they were short-lived and hardly effective (Núñez, 1992, 208–229).

<sup>13</sup> Given that the Act did not consider establishing fines and that labour regulation did not limit child labour, this result should not be surprising (Borrás, 2002, 538). Spanish legislation only started to regulate child labour in 1873 and only in industrial occupations (Borrás, 2002, 541).

to inadequate levels of schooling expenditures (Núñez, 1991; García and Comín, 1995; Sarasúa, 2002a).<sup>14</sup> Notwithstanding other factors, such as the prevailing social, cultural and political attitudes to literacy, the low level of development also clearly constrained both the supply and the demand for education. Interestingly for our purposes in this paper, the literature has also considered the concentration of land ownership as a factor hindering the spread of education.

Spain in mid-19th century was a predominantly agrarian society. If we leave aside the cities of Madrid and Barcelona, 80 per cent of the total active population was employed in the primary sector. In this type of society, access to land was the key factor driving social stratification. Having access to a plot of land, however tiny, allowed cultivating potatoes, beans, vegetables and fruits, as well as sustaining a few animals, for home consumption. This is relevant because it not only provided a crucial income for sustaining a household but also expanded the farmers' bargaining power in their daily negotiations with the local notables.

Given a certain level of income, land access inequality can affect education through two mechanisms. Firstly, a more unequal distribution of resources pushes a larger part of the population down to subsistence levels. In this situation, the cost of education plays a key role in households' decision to invest in education. Families have to consider not only the direct cost of providing education, in form of fees, but also the opportunity cost of child labour. Child labour during this period was widespread and its contribution, either within the household or as waged-work, was indeed a crucial element of the reproductive strategies of Spanish households until the first decades of the 20th century (Borrás, 2002; Sarasúa, 2002a). The need to resort to children's work, especially in rural areas, continuously appears in the contemporary reports addressing the low levels of school attendance. It is telling that, despite that the *Moyano Act* (1857) had made primary education compulsory between the ages of 6 and 9, only around 48 per cent of children aged 6–9 was enrolled at school in 1885, thirty years after the Act was enacted (Borrás, 2002, 518).<sup>15</sup>

It is true, however, that education was not only a matter of resources but of interest. Núñez (2005, 132) argues that, while small and middle size farmers positively valued education, landless labourers, due to the lack of prospects, did not see any economic advantage from investing in it. In 1872, for instance, the minutes of the council of Belmonte de los Caballeros, in the province of Zaragoza, ascribed the poor attendance of boys and girls to the school to their own apathy and that of their parents (Lisón Tolosana, 1966, 105).<sup>16</sup> In this regard, Viñao (1990, 584) also notes that schooling faced some opposition in rural areas. Gabriel (1990), in contrast, argues that these attitudes were promoted by the local elites, so as schooling was perceived as the main cause behind high local taxes. Sarasúa (2002a, 568) contends that, given that the sources usually describe the opinion of 'enlightened' informants and not that of the peasants themselves, it is very difficult to know whether those reports actually reflected the prejudices of these notables. The fact that attendance to school was significantly higher in winter, when the agricultural demand for work decreased is however a clear sign of peasants' interest in sending their children to school, especially if we bear in mind that attendance usually required having to pay a fee (Sarasúa, 2002a).

Secondly, given that the poor and working classes generally lacked the resources to invest in education, the possibility of relying on a subsidised education that would reduce the cost of schooling probably mattered. The ability and willingness of local councils were crucial when it came to support local schools. In this regard, municipal councils actively funded local schools in 16th century Castile (Kagan, 1981, 60; Benassar 1985, 156–159). However, the 17th century witnessed not only how households' and municipalities' finances deteriorated, but also how elites altered their attitude towards educating the masses. This coincided with a gradual proliferation of negative attitudes towards literacy (Viñao, 1999, 42). Reading and writing was seen as endangering society's religious and moral health, as well as encouraging social mobility (Nalle, 1989, 124). Large landowners exerted a crucial influence on the Spanish political process (Moreno-Luzón, 2007; Curto-Grau et al., 2012), so it is thus plausible that an unequal land ownership structure affected the willingness of municipalities to fund schooling. In mid-19th century, the public support for schooling greatly varied across municipalities and regions (Núñez, 1991; Sarasúa, 2002a, 571). Several authors have stressed the elites' lack of interest for educating the masses (Núñez, 1992; Pérez Moreda, 1997; Reher, 1997a). Moreover, Núñez (1991) argues that those regions where landowning elites were powerful enough gave priority to secondary schooling, thus reducing the resources available for primary education.

### 2.3. Gender differences in education in pre-industrial Spain

Given that the value attached to men's and women's education, together with the opportunity cost of boys' and girls' labour, were significantly different, examining differences by gender provides crucial insights about the link between land access inequality and education. Women were substantially less literate than men everywhere in early modern Europe due to prevailing attitudes regarding the nature of the female sex and what girls should learn (Houston, 2002, 21).<sup>17</sup> Subject to a subordinate position, the intra-household

<sup>14</sup> The number of schools and teachers was insufficient, teachers' salaries were low and material conditions poor. This also attracted less qualified and motivated professionals (Núñez, 2005, 130).

<sup>15</sup> Absenteeism was also prevalent and it was considered a serious problem by teachers and education inspectors (Borrás, 2002). However, it should be noted that, although child labour is likely to have constrained attendance to school, both were not incompatible. The combination of child labour and schooling was nonetheless easier in rural areas where the working time was more flexible and the concentration of tasks in certain seasons allowed for more free time in others.

<sup>16</sup> This author argues that, while the lower classes did not value it, the local notables regarded education as necessary.

<sup>17</sup> 'Men conventionally describe females as intellectually and morally inferior, endowed with less reason than men, easily influenced and thus in need of strong guidance' (Houston, 2002, 21). Women's role in society was restricted to the domestic sphere as 'a dutiful daughter, obedient wife and careful mother'. Virginia Woolf's famous quote in *A Room of One's Own* reflects the narrow possibilities that were open to women outside her household: 'Any woman born with a great gift in the 16th century would certainly have gone crazed, shot herself, or ended her days in some lonely cottage outside the village, half witch, half wizard, feared and mocked at' (quoted by Howe, 2008, ix).

allocation of resources was therefore biased against girls, a situation that was exacerbated in case of scarcity. Discrimination against women was even more pronounced in Catholic countries (Benassar, 1985; Houston, 2002, 22).<sup>18</sup>

The literacy gender gap in Spain was actually larger than in other European countries (Nalle, 1989; Núñez, 1992; Viñao, 1999). In this regard, while 30 per cent of men were able to read and write, only 8 per cent of women were literate in 1860. The differences in schooling enrolment rates for boys and girls were not that extreme but still show a considerable gender bias.<sup>19</sup> Many families that sent their sons to school did not consider that doing the same for their daughters was worthy (Núñez, 1992, 249; Sarasúa, 2002a, 591).<sup>20</sup> Although sometimes boys and girls indistinctly helped with some agricultural tasks, a gendered division of labour was in place, especially at older ages (Borrás, 2002; Sarasúa, 2002a). In rural areas, while boys were fully devoted to agricultural tasks, girls' involvement in agriculture was mostly part-time and seasonal.<sup>21</sup> They were mainly employed in housekeeping tasks, textile-related occupations and the service sector.<sup>22</sup>

This disparity did not only pertain to the numbers attending school, but also to the type of education that was traditionally taught. Although the situation gradually improved during the 19th century, schools for girls were not supposed to teach reading and writing skills at the end of the 18th century, but only domestic skills and religious and moral values (Viñao, 1999, 52; Sarasúa, 2002a, 552).<sup>23</sup> The problem was even worse in earlier periods when schools were almost exclusively restricted to boys, thus confining girls' (scarce) education to the domestic realm.<sup>24</sup> This discrimination reflects the cultural atmosphere dominating the Spanish society at that time (Vollendorf, 2005; Howe, 2008).<sup>25</sup> It is only at the end of the 18th century when some regions started to create public schools for girls.<sup>26</sup> In 1847, still more than half of the Spanish municipalities did not have a school for girls (or a mixed school otherwise), a problem which was especially severe in small villages (Sarasúa, 2002a, 558–559). In addition, public support for girls' schools was also lower in terms of funding.<sup>27</sup>

### 3. Data and methodology

In order to examine whether land access inequality affected educational levels and explore the potential mechanisms behind that relationship, we have collected information at the district level using the 1860 Population Census (*Dirección General del Instituto Geográfico y Estadístico, 1863*). Excluding the Canary Islands, this data set comprises information on 464 districts. This source provides the number of landowners, tenants and farm labourers but it does not include information on the size of the holdings. Therefore, the more adequate measure of our variable of interest is the fraction of farm labourers over the total agricultural population. Map 1 shows the substantial geographical variation of this variable. While in some regions landless peasants were relatively rare, they constituted the majority of the agricultural population in others. The highest figures can be found in Western Andalusia, Extremadura and some areas of central Spain. This picture basically mirrors the contours of the *latifundia* regions described by the literature (Carrión, 1932; Malefakis, 1970). Parts of Galicia, the Ebro valley, Catalonia and some areas in Eastern Spain also show relatively high numbers of landless labourers.

Although Map 1 closely reflects what we know about land access in Spain (Simpson, 1996; Gallego, 2007), it is true that those referred to as landless labourers (*jornaleros*) sometimes held a small plot of land that was usually not enough to secure their livelihood and, therefore, had to rely on wage work to make a living. However, this type of peasant was more widespread in those regions where *jornaleros* were also less prevalent (Domínguez, 1994, 89; Malefakis, 1978, 16; Gallego, 2007, 171). Therefore, if anything, the map above mitigates the differences in land access inequality between regions.

The 1860 Population Census also contains information about the reading and writing skills of the population. Literacy in pre-industrial Spain was mostly a male and urban phenomenon (Viñao, 1999; Núñez, 2005). Incentives to acquire education mainly

<sup>18</sup> In this regard, Praz (2006) finds that Catholic cantons in Switzerland showed lower levels of investment in girls' education between 1860 and 1930. In addition, Becker and Woessmann (2008) suggest, based on data for the 19th century, that Protestantism favoured the advancement of female education in Prussia.

<sup>19</sup> By the end of the 18th century, the Census of Godoy (1797) estimates that around 35 and 9 per cent of school-aged boys and girls attended school, respectively (Guereña and Viñao, 1996). In 1860, the gender gap was less pronounced: schooling enrolments rates for boys and girls were 42.3 and 28.7 per cent, respectively.

<sup>20</sup> A report from 1900 complains about the widespread opinion that women do not need education to fulfil their mission: to serve God, housekeep and obey their husbands (Núñez, 1992, 249). Women could not access many occupations or attend secondary and tertiary education (Sarasúa, 2002a, 608–609). They were not actually recognised as legal subjects by the law, so they did not have the legal right to make free use of their earnings, nor they could defend themselves in a trial, without permission of their fathers or husbands.

<sup>21</sup> Girls could also carry out cattle rearing tasks (Borrás, 2002).

<sup>22</sup> Sarasúa (2002a, 573–574) argues that girls enjoyed less flexibility because they also had to help their mothers at home, not only with housekeeping, but also by taking care of their siblings, thus increasing the girls' opportunity cost to attend the school.

<sup>23</sup> The 19th century witnessed some changes in this regard but the general attitudes to what girls should learn remained highly retrograde (Sarasúa, 2002a, 598–604).

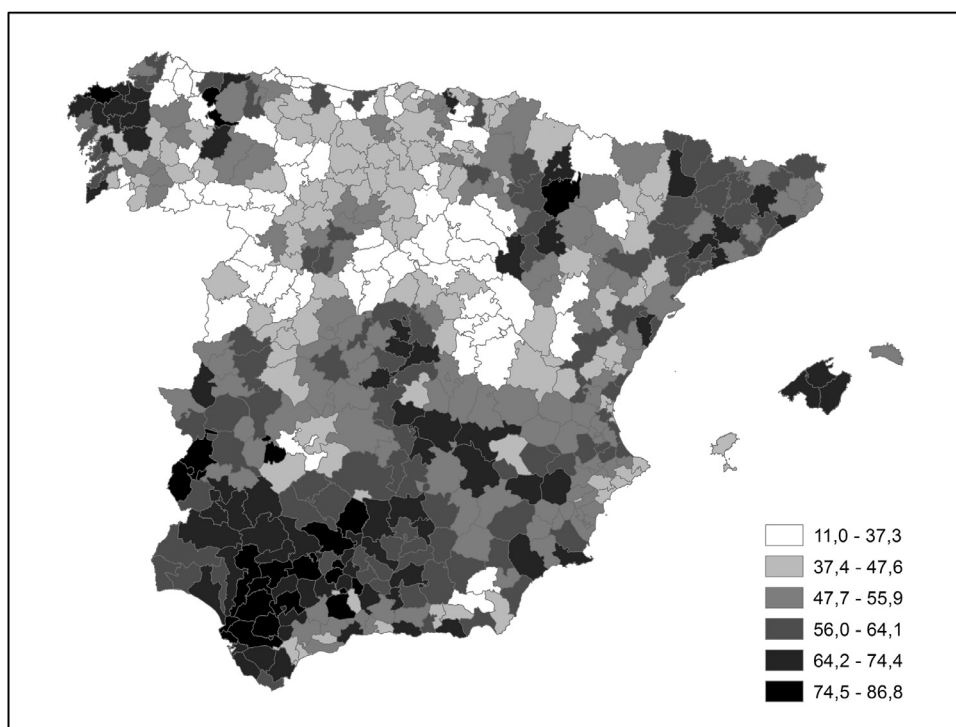
<sup>24</sup> Only the nobility and the administrative elites entrusted their daughters' education to convents (Viñao, 1999; Howe, 2008). Most literate women, however, had been educated at home (Nalle, 1989, 75).

<sup>25</sup> The influential Juan Luis Vives' *Instrucción de la mujer cristiana*, published in the 16th century, became the principal conduct book for the education of women and girls during early modern Spain. This author prescribed women and girls to stay at home to protect their virtue and advocated that there is 'no need for eloquence in a woman since nature has dictated silence and subservience as her role' (Howe, 2008, 101–102). See Howe (2008, 99–103) for a detailed account of this author's prescriptions. The submissive wife as the feminine ideal was also portrayed in Fray Luis de León's *The perfect wife* and other moralist writings of this period (Vollendorf, 2005, 171–172).

<sup>26</sup> Segregating boys and girls was considered the morally acceptable way of schooling (Viñao, 1990; Sarasúa, 2002a).

<sup>27</sup> In mid-19th century, while 18.2 per cent of the schools for boys completely relied on private funding, this figure reached almost half of the schools for girls (Sarasúa, 2002a, 579). This author estimates that only 15.5% of the total municipal expenditures on primary education were devoted to the schooling of girls (582). In summary, gender discrimination resulted in either three possibilities: there was no school for girls; when there was one, it was private; and if there was a public school for girls, it received less funding than those for boys.





**Map 1.** Land access inequality (% of farm labourers), 1860.

**Table 1**  
Literacy in Spain, 1860.

	Literacy (%)			Population	Manufacturing (%)
	All	Men	Women		
Rural districts	18.7	30.7	7.1	1680	8.8
Madrid	50.6	64.1	37.0	298,426	25.1
Barcelona	38.8	53.3	24.3	189,948	40.5
Valencia	35.2	43.9	26.5	118,298	29.2
Sevilla	33.4	46.6	21.4	107,703	31.4

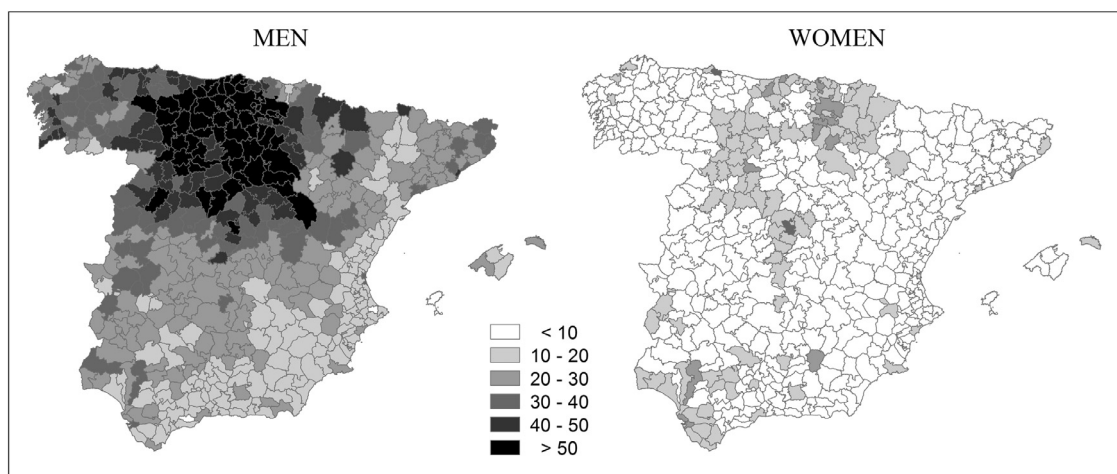
Rural districts refer to those where there are no towns larger than 10,000 inhabitants (323 rural districts in total). The figure for the population of these rural districts is the village median size. Manufacturing reflects the percentage of the active population working in manufacturing in the whole district. *Source:* see text.

existed in urban areas where a higher number of occupations attached economic value to literacy skills (Núñez, 1992; Viñao, 1990). In addition, the urban environment not only offered a better access to schools, but also provided a favourable environment for the written word (Reis, 2005).<sup>28</sup> In contrast, it is likely that only the local notables were able to read and write in rural areas. Women were further disadvantaged in this dimension. The figures collected for 1860 Spain mostly confirm this view. Table 1 reports Spanish literacy rates by gender in 1860 distinguishing between urban and rural areas. As shown there, both gender and rural–urban differences were remarkable.

As Núñez (1992) has already stressed by using provincial-level data, regional variations were also pronounced. Map 2, which portrays average literacy rates by districts for both men and women, corroborates that picture at a more disaggregated level. In spite of having a similar legal framework across the country, educational attainment was clearly higher in Northern Spain. Remarkably, that area was not urban at all but was rather composed of dispersed small villages. The lowest levels of literacy were found in the South-Eastern part of the Iberian Peninsula and in Galicia in the North West. Catalonia, the more industrialised region by far, did not enjoy especially high literacy rates. Apart from evidencing that female literacy rates were considerable lower, Map 2 also stresses that, although sharing similar geographical patterns, female educational levels present their own spatial characteristics.

Our hypothesis is that the degree of land access inequality is related to the level of human capital. As indicated by Fig. 1, which plots the share of farm labourers over total agrarian population against male and female literacy rates, a preliminary exploration of

<sup>28</sup> In contrast to rural areas, towns and cities enjoyed a more frequent contact with written documents as a result of continuous market exchanges and regular encounters with the authorities and the law (Reis, 2005, 207).



Map 2. Literacy in Spain (%), 1860.

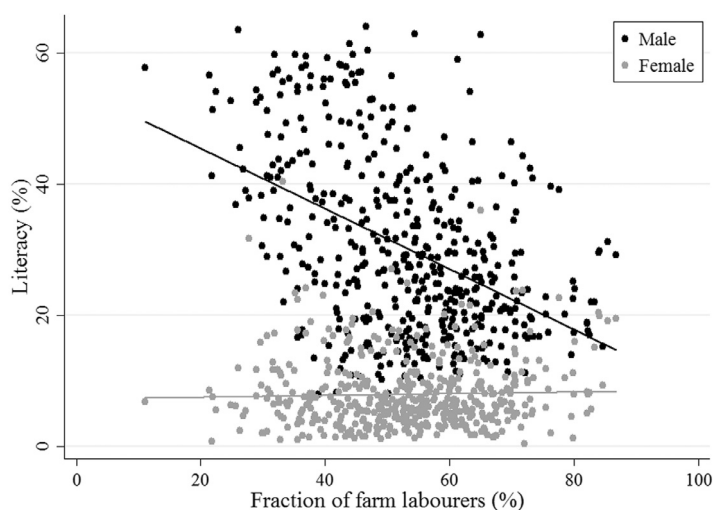


Fig. 1. Land access inequality and literacy, 1860.

the data confirms that a negative association exists, but only for men. This simple correlation can obviously be driven by the presence of other factors that are related to both variables. Next section therefore attempts to clarify this link by including other variables in the analysis.

#### 4. Empirical exercise

In order to test whether land access inequality is negatively associated with education, we estimate the following model:

$$educ = \beta ineq + X'\gamma + \varepsilon \quad (1)$$

where *educ* is the male/female literacy rate and *ineq* refers to the percentage of farm labourers in each district. While  $\varepsilon_i$  is the error term,  $X'$  is a set of covariates that allows controlling for other factors that may challenge our identification strategy. These variables capture other dimensions of the demand and supply of education that might also be associated with land inequality. Population density, the share of urban population and the fraction of the active population employed in the manufacturing sectors aim to capture demand factors.<sup>29</sup> In order to further control for access to markets and urban areas, we control for distance to big cities, to provincial capitals and to the sea.<sup>30</sup>

There are other dimensions that may also affect education. Two basic inheritance systems have predominated in Spain: sole heir and equal shares (Ferrer Alòs, 2014). In the north, where the Carolingian counties established by the Franks were located, the

<sup>29</sup> A higher population density also allows exploiting economies of scale in the supply of schooling.

<sup>30</sup> Distance is measured in kilometres and included as logs. Big cities refer to those larger than 100,000 inhabitants, namely Madrid, Barcelona, Valencia and Seville. Changing this threshold does not alter the results of the analysis.

impartible inheritance system predominated. In this case, property rights were transmitted to just one son or daughter.<sup>31</sup> In the rest of Castile, however, legal regulations stemmed from Visigothic Code. This legal system considered all sons and daughters to be equal and therefore did not allow freedom of bequest. Therefore, estates had to be shared equally between the heirs.<sup>32</sup> As well as in the rest of North-Western Europe, the nuclear family, associated with partible inheritance, was then the prevalent form of household organisation in Spain. The presence of stem family types, however, linked to impartible inheritance systems, was notable in Northern Spain. Todd (1987, 1990) argues that the family structure is crucial to understand the expansion of literacy. Following Reher (1997b, 31), the degree of household complexity is measured as the number of female adults (aged 26–80) per household.

A larger share of young population is likely to have put more pressure on the education system. Also, if households' resources were constrained, a larger offspring limited the possibility that every child was enrolled at the school. The fraction of the population aged 0–15 over the labour force is thus included in the model. It is nonetheless possible that the provision of education enjoyed economies of scale, thus counteracting the demographic negative effect. A more dispersed population, together with deficient communications, also militated against the extensive provision of schools. The problems derived from geographic isolation were accentuated in the rugged terrain typical of mountainous regions (Viñao, 1990; Borrás, 2002).<sup>33</sup> In order to capture this factor, we compute the number of settlements per 100 km<sup>2</sup>, as well as a measure of ruggedness.

Although the Catholic Church did not actively encourage education, as noted in Section 2, it is true that in a context where scarcity of teachers prevailed, local priests usually played that role (Viñao, 1999; Sarasúa, 2002a, 604). It is thus important to include their relative importance (as a percentage of the active population) to understand the variation in human capital within Spain. Likewise, although *castellano* was the language in which education was conventionally provided, we control for the possibility that educational attainments were affected in those regions where Spanish coexisted with other native languages (Catalonia, the Balearic Islands, Galicia and parts of the Basque Country, Navarra and Valencia). A dummy variable thus takes the value of 1 in those districts where another language was spoken.

Moreover, Beltrán Tapia (2013) has shown that the stock of common lands was related to higher levels of schooling expenditures and literacy rates. Collectively managed by the village community, the commons contributed to supporting both municipal and households' incomes, thus promoting the supply and demand for education. The relative importance of these collective resources, measured as the fraction of total district area, is therefore also considered in the model. Likewise, the density of social networks and trust might be related to both inequality and education, thus biasing our estimates. Relying on data on Andalusian municipalities, Oto-Peralías and Romero-Ávila (2017a) show that persistent inequality in Southern Spain has adversely affected current levels of social capital, measured in terms of blood donation. The strength of social capital in pre-industrial Spain was associated with the stock of communal resources (Beltrán Tapia, 2012). Controlling thus for the importance of common lands allows for mitigating this concern.

In addition, a dummy for the districts belonging to the Kingdom of Aragon is also taken into account. Despite the marriage of the Catholic Kings and the subsequent unification of the Crowns of Castile and Aragon (1469), both regions maintained their institutional and legal system until 1714. Aragon's home rules (*fueros*) were abolished at the end of the War of Spanish Succession due to the support that part of this region gave to the contending's candidate to the throne.<sup>34</sup> This territory's own history could therefore have influenced the variables examined here. Similarly, the region that belonged to the old Kingdom of Navarra was also able to keep its *fueros* even longer than Aragon, so an additional dummy variable has been created to capture Navarra's peculiarities.<sup>35</sup>

Lastly, land concentration has also been related to climate and geographical variables. The large estates characterising the *latifundio* system are prevalent in Southern Spain where rainfall is scarce and heat intense. Although this is a controversial issue, it is argued that, under these conditions, land can only be efficiently cultivated in large, capital-intensive, farms.<sup>36</sup> Cultivating in a flat terrain also facilitates economies of scale. In order to account for these potential confounders, measures of altitude, ruggedness and aridity are included in the analysis.<sup>37</sup> Table A.1 in the Appendix presents summary statistics of all the variables employed and Table A.2 describes how these variables have been computed.

<sup>31</sup> In Catalonia, the estate was passed down to the sons by order of birth (*hereu*) or to the first daughter (*pubilla*) in case there were no sons. In the Basque Country, Asturias, Galicia and the north of Aragon and Navarre, the progenitors were free to choose an heir (either male or female). In areas close to the Pyrenees there was a strict system of primogeniture.

<sup>32</sup> Although a fifth of the estate could be disposed freely (*quinto de libre disposición*), the rest was divided equally among sons and daughters. This is what happened in Castile, Extremadura, Murcia and Andalusia. However, in inland Cantabria, the western areas of Asturias and in Lugo, one of the heirs could be further favoured via the *mejora del tercio*, thus making this arrangement relatively similar to the sole heir system. In Guipuzcoa, which was governed by Castilian law, rural areas adopted a system similar to the sole heir system that was used in the rest of the Basque Country. For more details, see Ferrer Alòs (2014).

<sup>33</sup> In mountainous areas where population lived in disperse settlements, having to walk between 2 and 5 km through impassable roads to the nearest school was discouraging to say the least, especially in times of harsh weather (Borrás, 2002, 529).

<sup>34</sup> The *fueros* were the set of laws that conformed the legal and institutional systems of the four kingdoms that made up the Crown of Aragon. These included the *usages and constitutions* in Catalonia (established between the XI and XIII centuries), the *Carta de Franquesa* in the kingdom of Mallorca (1230), the *Furs de València* (1261), and the *Fuero de Aragón* (1283). The Spanish War of Succession (1701–1714) and the arrival of the House of Bourbon to the throne implied the abolition of the *fueros* in the territories of the Crown of Aragon and their substitution with the laws and institutions of Castile via the Decrees of *Nueva Planta*.

<sup>35</sup> See Grafe (2012) for a detailed account of the legal peculiarities of these historical territories.

<sup>36</sup> On this debate, see Martínez Alier (1971, 23–27) and Malefakis (1970, 35–50).

<sup>37</sup> Given that institutions can be endogenous to initial conditions (Engerman and Sokoloff, 2000), we have additionally considered a number of soil quality variables provided by the European Soil Database (ESDB 1-km resolution): top soil available water capacity, base saturation of the top soil, topsoil organic content, volume of stones and distance to rock (Combes et al., 2010). Although the results are unchanged, we have decided not to include them in our main specification for two main reasons. On the one hand, the inclusion of these variables risks overfitting our model. On the other hand, given that we are also accounting for spatially correlated omitted variables (see Section 6), we effectively control for this type of ecological variables. These results are nonetheless available upon request.



**Table 2**  
Land inequality and literacy. OLS.

Panel A	Dependent variable: Male literacy (%)			
	(1)	(2)	(3)	(4)
Farm labourers (%)	–.46*** (0.07)	–.34*** (0.05)	–.34*** (0.05)	–.33*** (0.05)
R-squared	0.203	0.653	0.668	0.691
Panel B	Dependent variable: Female literacy (%)			
	(1)	(2)	(3)	(4)
Farm labourers (%)	0.01 (0.03)	0.00 (0.02)	0.01 (0.02)	–0.02 (0.02)
R-squared	0.001	0.557	0.626	0.659
Socio-economic controls	No	Yes	Yes	Yes
Distance controls	No	No	Yes	Yes
Geography/climate controls	No	No	No	Yes
Observations	464	464	464	464

Robust standard errors clustered at the province level; \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ ; For simplicity, the intercept is not reported. OLS regressions.

Table 2 reports the results from estimating Eq. (1) via OLS. In order to take into account that model errors are likely to be correlated between neighbouring districts, standard errors are clustered at the province level. While column (1) presents the baseline specification, columns (2)–(4) sequentially add the set of controls described above.<sup>38</sup> These results strongly support the existence of a negative relationship between land access inequality and male literacy levels (Panel A). Women's literacy, however, does not seem to be related to land ownership (Panel B). It is worth stressing that the coefficient on our variable of interest hardly changes as other potential confounders are added into the model. According to column 4, which includes the complete set of controls, a 10 percentage-point increase in land access inequality implies a 3.3 percentage-point reduction in male literacy rates. If we consider that male literacy in the median district is 27.4 per cent, this is a sizable effect. In other words, moving from a hypothetical district occupying the 25th percentile of the distribution (43.8 per cent of farm labourers) to one in the 75th percentile (62.0 per cent of farm labourers) would reduce literacy levels by 6 percentage points, more than one fifth of the median literacy.

There exist however some issues that prevent considering the previous estimate as causal. Despite having controlled for many potential confounding factors, there is a possibility that some unobserved variable is driving both land access inequality and literacy rates. It is also plausible that the relationship runs the other way around and that literacy rates may have influenced the degree of concentration of land ownership, thus biasing the coefficient of interest. In order to overcome these concerns, next section employs the *Reconquest*, a crucial episode in Spanish history, as a source of exogenous variation.

## 5. The reconquest as an instrument

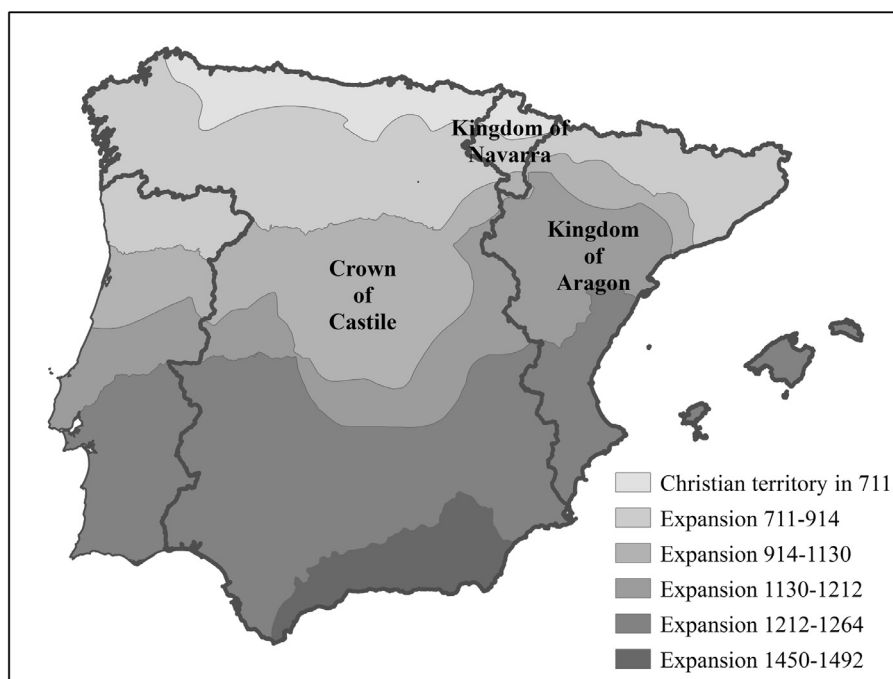
In 711, a Muslim army invaded the Iberian Peninsula. The Visigothic Kingdom hardly opposed any resistance and the Muslim forces rapidly occupied the whole territory, except some mountain strips in the North. The *Reconquest* refers to the long process of expansion carried out by the Christian Kingdoms at the expense of the Muslims between the 9th and the 15th centuries. This historical episode provides a source of exogenous variation that allows identifying the causal effect of land access inequality on human capital. The Christian expansion was characterised by 'a slow and intermittent advance from one river frontier to another and was accompanied by the colonisation or repopulation of the occupied territory' (O'Callaghan, 2002, 19).<sup>39</sup> We argue that the timing of the *Reconquest* is crucial for the type of institutions implemented in each region of the Crown of Castile, which in turn influenced the distribution of land.

It is important to stress that, although a lengthy process, the *Reconquest* was not 'a slow, steady and gradual one', but instead it 'took great leaps forward, to the Duero, the Tagus, the Guadalquivir and the south coast, and after each leap [the Christians] waited for centuries to consolidate their position before making the next one' (Lomax, 1978, 175–176). The institutions defining the social appropriation of the territory in each stage depended on a complex and changing mix of factors including demographic factors, the relative power of the Crown and the nobility, the size of the conquered territory, the scale of war effort and the density and assimilability of the Muslim population.<sup>40</sup> This idea is not original and can be traced back to Carrión (1932), Vicens Vives (1969) or Malefakis (1970), among others.

<sup>38</sup> Table A.3 in the Appendix reports the coefficients of all the variables employed in this model. The data and models employed in this paper can be found in Beltrán Tapia and Martínez-Galarra (2017).

<sup>39</sup> Detailed accounts of the *Reconquest*, to whom we rely on, can be found in Lomax (1978), Moxó (1979), García de Cortázar et al. (1985), O'Callaghan (2002) and Valdeón (2006). As explained below, the characteristics of the *Reconquest* differed between the Kingdoms of Castile and Aragon.

<sup>40</sup> As the Christian conquest progressed, the Muslim population often remained in the territory under the political control of the Christians. This population, initially referred as *mudéjares*, was forced to Christian conversion in 1502 under the rule of the Catholic Kings. From then on, after the coerced conversion to Christianity,



Map 3. Stages of the Reconquest, 711–1492.

Source: Mackay (1977), Lomax (1978), García de Cortázar et al. (1985) and Ladero (2014).

Oto-Peralías and Romero-Ávila (2016) have also recently applied this reasoning using data at the provincial level. These authors argue that the conditions associated with each stage of the *Reconquest* determined the type of political and economic institutions established in each area, which in turn influenced long-run regional economic development. Likewise, Oto-Peralías and Romero-Ávila (2017b) find that the frontier between the Kingdoms of Granada and Castile in the late Middle Ages had a persistent effect on inequality levels. In particular, they show that insecurity led to a higher concentration of political and economic power in the municipalities located at the Castilian side of the frontier.<sup>41</sup>

The *Reconquest* originated in a mountainous strip along the Biscay Coast in northern Spain (see Map 3). These highlanders, who were never conquered by the Muslim forces,<sup>42</sup> had an egalitarian social organisation based on local assemblies of freemen. A no-man's land stretching from the mountainous northern regions to the Duero River separated Christian and Muslim territory. During the 9th and 10th century, as the Christian population increased, the frontier slowly expanded southward to the Duero Valley. This depopulated area was resettled as a result of official initiatives and spontaneous settlements that made use of the *presura*, a legal instrument granting settlers the possession of the lands they occupied. This initial stage created both a wide layer of small holders and large domains depending on the type of settlers who exercised these rights, either small farmers, nobles or religious lords.

Some authors have argued that the *Reconquest*, understood as a conscious and planned incorporation of occupied territories, only started in the 11th century (Lomax, 1978, 96; García de Cortázar et al., 1985, 91). During this second stage, when the frontier reached the Tagus River, the resettlement process was conducted by the monarch (or his agents) who offered the new settlers better legal conditions than for those settled down north the Duero. This is explained partly because of the difficulties to attract new colonists and partly because the royal intervention limited the need to resort to seigniorial contracts. Instead, the Crown delegated the task of resettlement to newly established municipal councils (*concejos*). The role of these relatively democratic institutions, together with the generous privileges granted to the settlers, favoured the creation of a wide layer of small farms, which facilitated the emergence of a fairly egalitarian peasant society.

In contrast, the conquest of the vast territories between the Tajo and the Guadiana rivers was extremely fierce. After the capture of Toledo in 1085, the *Reconquest* came to a halt and, up to the early 13th century, that region was subject to continuous military operations from both sides.<sup>43</sup> The Christian subjugation of this territory only thus took place after a significant increase in the scale of war effort. Furthermore, partly due to the lack of urban entities and council militias in this region, the nobility and the Military

they were usually denominated *moriscos* and they were particularly relevant in the former kingdoms of Granada, Valencia and Aragon (especially around the Ebro Valley). The *moriscos* were finally expelled by Philip III in 1609: almost 300,000 people, around 4% of the Spanish population, were forced to abandon the country.

<sup>41</sup> Tur-Prats (2015), on the other hand, also argues that the timing of the *Reconquest* led to diverse land ownership structures but, given that these systems required different inheritance systems, this author uses this variation to instrument for family types.

<sup>42</sup> Barbero and Vigil (1988) argue that, apart from the Muslims, neither Romans nor Visigoths could effectively dominate this area.

<sup>43</sup> The Muslims kings were helped by two successive waves of North African invaders, the Almoravids and Almohads, which contributed to keep the frontier in a relative equilibrium (García de Cortázar et al., 1985, 126–127).

Orders had the leading role in the military campaigns and the repopulation process.<sup>44</sup> These social groups subsequently received vast tracts of land in compensation for their services, which also included the responsibility of defending the frontier. Moreover, instead of councils, the social organisation of the territory was then left to these seigneurs, either secular or religious. All these factors contributed to creating a highly stratified society.

The occupation of Andalusia (except for the Kingdom of Granada), mainly carried out during the second third of the 13th century, followed similar traits. The fighting during this stage was even fiercer than in the previous one and necessitated even more complex planning. The main difference, however, with the previous period is that the area seized in such a relatively short span was immense. The Royal Crown was unable to organise the repopulation of these territories and resorted again to the nobility and the military orders, which accumulated enormous extensions of land, especially in the countryside.<sup>45</sup> Also, the process of expansion stopped there for more than a century and this territory remained a frontier zone. It was not until the end of the 15th century that the Catholic Kings led a campaign that put an end to the Muslim presence in the Iberian Peninsula by conquering the Kingdom of Granada in 1492. Although the resettlement process resembles the one carried out in the rest of Andalusia, the Catholic Kings were aware of the excessive power that nobles enjoyed and subsequently tried to limit their ascendance in this last stage.

In order to incorporate the *Reconquest* as an instrumental variable for our analysis, we have created a dummy variable for each stage with a value of 1 if the district geographical centre falls within it. This strategy adds up to five stages, having the mountainous area stretching along the Biscay Coast in northern Spain as the reference category. By instrumenting land access inequality with the timing of the *Reconquest* we are assuming that each period only affected literacy levels via its effect on the land ownership structure. This is obviously a strong assumption. Apart from land access inequality, the timing of the *Reconquest* certainly shaped other dimensions of the economic and social body. Firstly, each stage resulted in different settlement patterns: while a dispersed habitat, characterised for a dense network of small villages, dominated in the North, a concentrated settlement pattern, where the population lived in large villages quite distant from each other, prevailed in the Southern part of the Peninsula (García de Cortázar et al., 1985). Secondly, Tur-Prats (2015) uses the timing of the *Reconquest* to instrument for different family types. According to this author, the small- and medium-size holding typical of the first stages of the *Reconquest* required impartible inheritance so as to secure family's continuity, which led to stem families. Farm labourers, on the contrary, were less concerned with inheritance rules, thus resulting in the predominance of nuclear family households. Lastly, some authors have argued that the downward expansion throughout the Peninsula closely matches the transition from humid to arid Spain.<sup>46</sup> In order to take these concerns into account, our analysis incorporates the set of controls employed in the previous section, which include the population settlement pattern, the prevailing family type and the climatic conditions, as well as other potential confounding factors.

As mentioned above, the mechanisms that relate the different stages of the *Reconquest* with the land ownership structure only applies to the Crown of Castile. The expansion of the Kingdom of Aragon comprised the eastern part of the Iberian Peninsula and the Balearic Islands (see Map 3). The institutional context, and the way the conquered land was subsequently distributed, differed because the Crown closely managed the repopulation process, thus leaving less room to the nobles' ambitions (Vicens Vives, 1969; Sobrequés, 1972; Casado, 2002). In addition, the area conquered by Aragon was much smaller, thus facilitating the kings' task. As a further test of our research strategy, we estimate the model separately for both Kingdoms. We expect that while the instrument will hold for the Castilian case, it will not for Aragon.<sup>47</sup>

Table 3 shows the results of estimating Eq. (1) using the stages of the *Reconquest* as instrument. While column (1) reports the baseline specification, columns (2)–(4) subsequently add the set of controls explained above. Columns (5) and (6) retain the full set of controls but estimate the model only for the Crowns of Castile and Aragon respectively. As shown in Panel C, the first stage regressions confirm that the timing of the *Reconquest* is significantly related to the land ownership structure. Both the F test and the Sanderson–Windmeijer F test evidence that the model is not weakly identified. Examining the individual coefficients of each stage is reassuring because their relative size mostly confirms the distinct effect that, as described above, the literature has attached to the institutional mechanisms underlying the social appropriation of the land in each period of the *Reconquest*. Interestingly for our purposes, the instrument does not work when applied to the Kingdom of Aragon sample in column (6).<sup>48</sup>

The coefficient on farm labourers in the second stage is now highly significant not only for male but also for female literacy. Given that the instrument only works when the analysis focuses exclusively in Castile, we rely on the results reported in column (5). A ten-point increase in land access inequality reduces male and female literacy rates by 8.5 and 1.3 percentage points respectively. Although the effect is much stronger for men, this is partly due to higher male literacy rates.<sup>49</sup> Not only the coefficient for women is now statistically significant, but the IV estimation for men is almost three times larger than the OLS result, which is in line with what has been found in similar analyses employing instrumental variables (Easterly, 2007, 766; Ramcharan, 2010, 736; Cinnirella and

<sup>44</sup> This epoch witnessed the birth and rise of the military orders. Although some foreign military orders also participated in the *Reconquest* (Hospitallers and Templars), the process was dominated by Iberian Military Orders (the *Orden de Santiago*, the *Orden de Calatrava* and the *Orden de Alcántara*). The *encomienda* was the legal tool through which the Crown entrusted these territories to the different Orders.

<sup>45</sup> The major cities, on the contrary, stayed under royal control.

<sup>46</sup> On this issue, see Malefakis (1970) and Martínez Alíer (1971).

<sup>47</sup> Moreover, the fact that some variations of the Catalan language constitute the native language in a large part of the Crown of Aragon obscures the relationship between land inequality and education in those territories. Getting literate in Spanish was therefore very difficult for the bottom part of the rural population regardless of whether they were landless labourers or have access to small plots of land.

<sup>48</sup> Note how, in this specification, the F test addressing the joint significance of the stages of the *Reconquest* collapses below the standard threshold value of 10 and the Sanderson–Windmeijer F test cannot reject the null that the endogenous variable is weakly identified. Therefore, given that using the *Reconquest* as an instrument does not work in the case of the Kingdom of Aragon, the coefficient on farm labourers in column (6) cannot be trusted.

<sup>49</sup> The district median literacy is 27.4 and 6.6 per cent for men and women, respectively.

**Table 3**  
Land inequality and literacy. 2SLS.

Panel A	Dependent variable: Male literacy (%)					
	All (1)	All (2)	All (3)	All (4)	Castile (5)	Aragon (6)
Farm labourers (%)	−1.47*** (0.35)	−.94*** (0.14)	−.98*** (0.14)	−1.08*** (0.16)	−.85*** (0.11)	1.19* (0.63)
F-test (p-value)	0.0001	0.0000	0.0000	0.0000	0.0000	0.0178
Panel B	Dependent variable: Female literacy (%)					
	All (1)	All (2)	All (3)	All (4)	Castile (5)	Aragon (6)
Farm labourers (%)	−0.13 (0.11)	−.16** (0.07)	−.16*** (0.06)	−.21*** (0.05)	−.13*** (0.04)	.35* (0.20)
F-test (p-value)	0.2596	0.0000	0.0000	0.0000	0.0000	0.0001
Socio-economic controls	No	Yes	Yes	Yes	Yes	Yes
Distance controls	No	No	Yes	Yes	Yes	Yes
Geography/climate controls	No	No	No	Yes	Yes	Yes
Observations	464	464	464	464	353	111
Sanderson–Windmeijer F test	5.722	12.24	11.53	13.79	11.69	2.036
S-W F test (p-value)	0.0003	0.0000	0.0000	0.0000	0.0000	0.1728
Panel C: First stage	Dependent variable: Farm labourers (%)					
	(1)	(2)	(3)	(4)	(5)	(6)
Stage 1: 711–914	6.25** (3.13)	10.50*** (2.21)	9.71*** (2.60)	11.67*** (2.39)	9.53*** (2.49)	
Stage 2: 914–1130	2.69 (4.04)	8.51** (3.96)	6.08 (4.06)	9.89** (3.90)	4.77 (3.38)	−4.39 (6.17)
Stage 3: 1130–1212	6.18 (3.78)	14.05*** (3.63)	13.64*** (4.03)	15.55*** (3.21)	9.60** (3.79)	−6.49 (4.60)
Stage 4: 1212–1264	16.25*** (3.22)	21.15*** (2.89)	19.01*** (2.60)	20.63*** (2.70)	19.28*** (2.77)	−9.93** (4.12)
Stage 5: 1450–1492	10.72*** (3.18)	14.75*** (3.55)	14.63*** (3.84)	20.34*** (5.37)	14.51*** (5.29)	
Observations	464	464	464	464	353	111
R-squared	0.188	0.349	0.373	0.450	0.559	0.242
F-test (Stages 1–5)	29.54	64.89	61.55	74.26	64.26	8.12

Robust standard errors clustered at the province level; \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . For simplicity, the intercept is not reported. 2SLS regressions employing the timing of the Reconquest as an instrument for the importance of farm labourers.

Hornung, 2016, 145). Measurement error is likely to have downward biased the OLS estimates. As discussed above, our measure of inequality mitigates regional differences and the IV results thus correct for the fact that a *jornalero* in the latifundio regions had even less access to land than a *jornalero* in less unequal areas who usually had access to a small plot of land.

Returning to our previous hypothetical situation, moving from the 25th to the 75th percentile of the land inequality distribution (from a 43.8 to a 62.0 per cent of farm labourers) would imply literacy rates 15.5 and 2.4 percentage points lower for men and women respectively. This effect is considerable, especially taking into account that male and female literacy rates at that time were quite low (the median was 27.4 and 6.6 per cent, respectively). It thus appears that Sánchez Albornoz (1977, 723–726) was indeed right in considering the *Reconquest* as the key to the history of Spain,<sup>50</sup> at least regarding the structure of land ownership that arose from it and its effect on educational levels.

## 6. Spatial dependence

An additional concern lies in the presence of spatial autocorrelation. As evident in Map 2, spatial clustering was a clear characteristic of the distribution of male and female literacy rates over the Spanish geography. Apart from sharing a similar socio-economic and physical context (including the levels of inequality), this spatial pattern might be the result of the diffusion of norms via social interaction and/or migration. In this regard, the decision of educating children is likely to depend on the value that other households attach to literacy.

<sup>50</sup> Also in Mackay (1977, 1–3) and Lomax (1978, 1). These authors however rather stress the role of the *Reconquest* on creating the economic, social and political structures that would allow Spain to build a global empire after 1492.

**Table 4**  
Land inequality and literacy. Spatial dependence. IV/GMM.

Panel A	Dependent variable: Male literacy (%)		
	(1)	(2)	(3)
Farm labourers (%)	-.61*** (0.11)	-.42*** (0.05)	-.40*** (0.07)
<i>P</i>	.11*** (0.01)		.08*** (0.01)
$\Lambda$		.06*** (0.01)	.05*** (0.01)
Panel B	Dependent variable: Female literacy (%)		
	(1)	(2)	(3)
Farm labourers (%)	-0.08 (0.05)	-0.03 (0.03)	-0.02 (0.03)
<i>P</i>	.11*** (0.01)		.04** (0.02)
$\Lambda$		.07*** (0.01)	.06*** (0.01)
Socio-economic controls	Yes	Yes	Yes
Distance controls	Yes	Yes	Yes
Geography/climate controls	Yes	Yes	Yes
Observations	353	353	353

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . For simplicity, the intercept is not reported. For simplicity, the intercept is not reported. Each column refers to a different spatial specification: the Spatial Error Model, the Autoregressive Spatial Model and the General Spatial Model. All of them employ the timing of the Reconquest as an instrument for the importance of farm labourers (IV/GMM). The complete set of controls is included in all specifications. The exercise focuses on the Castilian districts and thus excludes those of the Crown of Aragon.

Spatial dependence is addressed here by employing three different specifications (Anselin, 2003; Pace and LeSage, 2010; Elhorst, 2014). Firstly, we estimate a Spatial Error Model that allows literacy rates to be influenced by common unobserved factors in neighbouring districts. Although our previous specification controls for a variety of variables that might be affecting the choice of investing in education, omitted variables that are correlated across space, such as ecological features or shared social norms, might be affecting the error term in (1). If that were the case, disturbances would be spatially correlated. In order to account for this type of spatial dependence, we use a spatial weight matrix ( $W$ ) that models each district's disturbances as being related to those of its neighbours (2). The error term would then be correlated across space if  $\rho \neq 0$ .

$$\varepsilon = \rho Wu + v \quad (2)$$

An alternative specification relies instead on estimating a Spatial Autoregressive Model, the so-called spatial lag model, which includes a spatial lag of the dependent variable (3). Literacy rates are then not only explained by local characteristics but also by literacy rates in nearby districts, thus suggesting the presence of some sort of diffusion process. This spatial dependence is again structured by a weighting matrix that links literacy levels in neighbouring locations (3). The parameter  $\lambda$  thus captures the degree of the spatial effect.

$$educ = \beta ineq + \lambda Weduc + X'\gamma + \varepsilon \quad (3)$$

Lastly, a more comprehensive specification, the General Spatial Model, combines the two previous models and therefore allows for accounting for both sources of spatial dependence: a spatial lag of the dependent variable and interaction effects among the error terms.

$$educ = \beta ineq + \lambda Weduc + X'\gamma + \varepsilon; \quad \varepsilon = \rho Wu + v \quad (4)$$

Given the endogenous nature of inequality, Table 4 reports the IV/GMM results of estimating the previous spatial models using the stages of the *Reconquest* as instrument.<sup>51</sup> Since the instrumental variable strategy is only suitable for the Castilian Crown, we limit the analysis to that particular sample of districts. These specifications also take into account the full set of controls discussed in preceding sections.

Two main conclusions arise. On the one hand, spatial dependence plays a role when explaining district educational levels: the parameters of the spatial error model ( $\rho$ ) and the spatial lag ( $\lambda$ ) are statistically significant, even when both components are considered

<sup>51</sup> We implement the estimation procedure using the *spivreg* command in Stata (Arraiz et al., 2010; Drukker et al., 2013). We assume that spatial dependence affects districts that are contiguous. The weighting matrix then has a value of one for observations that are contiguous and zero otherwise. The results reported here do not change if we employ a spatial matrix based on the inverse of the distance between locations within 25, 50 or 100 km from each other.



**Table 5**  
Land inequality and literacy. Rural vs urban.

Panel A	Dependent variable: Male literacy (%)	
	All (1)	Rural (2)
Farm labourers (%)	−.40*** (0.07)	−.38*** (0.08)
$\rho$	.08*** (0.01)	.12*** (0.01)
$\lambda$	.05*** (0.01)	.04*** (0.01)
 Panel B		
	Dependent variable: Female literacy (%)	
	All (1)	Rural (2)
Farm labourers (%)	−0.02 (0.03)	−0.02 (0.04)
$\rho$	.04** (0.02)	.09*** (0.02)
$\lambda$	.06*** (0.01)	.06*** (0.02)
Socio-economic controls	Yes	Yes
Distance controls	Yes	Yes
Geography/climate controls	Yes	Yes
Observations	353	283

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . For simplicity, the intercept is not reported. General Spatial Models employing the timing of the Reconquest as an instrument for the importance of farm labourers (IV/GMM). The complete set of controls is included in all specifications. The exercise focuses on the Castilian districts and thus excludes those of the Crown of Aragon.

simultaneously (and all local characteristics are controlled for), thus evidencing that the choice of investing in literacy was also influenced by spatially correlated omitted variables (such as environmental characteristics and/or shared social norms) and processes of social diffusion. On the other hand, while the negative effect of inequality on male literacy rates is robust to accounting for different sources of spatial dependence, it no longer affects female levels.<sup>52</sup>

Inequality was thus negatively influencing male literacy levels in mid-nineteenth century Spain. However, did the high concentration of land ownership negatively affect the provision of education because the rural oligarchies blocked the expansion of schooling or, alternatively, did land inequality just limited the demand for education among the lower classes? Next section attempts to disentangle the mechanisms behind the observed relationship.

## 7. Mechanisms: supply or demand?

As explained in Section 2, an unequal land property structure may have affected education via different channels. On the one hand, an unequal land structure implies a more concentrated economic and political power in the hands of large landowners. These local notables, who control municipal offices, may limit schooling so as to preserve their privilege status. On the other hand, higher levels of inequality broaden the bottom part of the population, a social class who possess scarcer resources, and possibly fewer incentives, to invest on education.

Given that, after accounting for spatial dependence, inequality only affects male literacy rates, the previous section suggests that demand factors might be playing a prominent role. If the supply of education was the key driving force, both male and female literacy rates would have then been similarly affected by an unequal land ownership structure. Although girls often helped with some agricultural tasks, it was mostly boys who were fully devoted to working the land (Borrás, 2002; Sarasúa, 2002a). More importantly, land was expected to be inherited by boys, so it made more sense to invest on the human capital of those who were going to run the farm.

Galor (2011), however, argues that, while large landowners opposed educating the rural labour force so as to limit migration and keep agricultural wages low, elites in urban, industrialised areas were in favour of supporting education and promoting human capital accumulation. In order to further explore the channels through which land access inequality affected educational attainments, we now re-estimate the General Spatial Model defined by Eq. (4) but restricting our analysis to rural districts and comparing the

<sup>52</sup> Interpreting the estimated coefficient on land inequality is not straightforward. Including a spatial lag of the dependent variable implies that the outcomes of the model are jointly determined with those of neighbouring districts.

**Table 6**

Land inequality and supply of public schools.

Panel A	Dependent variable: Public schools for boys and girls (mixed)			
	All		Rural	
	Complete (1)	Incomplete (2)	Complete (3)	Incomplete (4)
Farm labourers (%)	−.01** (0.01)	−0.03 (0.02)	−.02*** (0.01)	−.05*** (0.02)
<i>P</i>	−.09** (0.03)	−0.02 (0.05)	−0.06 (0.04)	0.02 (0.06)
$\Delta$	.17*** (0.02)	.14*** (0.03)	.17*** (0.03)	.08** (0.04)
Panel B	Dependent variable: Public schools for boys			
	All		Rural	
	Complete (1)	Incomplete (2)	Complete (3)	Incomplete (4)
Farm labourers (%)	−0.01 (0.01)	.03** (0.01)	−0.01 (0.01)	.04** (0.02)
<i>P</i>	−0.02 (0.03)	−0.12** (0.05)	−0.01 (0.04)	−.14* (0.08)
$\Delta$	.12*** (0.02)	.18*** (0.01)	.12*** (0.03)	.21*** (0.02)
Panel C	Dependent variable: Public schools for girls			
	All		Rural	
	Complete (1)	Incomplete (2)	Complete (3)	Incomplete (4)
Farm labourers (%)	0.00 (0.00)	0.01 (0.00)	0.00 (0.00)	0.01 (0.01)
<i>P</i>	−0.05 (0.05)	−0.09 (0.08)	−0.06 (0.07)	−.16* (0.09)
$\Delta$	.16*** (0.04)	.17*** (0.06)	.15*** (0.04)	.20*** (0.05)
Socio-economic controls	Yes	Yes	Yes	Yes
Distance controls	Yes	Yes	Yes	Yes
Geography/climate controls	Yes	Yes	Yes	Yes
Observations	318	318	259	259

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . For simplicity, the intercept is not reported. General Spatial Models employing the timing of the Reconquest as an instrument for the importance of farm labourers (IV/GMM). The complete set of controls is included in all specifications. The exercise focuses on the Castilian districts and thus excludes those of the Crown of Aragon.

results to those obtained using the full sample.<sup>53</sup> If landowning elites were more able to block expanding the provision of education in rural areas, we expect the negative coefficient on inequality to be even larger.

Table 5 reports the results of this exercise. Our baseline specification, column (1) in panels A (male literacy) and B (female literacy), employs the timing of the Reconquest as an instrument and includes the complete set of controls.<sup>54</sup> Again, in order to secure the validity of the instrumental variable strategy, we focus our analysis on the districts belonging to the Castilian Crown. Column (2) repeats the analysis but restricted to rural districts. Comparing the estimated coefficients evidences that the negative relationship between land inequality and literacy is hardly changed, thus casting doubt on the importance of the supply-side mechanisms stressed by Galor (2011).

In order to further examine these links, we have collected information on the number of schools, the number of teachers and schooling enrolment rates.<sup>55</sup> Table A.4 in the Appendix provides an overview of this information comparing the whole Castilian sample with the more agricultural districts. Although these variables attempt to proxy for supply and demand considerations respectively, both

<sup>53</sup> The rural sample excludes the less agricultural districts: those whose fraction of the active population working in agriculture lies in the bottom 20% of the distribution (less than 58.5 per cent of the labour force; 70 out of 353 districts). The results reported here are virtually unchanged if we expand the range of districts excluded to those lying in the bottom 40 per cent (less than 65.8 per cent of the labour force; 142 observations).

<sup>54</sup> It is therefore the same specification as in column (3) in Table 4. Note also that the direct effect of the importance of urbanisation levels on literacy is already accounted for in the specification.

<sup>55</sup> Data on the number of schools come from an alternative source (Madoz, 1850). Data is referred to the years 1846–1850. Given that no information is offered for the provinces of Burgos, Cádiz and Logroño, our sample is restricted to 318 out of 353 Castilian districts.

**Table 7**  
Land inequality, teachers and schooling enrolment.

Panel A	Dependent variable			
	Male school teachers		Boys' schooling enrolment (%)	
	All (1)	Rural (2)	All (3)	Rural (4)
Farm labourers (%)	−.08*** (0.02)	−.09*** (0.02)	−.51*** (0.10)	−.52*** (0.13)
$\rho$	−.06** (0.03)	−0.03 (0.03)	.04** (0.02)	.09*** (0.02)
$\lambda$	.07*** (0.01)	.06*** (0.01)	.06*** (0.01)	.03*** (0.01)
Panel B	Dependent variable			
	Female school teachers		Girls' schooling enrolment (%)	
	All (1)	Rural (2)	All (3)	Rural (4)
Farm labourers (%)	−0.00 (0.01)	−0.01 (0.01)	−.16** (0.07)	−0.13 (0.10)
$\rho$	.05*** (0.02)	.07*** (0.02)	0.01 (0.02)	.11*** (0.02)
$\lambda$	.05*** (0.01)	.04*** (0.02)	.07*** (0.01)	.03** (0.02)
Socio-economic controls	Yes	Yes	Yes	Yes
Distance controls	Yes	Yes	Yes	Yes
Geography/climate controls	Yes	Yes	Yes	Yes
Observations	353	283	353	283

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . For simplicity, the intercept is not reported. General Spatial Models employing the timing of the Reconquest as an instrument for the importance of farm labourers (IV/GMM). The complete set of controls is included in all specifications. The exercise focuses on the Castilian districts and thus excludes those of the Crown of Aragon.

are however endogenous: a larger supply of schools and teachers may encourage more children to attend school and, alternatively, higher schooling enrolment rates may push for more schools and teachers. Nevertheless, exploring how inequality affects these variables is highly informative.

Table 6 reports the results of analysing whether land access inequality influenced the supply of public schools for both the whole sample and the rural districts. As explained in Section 2, gender segregation was a crucial feature of 19th century education. Consequently, the source distinguishes between mixed schools and those only for boys or girls. Schools are also classified depending on whether they “complete” or “incomplete”.<sup>56</sup> Land inequality negatively affected the supply of mixed schools and especially so in more rural areas. However, there is no clear relationship with the provision of schools for boys or girls and the link turns to be positive in the case of incomplete schools for boys. Therefore, although these results do not discard the role of supply considerations, they evidence that other factors were at play in explaining the relationship between inequality and education.

In order to further address these issues, Table 7 repeats the exercise focusing now on the number of teachers and schooling enrolment rates.<sup>57</sup> Given the gender segregation issues, male and female teachers, as well as boys' and girls' enrolment rates, are considered separately.<sup>58</sup> While the fraction of farm labourers is shown to have a significant negative impact on both male and female schooling enrolment rates, inequality only has an effect on the supply of male school teachers. The standardised coefficients show that the effect of our variable of interest is larger on boys' schooling enrolment (0.39) than on male teachers (0.31), thus suggesting that demand factors played a slightly more important role. Likewise, the fact that inequality affects girls' schooling enrolment but shows no effect on the supply of female teachers also points in the same direction. Lastly, as with the case of literacy, the results on schooling enrolment and the supply of teachers remain virtually unaltered when restricting the analysis to the rural sample.<sup>59</sup>

<sup>56</sup> Incomplete schools (*escuelas incompletas*) were typical of small towns and rural areas. Compared to complete schools (*escuelas completas*), these schools employed less qualified teachers and were primarily focused on learning basic skills (reading, writing, calculating and learning the catechism). Finally, it is worth noting that a large number of girls attended these schools.

<sup>57</sup> This information is provided by 1860 Population Census, so it is available for all the *partidos judiciales*.

<sup>58</sup> Given that girls were expected to learn domestic skills, their education was primarily in the hands of female teachers. On these issues see Sarasúa (2002b).

<sup>59</sup> This conclusion holds if, instead of the absolute effect of inequality on the dependent variables, we compute the standardise coefficients. Although the effect on girls' schooling is no longer significant when the analysis is restricted to rural areas, this is likely due to the larger standard errors arising from the lower number of observations.

## 8. Conclusion

Land access inequality exerted a large negative influence on male educational attainments in pre-industrial Spain. As well as a story of “extractive institutions” where landowning elites limited the provision of education, this paper shows that demand factors also mattered, at least at this stage of development. Where land ownership was highly concentrated, the economic situation of the rural poor was extremely precarious and investing on education was beyond the budget constraints of large segments of the population. Moreover, the incentives to acquire literary skills were limited because the possibilities of upward mobility were almost non-existent. In this regard, due to the prevailing attitudes towards women in general, and women’s education in particular, the demand factors that help fostering boys’ access to education had a much smaller effect on girls’. Although, by controlling local offices, large landowners were able to somewhat restrict public support for education, the role of supply factors is only part of the story.

Our results hardly change when restricting the analysis to rural areas, thus casting doubt in the idea that elites in urban, industrialised areas were more in favour of promoting human capital accumulation. It is likely, however, that mid-19th century Castile was still too agriculturally-oriented to nurture the type of modernising elites described by [Galor \(2011\)](#). Migratory flows were also weak, especially in Southern Spain ([Silvestre, 2005](#)), so large landowners perhaps did not fear that they were going to lose their labour force. In any case, this paper adds another dimension to the ‘agrarian question’ as a fundamental problem for economic development. Apart from generating a dysfunctional structure of incentives that reduced investments on labour-saving technologies and fuelled social conflict in the countryside ([Clar and Pinilla, 2009](#)), the concentration of land ownership acted as a formidable barrier for human capital accumulation.

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## Appendix

[Tables A1–A4.](#)

**Table A.1**  
Summary statistics.

	Obs.	Mean	St. dev.	Min.	Max.
<i>Land inequality</i>					
Farm labourers (%)	464	53.14	13.29	11.02	86.80
<i>Literacy rates (%)</i>					
Total	464	18.96	8.421	4.960	49.55
Men	464	30.27	13.55	8.008	64.03
Women	464	8.031	5.463	0.431	40.40
<i>Public schools (per 1000 school-age children)</i>					
Mixed complete	402	0.505	0.953	0	4.769
Male complete	402	2.407	2.345	0	21.07
Female complete	402	0.645	1.091	0	7.257
Mixed incomplete	402	0.911	2.279	0	14.78
Male complete	402	1.791	4.173	0	34.44
Female incomplete	402	0.386	1.528	0	25.83
<i>School teachers (per 100 school-age children)</i>					
Total	464	3.645	2.017	0.377	18.51
Men	464	4.931	3.463	0.175	34.64
Women	464	2.322	1.391	0	8.380
<i>Schooling enrolment rates (%)</i>					
Total	464	35.57	14.11	1.470	82.88
Boys	464	42.31	17.44	2.511	95.75
Girls	464	28.66	13.35	0.396	69.69

(continued on next page)

Table A.1 (continued)

	Obs.	Mean	St. dev.	Min.	Max.
<i>Control variables</i>					
Urbanisation (%)	464	16.43	27.67	0	100
Industrialisation (%)	464	10.37	6.461	0.965	64.37
Population density	464	63.42	283.3	3.730	5502
Population aged < 16 (%)	464	86.22	18.45	29.77	164.0
Settlement pattern	464	30.71	46.34	1.127	293.9
Family type	464	1.025	0.142	0.750	1.573
Commons	464	0.219	0.216	0	0.75
Priests (%)	464	0.637	0.330	0.182	2.125
Non-Spanish language	464	0.293	0.456	0	1
Crown of Aragon	464	0.239	0.427	0	1
Kingdom of Navarre	464	0.011	0.103	0	1
Capital	464	0.002	0.046	0	1
Distance to big cities	464	197.8	122.2	4.360	537.0
Distance to provincial capital	464	44.05	23.88	1.080	129.6
Distance to coast	464	103.2	89.84	0.330	356.2
Aridity index	464	50.02	28.29	15.82	307.1
Altitude	464	571.0	343.4	2	1915
Ruggedness	464	179.1	114.9	6.530	706.9
District area (km <sup>2</sup> )	464	1079	686.0	13	4225

Source: See text and Table A2 in the Appendix.

Table A.2

Description of the variables employed.

Farm labourers	Importance of farm labourers over the active agricultural population.
Literacy	Percentage of population able to read and write. It also distinguishes between male and female literacy.
Schools	Number of public schools, relativised by the schooling-age population (per thousand), taken from Madoz (1850). Schools are classified depending on the gender of students (mixed, boys' and girls') and the type of school (complete and incomplete). The source does not provide information on all the <i>partidos judiciales</i> .
Schooling enrolment	Percentage of students enrolled in primary education over the schooling-age population (6–15). It is also computed for boys and girls separately.
Teachers	Number of teachers over the schooling-age population (per thousand).
Urbanisation	Percentage of population living in towns larger than 10,000 individuals.
Industrialisation	Percentage of the active population working in manufacturing.
Population density	Total population divided by district area.
Population aged < 16	Percentage of population younger than 16 over the active population.
Settlement pattern	Settlements per 100 km <sup>2</sup> . Settlements are <i>Ciudades, villas, lugares, aldeas</i> and <i>caseríos</i> taken from the 1860 <i>Nomenclator</i> .
Family type	Number of female adults (aged 26–80) per household.
Commons	Fraction of common lands over the total district area. Taken from the <i>Catálogo de Montes Públicos</i> (1860).
Priests	Percentage of priests over the active population.
Non-Spanish language	Dummy variable taking the value of 1 in those districts where an alternative language to Spanish was spoken (in the district capital).
Distance to big cities	Distance from the district centroid to the nearest city bigger than 100,000 inhabitants (in km). Four cities fulfil that criterion: Madrid, Barcelona, Seville and Valencia.
Distance to provincial capital	Distance from the district geographical centre to the provincial capital (km).
Distance to coast	Distance is computed from the district geographical centre (centroid) to the nearest coastline (in km).
Aridity index	Average rainfall divided by average temperature. The climate information refers average temperature and average rainfall during the period 1950–2000. The WorldClim 1 km digital data can be found in Hijmans et al. (2005) ( <a href="http://www.worldclim.org/">http://www.worldclim.org/</a> ).
Altitude	Median altitude in each district using the SRTM 90-m resolution digital elevation data ( <a href="http://srtm.csi.cgiar.org">http://srtm.csi.cgiar.org</a> ).
Ruggedness	Standard deviation of altitude.
District area	District area (km <sup>2</sup> ).

Source: 1860 Population Census except when stated otherwise. The geographical data have been computed using ArcGIS.



Table A.3

Land inequality and literacy. OLS.

	Dependent variable							
	Male literacy (%)				Female literacy (%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Farm labourers (%)	−.46*** (0.07)	−.34*** (0.05)	−.34*** (0.05)	−.33*** (0.05)	0.01 (0.03)	0.00 (0.02)	0.01 (0.02)	−0.02 (0.02)
Manufacturing (%)		.31*** (0.10)	.22** (0.09)	.21** (0.10)		.32*** (0.07)	.25*** (0.06)	.26*** (0.06)
Urbanisation (%)		−.04** (0.02)	−.05** (0.02)	−.04* (0.02)		0.01 (0.01)	−0.00 (0.01)	−0.00 (0.01)
Population density (%)		.00* (0.00)	0.00 (0.00)	0.00 (0.00)		.00*** (0.00)	.00*** (0.00)	.00*** (0.00)
Priests (%)		20.02*** (2.42)	19.29*** (2.21)	17.45*** (1.97)		4.69*** (0.91)	5.51*** (0.79)	5.64*** (0.68)
Population aged < 16 (%)		−.21*** (0.03)	−.19*** (0.03)	−.17*** (0.03)		−.07*** (0.01)	−.05*** (0.01)	−.04*** (0.01)
Family type		18.90** (7.20)	23.68*** (7.58)	23.71*** (7.58)		−1.07 (3.01)	−0.96 (2.13)	0.33 (2.40)
Settlement pattern		0.00 (0.01)	0.00 (0.02)	−0.00 (0.02)		−0.01 (0.01)	−.02** (0.01)	−.02** (0.01)
Commons (%)		0.85 (2.69)	2.17 (2.58)	4.28* (2.39)		0.66 (1.43)	0.94 (1.23)	1.88* (0.99)
Non-Spanish speaker		−8.30*** (2.11)	−8.32*** (2.24)	−8.68*** (2.24)		−3.26*** (0.97)	−3.84*** (0.77)	−4.35*** (0.74)
Capital		20.44*** (2.23)	13.15*** (4.12)	13.17*** (4.41)		17.12*** (1.49)	17.22*** (1.63)	17.54*** (1.63)
Crown of Aragon		−7.46*** (1.81)	−8.15*** (1.89)	−7.09*** (1.69)		−2.66*** (0.68)	−3.56*** (0.58)	−3.18*** (0.48)
Kingdom of Navarre		−0.95 (1.81)	−0.61 (1.89)	−0.21 (1.88)		6.40*** (1.05)	6.22*** (0.91)	5.89*** (0.72)
Distance to coast			0.39 (0.97)	−0.56 (0.80)			−1.14*** (0.36)	−.58** (0.27)
Distance to big cities			−1.66* (0.98)	−1.44 (1.04)			−0.69 (0.41)	−0.46 (0.42)
Distance to province capitals			−1.78*** (0.58)	−1.78*** (0.57)			−1.29*** (0.29)	−1.22*** (0.28)
Altitude				0.00 (0.00)				−.00*** (0.00)
Ruggedness				−.02*** (0.01)				−0.00 (0.00)
Aridity index				0.03 (0.04)				0.01 (0.01)
District area (km <sup>2</sup> )				−0.00 (0.00)				−.00* (0.00)
Observations	464	464	464	464	464	464	464	464
R-squared	0.203	0.653	0.668	0.691	0.001	0.557	0.626	0.659

Robust standard errors clustered at the province level; \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . For simplicity, the intercept is not reported.

**Table A.4**  
Educational performance in 1860 castile.

	All districts			Rural districts		
	Obs.	Mean	St. dev.	Obs.	Mean	St. dev.
Literacy (%)						
Men	353	32.68	14.00	283	31.83	14.15
Women	353	8.87	5.74	283	7.42	4.25
Public schools (per 1000 schooling-age children)						
Complete						
Mixed	318	0.64	1.03	259	0.62	1.04
Boys'	318	1.97	1.97	259	1.94	2.03
Girls'	318	0.48	0.84	259	0.46	0.80
Incomplete						
Mixed	318	1.15	2.51	259	1.17	2.51
Boys'	318	1.67	4.36	259	1.75	4.54
Girls'	318	0.35	1.69	259	0.35	1.83
School teachers (per 1000 schooling-age children)						
Male teachers	353	5.19	3.75	283	5.17	3.89
Female teachers	353	2.08	1.30	283	1.79	1.05
Schooling enrolment rates (%)						
Boys	353	44.05	18.57	283	43.58	18.78
Girls	353	28.51	13.91	283	27.09	13.93

Source: See text and Table A.2 in the Appendix. The rural sample focuses on the more agricultural districts (the top 80 per cent of the distribution): those where more than 58.5 per cent of the labour force works in agriculture.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eeh.2017.12.003.

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