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Abstract

Relying on an extremely rich data set of individuals living in Madrid in 1880 and 1905, this article explores the relationship between class, access to education and social mobility. In order to do so, we first focus on children and assess the probability of being literate according to their parents' socio-economic status. Although inequality in education declined during the period under study, this social gap was still substantial in 1905. Linking where these children lived with the location of public schools, we show that, although the expansion of the supply of schools improved access to education of children from disadvantaged backgrounds, the public effort was clearly insufficient to overcome the challenges these families faced. Lastly, we analyse the returns to education by studying social mobility. In this regard, we have matched the children existing in our sample in 1880 with their corresponding adult-selves in 1905, 25 years later, using record linkage techniques. Our analysis shows that getting literate enhanced children's chances of moving up the social ladder. Taking together, our results show that high inequality levels, together with an inadequate schooling system, prevented a significant fraction of the schooling-age population to access education and thus limited subsequent economic growth.

JEL Codes: N33, J24, I24

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1. Introduction

The relationship between education and economic growth is at the core of the most important development strategies implemented both by national policy makers and international agencies (Heckman 2006; World Bank 2007; 2012). More education translates into higher earnings and the returns to education, both private and social, appear to be higher in developing countries (Card 1999; Hanushek and Woessmann 2010; Blundell et al. 2016; Montenegro and Patrinos 2014). Likewise, access to education widely varies across social classes and poverty indeed constitutes a formidable barrier to acquire education.

There are however few studies testing whether these links also hold with historical evidence. In this regard, it is unclear whether literacy mattered at all for economic development before the advent of modern economic growth (Mitch 2012). Although part of the literature attaches no economic importance to education, apart from signaling social status (Allen 2004; Clark 2005), other authors claim that education indeed increased productivity and was thus rewarded (Reis 2005; Baten and Van Zanden 2008; De Pleijt and Van Zanden 2017; Alvárez and Ramos-Palencia 2017).

In order to contribute to this debate, this article explores the relationship between class, access to education and social mobility relying on an extremely rich data set of individuals living in Madrid in 1880 and 1905. Focusing on children, we first assess the probability of being literate according to their parents' socio-economic status. We find an extremely wide educational gap in 1880: the probability that a child coming from a family of unskilled workers was around 55-60 percentile points lower than that of those of the highest classes. Although this difference declined over time, it was still considerable in 1905 (around 43-47 percentile points)[1]. Being landless labourers also significantly reduced educational levels in rural areas in 19th-century Spain (Beltrán Tapia and Martínez Galarraga 2018), so these findings extend to the urban content the important role that inequality played on the ability to invest in education.

Given that we have information on where these children lived and the location of schools, we then explore how the expansion of the supply of public schools during this period may have improved access to education of children from disadvantaged backgrounds. Although our analysis indicates that the expansion of schools probably helped to raise literacy levels among the poor, this public effort was insufficient to overcome the challenges that these children faced.

Lastly, we analyse the returns to education by studying social mobility. In order to do so, we have matched the children existing in our sample in 1880 with their corresponding adult-selves in 1905, 25 years later, using record linkage techniques. We show that getting literate enhanced children's chances of moving up the social ladder: those children than managed to overcome their social background and got literate were more likely to end up in a higher social class than that of his or her parents.

Our findings support the view that education increased productivity and was therefore rewarded economically (Reis 2005; Baten and Van Zanden 2008; De Pleijt and Van Zanden 2017; Alvárez y Ramos-Palencia 2017). Taking together, these results show that high inequality levels, together with an inadequate schooling system, prevented a significant fraction of the schooling-age population to access education, thus limiting subsequent economic growth.

2. Historical background

At the end of the 19th century, literacy rates in Madrid were relatively high, especially compared to those of the rest of country: while 76 per cent of the adult population in the Spanish capital

[1] Relying also on individual data from England in 1831, Clark and Gray (2014) also find that fathers' occupations are powerful predictors of literacy.

was able to read and write, this figure only reached 55 per cent in the rest of the country[2]. This situation was the result of an increasing demand for education arising from the dynamism of a booming city that required a relatively educated labour force, together with the increasing awareness of the value of education as a sign of social status and the growing popularity of written media[3]. Madrid's wealth was primarily based on its capital condition, thus developing a bureaucratic, financial and service sectors (Ringrose 1985; Juliá, Ringrose and Segura 2008; Otero and Pallol 2009). Although not a big industrial center, Madrid was growing rapidly, attracting migrants from all over the country (Beltrán Tapia and De Miguel 2016). In this regard, Madrid offered many possibilities for women, especially in the domestic sector, what made female immigration especially attractive (Carballo et al. 2016)[4]. The growing participation of women in the labour market surely contributed to reduce the gender gap. The literacy gender gap was indeed decreasing and the advances in average literacy were primarily due to the improvement in female rates (Otero 2018).

However, and as in most large cities at the time, economic prosperity coexisted with poverty and destitution, a contrast that plagues the contemporary literary accounts of the city by Pérez Galdós, Baroja or Blasco Ibáñez, among others[5]. Unemployment rates remained relatively high during the second half of the 19th century due to the industry's inability to absorb the continuous migratory flow and a large number of beggars lived off charity (Tiana Ferrer 1992, 85-88). The dynamism of the city also fueled a large construction sector that employed a high number of unskilled labourers, as well as an extensive informal economy. Mortality rates were really high, especially in the less privileged neighbourhoods, thus stressing the prevailing hygienic and economic conditions there (Gómez Redondo 1985; Fernández García 2001; Porras Gallo 2002; Huertas 2002; Casado and Ramiro Fariñas 2018). High levels of inequality therefore resulted in a large internal variation in educational attainments. In this regard, the deficient condition of schools starkly contrasts with the relatively high literacy rates that the city enjoyed.

Municipalities were in charge of providing public primary education[6]. However, the funds devoted to schooling were always insufficient[7]. Although education was theoretically compulsory for children aged 6 to 9 since the Moyano Act (1857), the lack of public schools and schoolteachers to meet the increasing demand obligated authorities not to enforce the law[8]. Demographic growth, especially fueled by immigration, expanded the schooling-age population, thus exerting more pressure to the limited existing resources. In Madrid, despite the efforts to increase schooling enrolment and the high average literacy rates, around 35 per cent of school-age children were out of school at the turn of the 20th century (Tiana Ferrer 1987, 45)[9]. Contemporaries complained that there were many children waiting to find a place in the public schools (Cossio 1897; Dicenta, 1910; Altamira 1912; Bello 1926; Luzuriaga 1926).

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[2] This statistics are taken from the 1900 Spanish Population Census.

[3] This section describing the economic and social context of Madrid follows Tiana Ferrer (1992), Pozo Andrés (1999), Liébana (2009), Pallol (2015), Vicente (2015), Carballo (2015), Díaz (2016) and De Miguel (2016).

[4] The 1900 Population Census indicates that 55 per cent of the population aged 16 to 40 in Madrid were women.

[5] See, for instance, Fortunata y Jacinta (1887), La Lucha por la vida (1904) or La Horda (1905), respectively.

[6] Descriptions of the Spanish school system can be found in Cossio (1897; 1915), Viñao (1989, 1998), Gabriel (1997), Beltrán Tapia (2013), Beltrán Tapia and Martínez-Galarraga (2018). For the situation in Madrid, see Ruiz de Azúa (1986, 1987), Tiana Ferrer (1992), Pozo Andrés (1999) and Liébana Collado (2009).

[7] Madrid was one of the municipalities which the lowest budget devoted to education: only 4 per cent of the total local expenditures (Ruíz de Azua 2001, 522). Not only local finances were strained but municipalities often preferred to devote fund to other uses. Referring to a village nearby Madrid, Bello (1926, 35) complains that, although the local school is severely underfinanced, the municipality is expending lavishly in bullfights.

[8] Compulsory education was extended to 12 years old in 1901 with the creation of the Ministry of Public Education and Arts, which also began to take care of paying the salaries of school teachers (Cossio 1915, 81).

[9] Absenteeism was also significant: only around 80 per cent of the enrolled students attended school regularly (Tiana Ferrer 1992, 143).

The quality of schooling was also deficient. Contemporary reports constantly denounced that most schools were overcrowded, lacked basic equipment and school supplies and suffered deficient hygienic conditions. Although primary schooling was theoretically divided into two grades (elementary and superior for children aged 6 to 9 and 9 to 12, respectively), this distinction hardly existed in practice due to lack of resources and children of all ages shared the same class[10]. Around 1900, the average student-teacher ratio in Madrid was 90 students (Tiana Ferrer 1992, 142)[11]. School teachers thus had to attend very large class sizes, thus further complicating the teaching-learning process, which basically involved reading, writing and numeric skills, as well as the Catholic doctrine and, if possible, some notions of history and geography. In addition, teachers usually did not receive any formal teachers' education, so teaching quality was relatively low. Rote learning was the most common teaching methodology and physical punishments seem to have been widespread. It should be stressed that schooling was segregated by sex: boys and girls attended different schools. Moreover, girls were taught domestic skills (such as sewing, embroidery and knitting), thus reducing the time available for other subjects.

Moreover, schooling was only free for those coming from very poor families. Parents had otherwise to pay a school fee although information on how large those fees were is scarce[12]. Apart from the direct cost of schooling, low-income families faced high opportunity costs. Child labour, crucial to complement household incomes, was indeed widespread (Tiana Ferrer 1987). Despite legislative attempts to prevent children's work, many children either did not attend school or left school at an early age, mostly to start working[13]. These children worked in factories and workshops all around Madrid, earning around one-third of an adult salary. The service sector also employed many children, either as servants or shopkeepers. It is also common to read complaints about children's boredom due to inadequate teaching practices and large class sizes: many of them saw school as a torture and were eager to abandon it at the first opportunity (Dicenta 1910, 6; Tiana Ferrer 1992, 165). Likewise, the incentives to acquire education were limited. Being employed as an artisan or factory workers did not require literacy skills. Only jobs in the service sector demanded certain educational levels (Tiana Ferrer 1987, 46). It is thus no wonder the lack of interest shown by many working-class families in sending their children to school, especially if we consider the deficient conditions of many of those schools stressed above.

The inability of public schooling to meet the educational needs of Madrid was evident: only 20.9 per cent of school-age children attended these schools in 1900 (Tiana Ferrer 1987, 45). Private schools partly filled this demand, especially that of the middle and upper classes. In contrast to rural areas where private schooling was almost nonexistent, private provision of primary education was common in urban areas. The importance of private schools in Madrid was extraordinary: 43.8 per cent of children attended private institutions in 1900. These figures precisely mimic the difference in the number of primary schools: 368 private versus 144 public

[10] On the structure of primary schooling in Spain, see Cossio (1897). Although there also existed *escuelas de párvulos* devoted to children aged 3 to 6, they were few in number and were only used as day-care for working mothers.

[11] The number was slightly lower in private schools: around 74 (Tiana Ferrer 1992, 140).

[12] The poor status had to be certified by the local priest and the municipal mayor (Cossio 1915, 79). Otherwise, children had to pay a weekly or monthly fee (stipulated by the municipality), which served to complement the school teacher's salary. Information about payments is dispersed. Bello (1926, 21), for instance, referring to a public school in a village nearby Madrid in the early 1880s, indicates that, apart from receiving 600 *reales* a year from the municipality, each child paid 2 *cuartos* every week.

[13] The first law limiting child labour was passed in 1873 forbidding children younger than 10 to work in industries, workshops, foundries and mines, as well as limiting the working day to 5 hours to those younger than 13. The law, however, was not implemented in practice and had to be replaced by another law that was enacted in 1900 which, although slowly, began to improve children's working conditions (Tiana Ferrer 1987, 47-55).

(Tiana Ferrer 1992, 138)[14]. The latter were actually despised as "schools for the poor" and, accordingly, the middle and upper urban classes sent their children to respected private institutions, which were mostly rung by religious institutions (Liébana Collado 2009, 6). It is true however that a significant number of charitable and philanthropic institutions also catered poor children (Tiana Ferrer 1992, 161-163, 301-302)[15].

But, how did this context translate into the actual educational achievements of children from different backgrounds? Did the supply of public schools facilitate that poor children got literate? And, lastly, did education have any effect on the economic prospects of those children? Next sections address these issues separately.

3. Data

This study relies on a large data set of individuals taken from the *Padrón Municipal de Habitantes* of Madrid in 1880 and 1905. This source provides detailed individual-level information about the inhabitants of the Spanish capital city. A large sample of these records have been recently digitalised, containing more than 350,000 observations for those two dates[16]. In particular, this data set comprises 40 and 35 per cent of the total population of Madrid in 1880 and 1905 respectively. Importantly for this article, the *Padrón* allows identifying whether each observation is able to read and write and their occupation in the case of adults. In addition, this source provides a variety of demographic information such as birthplace, birthdate, marital status and number of children, among others, as well as the address where they lived. The latter has allowed us to geo-reference the location of all individuals in our sample[17].

Unfortunately, the sample is not random but includes all individuals residing in the city center and some neighbourhoods in the northern part of the city[18]. Map A1 in the Appendix displays the location on the individuals in our sample using the Facundo Canada Map of 1900 as background reference. Although the period analysed here coincided with the expansion of the city towards the outskirts (Carballo 2015; Pallol 2015; Vicente 2015)[19], our data set hardly captures that process. It should also be noted that, contrary to the concentrated population characteristic of the city center, the northern neighbourhoods present a more dispersed population pattern. Given that living downtown was more expensive than on the outskirts, the composition of our sample might be biased. Figure 1 compares the percentage of individuals who were able to read and write in our sample to those obtained from the Population Census covering all inhabitants of Madrid. Although literacy rates obtained from the *Padrón* were lower than those from the Population Census in 1880, they were virtually identical in 1905.

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[14] Obtaining complete and precise information on private schools is more difficult than for public schools (Tiana Ferrer 1992, 160).

[15] In 1909, there apparently existed 78 charitable schools in the whole province of Madrid (Tiana Ferrer 1992, 315).

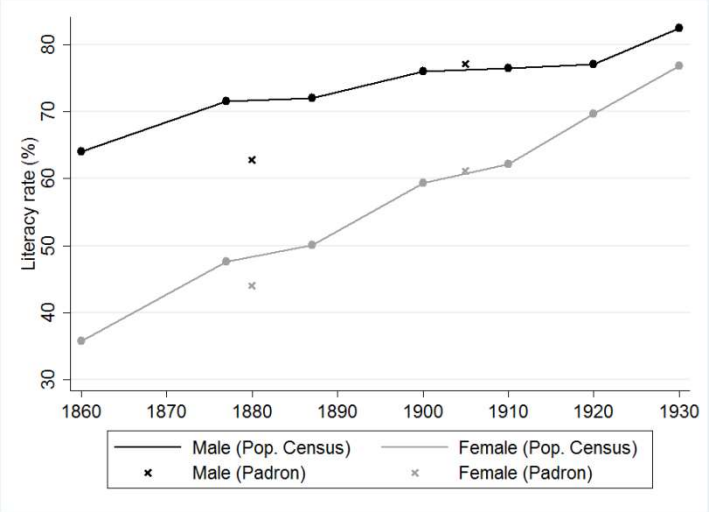
[16] In particular, our sample contains 161,824 and 189,998 observations in 1880 and 1905 respectively. See also Pallol (2015), Díaz (2016), De Miguel (2016) and Beltrán Tapia and De Miguel (2017) for other studies using this information.

[17] The geo-referencing is based on the street name and the number of the building and has relied on the 1900 Map by Facundo Canada (ref), which also provides a City Street Guide. We have not been able to locate 236 observations, a negligible fraction of the total sample, which mostly lived in dispersed buildings in the outskirts. For a detailed digitalised view of this map, see IDE Histórica de la Ciudad de Madrid: http://idehistoricamadrid.org/hisdimad/index.htm

[18] The initial aim for collecting this information was to understand the modernisation of the city centre, so data collection focused on the old districts but was later expanded to cover other neighbourhoods.

[19] The Castro Plan, passed in 1860, designed the *Ensanche*, the expansion of the city beyond the historical districts. After some delays, its implementation only fully began in 1875, progressed slowly and coexisted with a more spontaneous and disorganised process that populated the *Extrarradio*, the outskirts (Tiana Ferrer 1992, 42-44, 49-56).

Fig. 1. Literacy in Madrid, 1880-1905



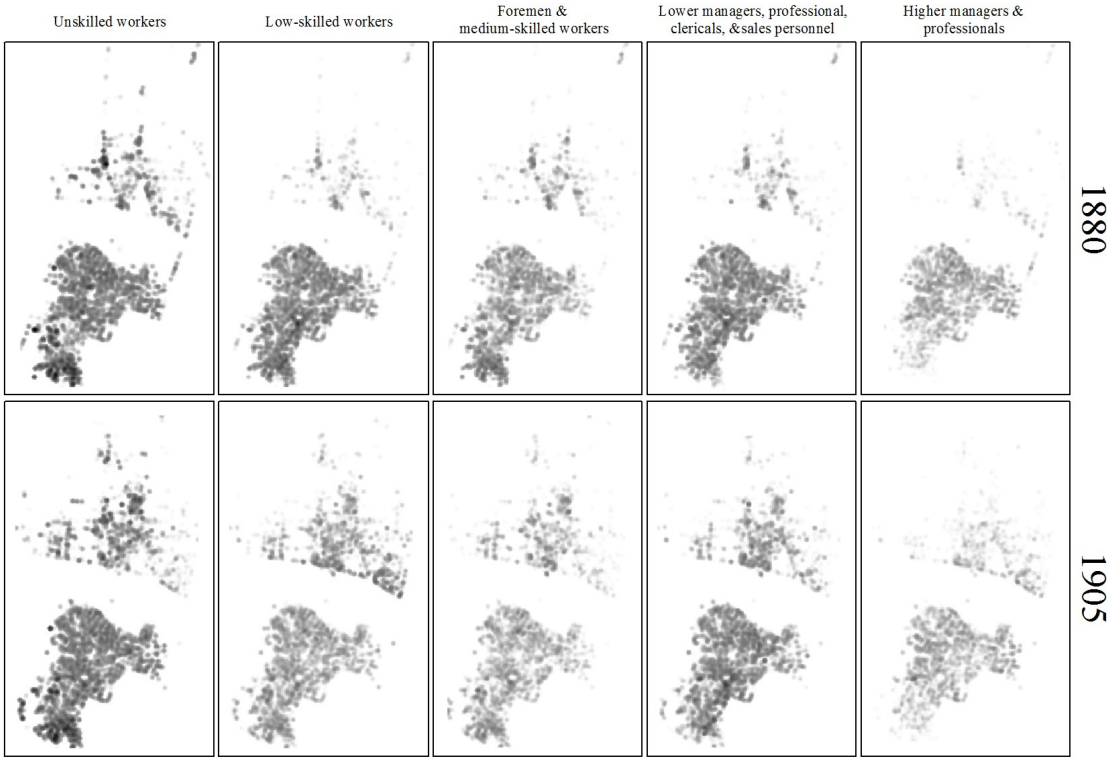
Source: Padron Municipal de Habitantes de Madrid (1880, 1905) and Population Census (1860-1930).

In any case, the neighbourhoods studied here were extremely varied (Pallol 2015; Díaz, 2016; De Miguel 2016). While the southern area was mostly populated by low-class families, households from all social backgrounds lived together in the city center. The northern part of the city was more segregated: while artisans and labourers populated some neighbourhoods, well-off families chose to live in other areas. Given that we have information on the rent paid by each family we can compute the average rent paid in each neighbourhood in our sample and consider it in the empirical analysis (Map A2 in the Appendix shows how the areas included in our sample compare in terms of rents). Moreover, families from all backgrounds lived together in the same streets and in the same buildings, thus ensuring an extremely high degree of socio-economic diversity in our sample[20]. In order to classify each observation by socio-economic status, we have first classified each occupation using the HISCLASS code and then grouped those twelve categories into five major groups[21]: (1) Higher managers & professionals; (2) Lower managers, professional, clericals, & sales personnel; (3) Foremen & medium-skilled workers; (4) Low-skilled workers; and (5) Unskilled workers. Map 1 offers a visual depiction of where individuals in our sample lived, depending on their socio-economic status, and confirms that families from all social strata coexisted together. Table A1 in the Appendix reports literacy rates by socio-economic status both in 1880 and 1905 for those individuals reporting occupation.

[20] While better-off families occupied the lower floors, the working classes lived in the higher floors, especially in the attics (Tiana Ferrer 1992, 29).

[21] Apart from missing, unknown or illegible records, the HISCLASS scheme does not allow to classify students, pensioners, unable or sick individuals and, more importantly, women doing housework. The latter group is especially important as the lower number of women than men reported in Table 1 evidences. However, given that we focus on children and the socio-economic status of the head of the household, this shortcoming does not constitute a problem for our analysis.

Map 1. Location of observations in the data set, classified by socio-economic status (kernel density)



Studying, however, the relationship between socio-economic status on education using adults suffers from two main problems. On the one hand, it is unclear whether the casual link goes from social class to education or the other way around. Many adults got literate at advanced ages and sometimes as a result of their occupation. On the other hand, both education and occupation is influenced by the socio-economic status of the families who raised these individuals. Given that information about parents in only available for children, we therefore focus our analysis on children. In order to study children who are old enough so as to have got literate but not too old as to have started working, we focus on children aged 8-12[22]. In total, we have more than 20,000 observations. In 1880, 50.8 per cent of children were able to read and write and this figure had increased to 56.5 per cent by 1905. Table 1 reports children's literacy rates by gender in those dates. These figures accurately mirror what we know about schooling enrolment during this period: as mentioned in the previous section, around one third of children did not attend school.

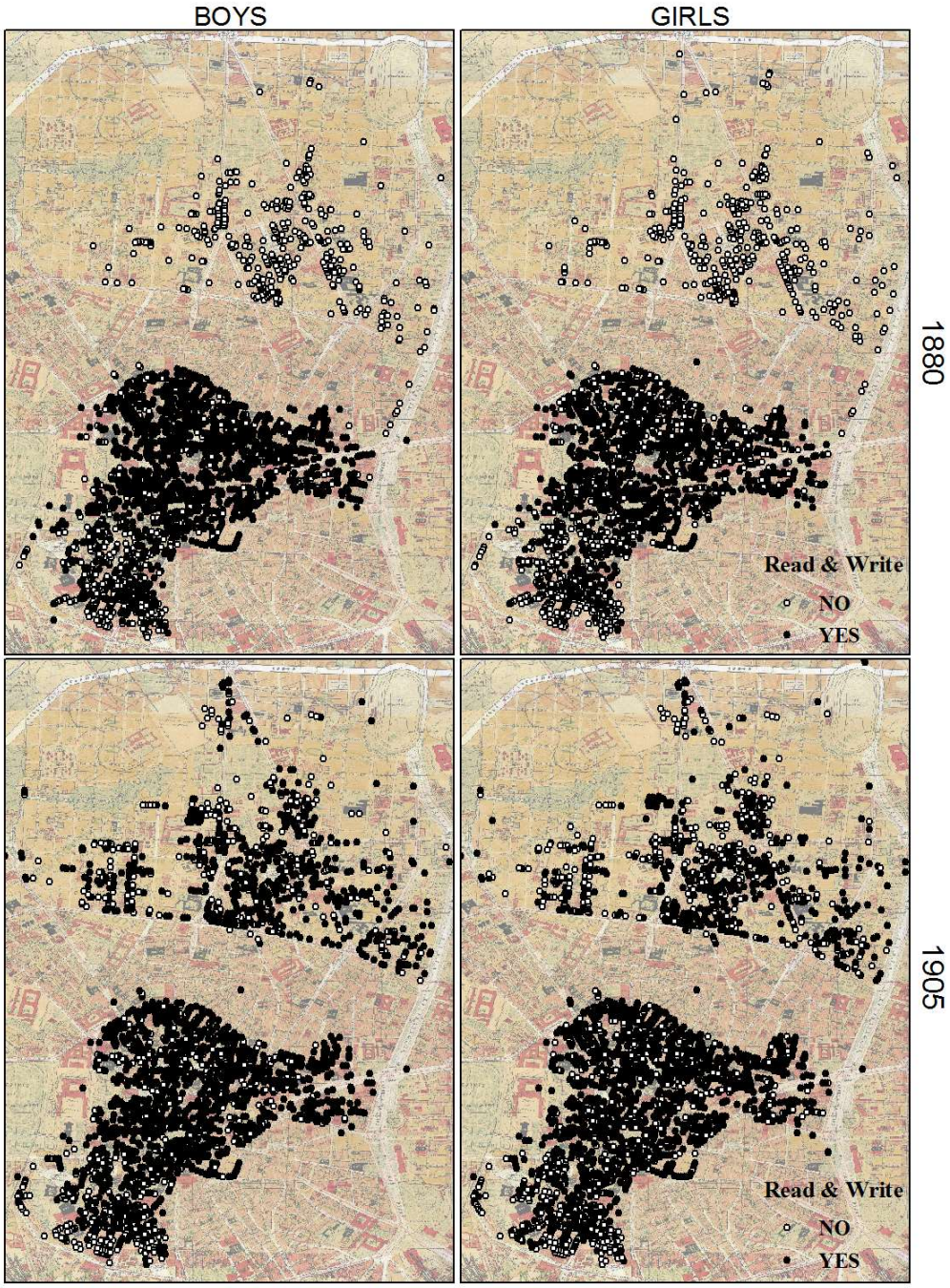
Table 1. Literacy rates (children aged 8-12), 1880-1905

	1880			1905		
	Obs.	Read	Read & Write	Obs.	Read	Read & Write
Boys	6,070	61.6	54.8	4,938	63.8	60.6
Girls	6,005	52.0	46.8	5,320	56.0	52.7

[22] The ages selected are aimed to target those children that were old enough so as to have learnt how to read and write but not as old as to have entered the labour market. Using slightly different ages hardly changes the results reported here.

Children's literacy was also clearly dependent on where they lived. Map 4 provides by visual account of their spatial distribution where black and white dots identify the place of residence of children who were literate or not[23]. As evident there, illiterate children tended to live either in the northern or southern neighbourhoods, although this spatial distribution had somewhat faded by 1905.

Map 4. Children's literacy (able to read & write) in Madrid, 1880-1905



[23] See also Tiana Ferrer (1992, 123-126) for differences in adult literacy rates between neighbourhoods.

4. Socio-economic status, schooling and education

Relying on the information described in the previous section, we now quantify the impact of socio-economic status on the ability to read and write. In order to do so, we estimate the following econometric model:

$$lit = \alpha + \beta\, socio_ec_status + X'\,\gamma + \varepsilon \qquad (1)$$

where *lit* is a binary variable which takes the value of 1 for those children who are literate and *socio_ec_status* refers to four dummy variables identifying the parents' socio-economic status (being the top class, higher managers and professionals, the reference category). While ε is the error term, X' refers to an additional set of demographic variables that allows controlling for other dimensions that might me correlated with both family background and educational attainment. In this regard, we introduce a set of dummy variables capturing the province of origin and an additional dummy variable distinguishing between those families coming from a provincial capital and those born in more rural areas. Given that age is also a crucial dimension of the learning process of these children, a set of dummies controlling for age is also included in the model[24].

Table 2 reports the results of estimating equation (1) using a logit model for both boys and girls and for each period in our data base. All coefficients show the expected signs are statistically significant at the 99 per cent level. Given that the reported coefficients do not offer a clear interpretation of the size of the effect studied here, Figure 2 depicts the predicted probabilities of being literate obtained from this model. The socio-economic status of the parents crucially shaped the educational achievements of these children. Although this result is hardly surprising, the size of the social gap is remarkable. While a boy coming from a family of unskilled workers only had, on average, 34 per cent probabilities of being literate in 1880, this figure reached 88 per cent in the case of the sons of the highest classes (55 percentile points difference). The gap was even higher for girls (60 percentile points)[25]. Although this social gulf had somewhat been reduced by 1905, differences between socio-economic groups were still considerable (43 and 47 percentile points for boys and girls respectively).

Table 2. Disparities in literacy by socio-economic status, 1880 & 1905

	Padrón 1880		Padrón 1905	
	Boys	Girls	Boys	Girls
	(1)	(2)	(3)	(4)
Ref. Cat.: Higher managers & professionals				
Lower managers, professional, clericals, & sales personnel	-1.09 (0.17)	-1.02 (0.21)	-1.35 (0.29)	-0.88 (0.19)
Foremen & medium-skilled workers	-1.93 (0.20)	-1.80 (0.23)	-2.00 (0.32)	-1.68 (0.20)
Low-skilled workers	-1.61 (0.22)	-1.64 (0.22)	-1.86 (0.30)	-1.42 (0.22)
Unskilled workers	-2.72 (0.24)	-2.82 (0.24)	-2.54 (0.31)	-2.25 (0.22)
Controls	YES	YES	YES	YES

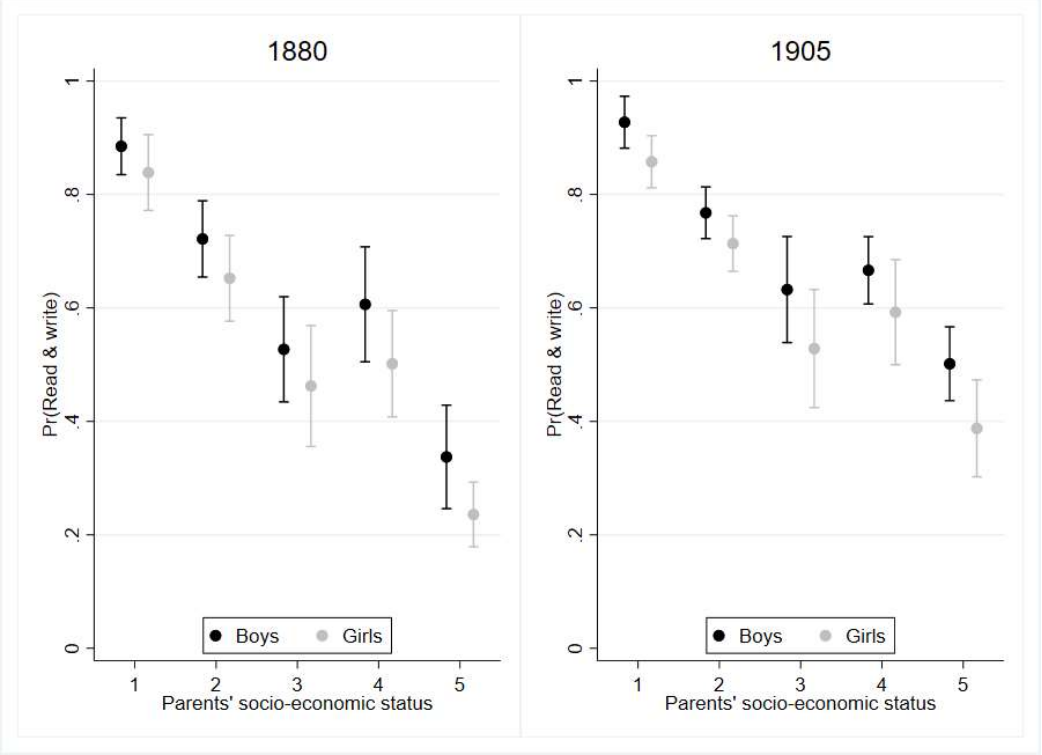
[24] In order to take into account that model errors are likely to be correlated between individuals living close by, robust standard errors are clustered at the neighbourhood level.

[25] Our results contradict those by Tiana Ferrer (1992, 125) who, relying on differences in adult literacy rates between neighbourhoods in 1915, argues that social differences played a larger role in shaping men's literacy rates than women's.

Observations	5,531	5,477	4,184	4,474
Pseudo R-squared	0.136	0.152	0.117	0.119

Logit regression. Clustered standard errors in parentheses. All coefficients are statistically significant at the 99 per cent level. The reference category is top socio-economic status: Higher managers & professionals. Controls include children's age and parents' place of origin (see text for more details).

Fig. 2. Predicted probabilities of being literate, by parents' socio-economic status



Note: Adjusted predictions with 95 per cent confidence intervals.
Categories: 1. Higher managers & professionals; 2. Lower managers, professionals, clericals & sales personnel; 3. Foremen & medium-skilled workers; 4. Low-skilled workers; 5. Unskilled workers.
These predicted probabilities are the result of estimating equation 1 controlling for children's age and parents' place of origin (see text for more details).

The influence of socio-economic status on children's educational achievements can occur via different channels. On the one hand, parents directly influence school attendance and learning efforts (Glewwe and Kremer 2006). As mentioned in the previous section, attending school was costly and children's earnings was often crucial to complement household incomes, thus limiting schooling enrolment. Likewise, complaints about the poor families' lack of interest in educating their offspring are prevalent in contemporary reports (Tiana Ferrer 1987, 47). Children from disadvantaged backgrounds were indeed likely to leave primary school before completion. In addition, deficient nutrition and health also negatively affects schooling enrolment and learning outcomes (Bleakley 2002; Miguel and Kremer 2004; Glewwe 2005; Bobonis et. 2006; Croke et al. 2016). Around 1920, a school teacher in *Prosperidad*, a working-class neighbourhood in the outskirts of Madrid, complains about the poverty of his pupils and how malnourishment and overworking is severely affecting their ability to concentrate and remain awake while at the school (Bello 1926, 67-68).

On the other hand, families from lower backgrounds tend to live in cheaper areas where the quality of public services, including schools, suffers. In this regard, 41 neighbourhoods (out of 100) lacked public school in 1900, especially in the outskirts (Tiana Ferrer 1992; Pozo

Andrés). An official report dated in 1913 still complains that there are children who have to walk up to 3 kilometers to attend their schools (Ayuntamiento de Madrid 1913, 8). The situation was even worse in 1880. Map A3 in the Appendix shows the spatial distribution of public schools for boys and girls in both dates[26]. The supply of public education increased during this period: from 70 schools in 1880 to 125 in 1905[27]. Given that most public schools during this period only had one classroom, this expansion seems insufficient to address the existing schooling problem (Tiana Ferrer 1992, 140)[28].

However, living in different neighbourhoods may not only affect education by having access to schools (as well as their quality), but also via other dimensions related to the characteristics and behaviour of people surrounding them (Lupton et al. 2009; Gibbons et al. 2013; Chetty and Hendren 2018). In this regard, social interactions and peer effects are likely to influence children's outcomes. Although the existence of the "neighbourhood effect" makes identifying the separate role of schooling more difficult, we can use the level of rents to capture the social structure of each neighbourhood (Tiana Ferrer 1992, 98).

In order to isolate the channels through which socio-economic status affects education, we re-estimate equation (1) but including now two additional variables. On the one hand, we include a measure of school density by computing the number of public schools within a 500-metre radius (see Map A4 in the Appendix)[29]. In 1880, 1,304 of the children in our sample (10.8 per cent) had either zero or one public school within that distance. One school only could attend around a maximum of 100 students, so their access to school was severely limited. This figure had decreased to 514 children (5.0 per cent) in 1905. On the other hand, we consider the socio-economic composition of neighbourhoods by including a set of dummies that classify the different vicinities according to the level of average rents (by quantile; see Map A2 in the Appendix).

Table A2 in the Appendix presents the results of this specification that, as done previously, also controls for children's age and parents' place of origin. The results show that, although both access to school and the wider external environment played a role in shaping children's outcomes, the source of the social gap in educational attainments lied within the household. Let's address these issues separately.

Figure 2 shows how the predicted probabilities of being literate varied depending on the number of schools nearby (holding the other covariates fixed, including the parents' socio-economic status). Having access to school had a substantial impact on the likelihood of being literate in 1880. The lack of public schools significantly prevented that many children attended one. The fact that school density is no longer significant in 1905 does not mean that schools were not important. All the contrary, the expansion of the network of public schools between these two dates facilitated access to school to virtually all neighbourhoods in our sample, so distance to school no longer explains the variation in the ability to read and write. In any case, as explained in the second section, the number of schools was insufficient to secure access to education for all children. In addition, either the direct or the opportunity costs of schooling, together with weak incentives, also helps explaining the large number of children out of school.

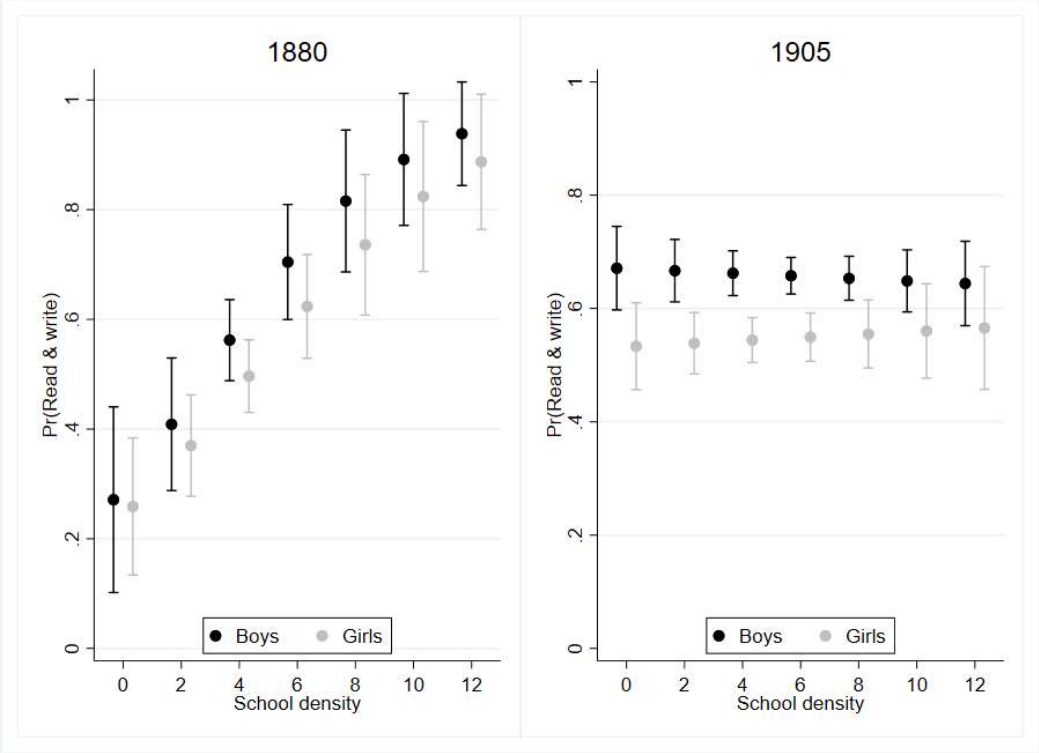
[26] Given that the information available for 1880 does not distinguish between elementary and superior schools, they are combined together. In theory, elementary and superior schools targeted children between 6 and 9 and 9 and 12 years old, respectively. However, as explained in the text, children of all ages were put together.

[27] This provision slightly favoured schools for girls, at least in quantity: 34 for boys and 36 for girls in 1880 and 61 and 64 in 1903. Unfortunately, we do not have information on sizes or quality of schools.

[28] Only in 1903, 20 schools for boys and 10 for girls established a double turn (one in the morning and one in the afternoon), so as to increase the existing schooling capacity (Tiana Ferrer 1992, 143).

[29] Computing school density within a 1,000-metre radius does not affect the results reported here.

Fig. 2. Predicted probabilities of being literate, by school density



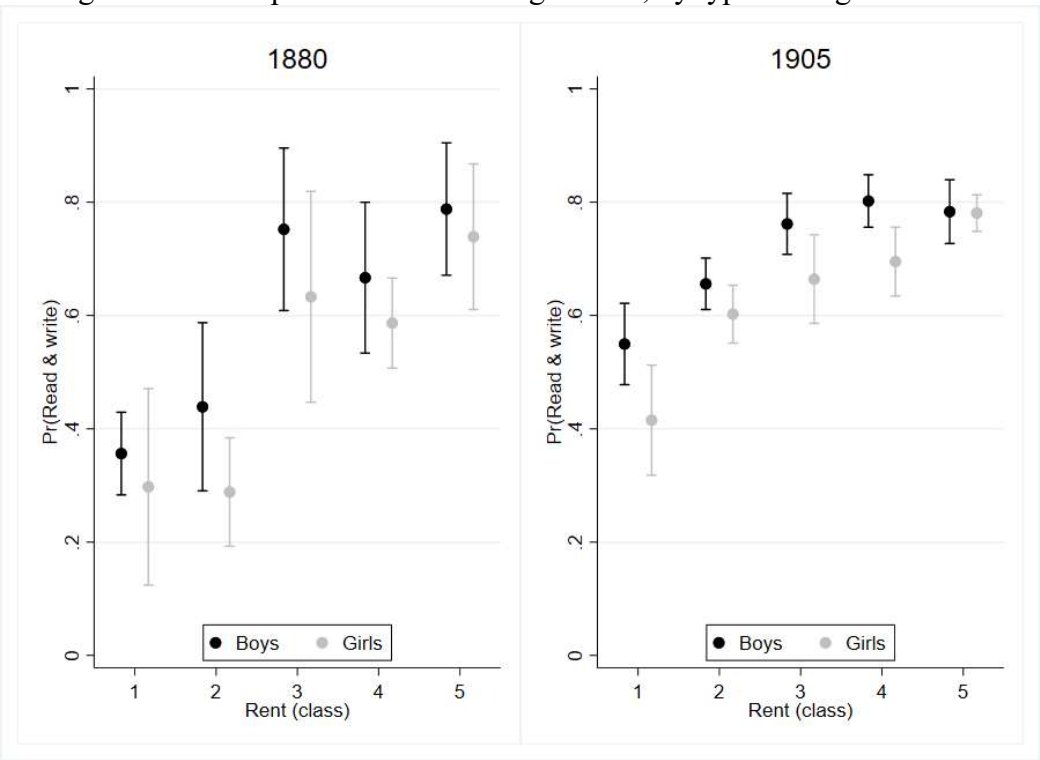
Note: Adjusted predictions with 95 per cent confidence intervals. School density refers to the number of schools within a 500-metre radius. These predicted probabilities are the result of estimating the effect of school density controlling for parents' socio-economic status, type of neighbourhood, children's age and parents' place of origin (see text for more details).

It is possible however that this exercise over-estimates the role of schools if the location of the new schools followed the demand for education. The information contained in the municipal sources, however, indicate that these decisions were not taken considering the city's needs but the results of corruption and nepotism (Tiana Ferrer 1992, 167-170). In this regard, in 1901, only 22 per cent of the schools were established in publicly-owned buildings (Pozo Andrés, 100). The majority of schools were located in rented buildings that belonged to influential personalities who, through rent-seeking behavior, obtained extremely advantageous deals, regardless of the location of these schools (Pozo Andrés 101-102). Even the buildings that were publicly-owned had not been initially constructed as schools but had other purposes (official, residential or religious) and had been reformed so as to be used as schools (Tiana Ferrer 1992, 167). In this regard, contemporaries continuously stress the lack of informed guidelines regarding the location of new schools, at least until the 1910s when progressive sectors within the municipality began to intervene in these issues (Dicenta 1910).

On the other hand, the type of neighbourhood where these children lived in also had a distinct effect on their educational attainments. According to figure 3, the poorest

neighbourhoods showed significantly lower literacy rates, even controlling for parents' socio-economic status and school density. This influence got smaller over time but was still visible by 1905, especially for girls. Given that our measure of school density does not contain information on school quality, the neighbourhood variable may reflect, apart from social interactions and peer effects, better public services, including schooling and therefore partly explain the lack of correlation in 1905 observed above.

Fig. 3. Predicted probabilities of being literate, by type of neighbourhood



Note: Adjusted predictions with 95 per cent confidence intervals. Neighbourhoods are divided into quantiles according to the level of average rents (see also map 2). These predicted probabilities are the result of estimating the effect of neighbourhood type controlling for parents' socio-economic status, school density, children's age and parents' place of origin (see text for more details).

Lastly, despite the role played by school density and type of neighbourhood, parents' socio-economic status remained the major driver of disparities in children's literacy rates. Table 3 reports the adjusted differences in the probability of being literate by social class (being "Higher managers & professionals" the reference category) before and after controlling for school density and neighbourhood[30]. This exercise shows, on the one hand, that most of the effect of the external environment variables is concentrated in the lower-class families. While the coefficients of the other classes hardly change when controlling for school density and type of neighbourhood, the effect of parents' socio-economic status gets reduced in households of unskilled-workers, especially in 1880. The environment where some of these lower-class families lived negatively affected the chances of their children to become literate, either through

[30] These results are robust to two additional specifications: controlling for neighbourhood fixed effects and excluding the northern neighbourhoods, whose dispersed settlement pattern differs to that of the city centre.

access to school or other peer effects. The expansion of public schooling and other improvements in urban conditions between 1880 and 1905 meant a reduction of the importance of the external context in explaining the social gap in educational attainments, although less so in the case of girls.

Table 3. Disparities in literacy by socio-economic status (adjusted probabilities), 1880 & 1905

	Padron 1880				Padron 1905			
	Men		Women		Men		Women	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ref. Cat.: Higher managers & professionals								
Lower managers, professional, clericals, & sales personnel	-0.16 (0.02)	-0.17 (0.03)	-0.19 (0.03)	-0.16 (0.04)	-0.16 (0.02)	-0.17 (0.03)	-0.14 (0.03)	-0.14 (0.03)
Foremen & medium-skilled workers	-0.36 (0.04)	-0.32 (0.04)	-0.38 (0.05)	-0.32 (0.04)	-0.30 (0.04)	-0.27 (0.04)	-0.33 (0.05)	-0.30 (0.03)
Low-skilled workers	-0.28 (0.04)	-0.25 (0.04)	-0.34 (0.04)	-0.31 (0.04)	-0.26 (0.03)	-0.24 (0.03)	-0.27 (0.04)	-0.22 (0.04)
Unskilled workers	-0.55 (0.04)	-0.44 (0.04)	-0.60 (0.04)	-0.47 (0.04)	-0.43 (0.03)	-0.36 (0.03)	-0.47 (0.04)	-0.38 (0.03)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
School density	NO	YES	NO	YES	NO	YES	NO	YES
Neighbourhood type	NO	YES	NO	YES	NO	YES	NO	YES
Observations	5,531	5,531	5,477	5,477	4,184	4,184	4,474	4,474

Change in the predicted probabilities of being literate by socio-economic status. The reference category is top socio-economic status: Higher managers & professionals. Clustered standard errors in parentheses. All coefficients are statistically significant at the 99 per cent level.

Although the net effect of social background on literacy was also diminished by 1905, it still exerted a crucial influence on children's educational achievement: while 89 per cent of children from the upper-class families were able to read and write, only 44 per cent of those coming from the bottom part of the distribution were literate. As explained in the previous section, not only these children were likely to leave school early to start working, but also their parents were not able (or were not so inclined) to facilitate their children's education. Malnutrition and deficient health might be another channel explaining why the educational achievements of these children were lower.

5. Returns to education

Social class thus crucially shaped children's chances of becoming literate. But, what happened to those children that overcame their background and got literate despite all the obstacles the lower classes faced? Did learning literacy skills improve their opportunities of climbing up the social ladder? In order to estimate the returns to literacy during the period studied here, we have matched the children existing in our sample in 1880 with their corresponding adult-selves in 1905, 25 years later. We restrict our sample to those children aged 10 or less in 1880 and employ six matching variables: name, surname 1, surname 2, birthplace, province and birthdate. As usual with historical data, the data set contains transcription errors and typos. Moreover, the information was originally digitalised by different researchers which sometimes relied on different abbreviation methods. The surname "Sánchez" for instance may also appear shortened

as "schez". Probabilistic record linkage allows overcoming these issues and refine the matching procedure by comparing the similarity of the records[31].

Relying on these techniques, we are able to match 3,432 individuals (out of 20,234). A 17 per cent matching rate is not very high though. In contrast to other studies that rely on the whole population[32], our sample only includes a fraction on the population on Madrid (around 40 and 35 per cent in 1880 and 1905 respectively), thus complicating the linkage if those individuals have moved out to a neighbourhood not covered in our sample (or elsewhere in Spain or abroad). Moreover, children are subject to much higher mortality rates than adults, so an important fraction of these children would have died by 1905, especially the youngest ones.

Table 4 compares the literacy rates of the children matched to those of the whole sample in the same age-cohort in 1905 (aged 25-35). Male literacy rates are virtually identical in both groups, thus evidencing than the matching procedure does not have introduced any bias in the case of boys. Girls however shows considerably higher literacy rates, thus making inferences from this group to the wider population more tentative.

Table 4. Literacy rates, aged 25-35 (%), 1905

	Men	Women
Matched individuals	92,9	90,0
All individuals	92,8	73,6

Source: See text.

Given than we do not have information on earnings, we focus on social mobility. Each occupation is again classified into five major groups. Given that not all individuals reported their occupation, we lose observations. This problem is especially acute for women who were often listed as housewives and therefore unable to be included in the HISCLASS code. We then estimate the effect of being literate on the likelihood of belonging to different social classes, conditional on parents' socio-economic status:

$$socio_ec_status = \alpha + \beta\, literacy + \beta\, parents_status + X'\gamma + \varepsilon \qquad (2)$$

Table 5 reports the results of estimating equation (2) using an ordered logit model for men and women where the dependent variable is the socio-economic status of our matched sample in 1905 controlling for parents' socio-economic status. Note that socio-economic status ranges from 5 (lowest social class) to 1 (top social class). Columns (2) and (4) control for individual characteristics such as age (and its square), marital status, number of children and place of origin. As expected, parents' socio-economic status crucially shaped children's future prospects. Social fluidity was quite sticky during the period analysed here. Interestingly, getting literate enhances your chances of moving up the social ladder. The effect is smaller for women.

[31] On these techniques, see Wisselgren et al. (2014), Thorvaldsen et al. (2015), Feigenbaum (2016; 2018) or Massey (2017).

[32] Feigenbaum (2018), for instance, obtains a 59 per cent matching rate relying on the whole census but other studies such as Parman (2011) or Guest *et al.* (1989) obtain lower rates.

Table 5. Literacy and social mobility

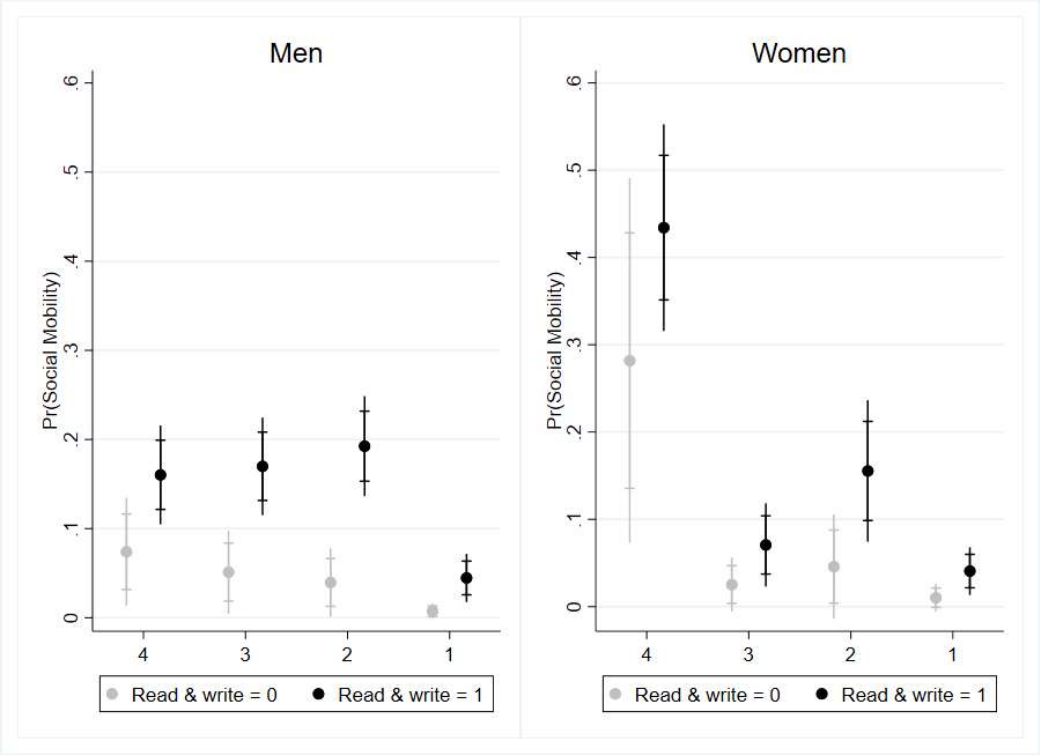
	Dep. Variable: Socio-economic status in 1905			
	Men		Women	
	(1)	(2)	(3)	(4)
Literacy	-1.44	-1.64	-1.43	-1.17
	(0.29)	(0.32)	(0.28)	(0.34)
Parents' socio-economic status				
Lower managers, professional, clericals, and sales personnel	1.42	1.46	1.33	1.70
	(0.24)	(0.27)	(0.41)	(0.54)
Foremen & medium-skilled workers	2.36	2.42	2.19	2.42
	(0.26)	(0.29)	(0.49)	(0.59)
Low-skilled workers	2.39	2.37	1.77	2.03
	(0.28)	(0.31)	(0.45)	(0.58)
Unskilled workers	2.61	2.61	1.82	2.16
	(0.26)	(0.29)	(0.41)	(0.55)
Controls	NO	YES	NO	YES
Observations	953	953	356	356
Pseudo R-squared	0.070	0.090	0.054	0.126

Order logit regression. Clustered standard errors in parentheses. All the coefficients are statistically significant at the 99 per cent level. The reference category is top socio-economic status: Higher managers & professionals. Controls include age (and its square), marital status, number of children and place of origin (see text for more details).

If we focus on those coming from the lowest classes (5), figure 4 illustrates the quantitative effect of education on social mobility by plotting the predicted probabilities of ending up in a different socio-economic group. Those boys who managed to get literate were more likely to climb up the social ladder and this difference increases as they moved into higher ranks: while only around 3 per cent of those children who did not get literate ended up as "lower managers, professionals, clericals or sales personnel", around 20 per cent of those who learnt how to read and write acceded those professions. Although also positive, the effect is less clear for women. As explained above, this might be due to the limitations of the source when registering women's occupations with results in a lower number of observations. Also, although quantitatively important, the female labour market in Madrid was relatively narrow: around three-fourth of women working were employed as household servants in the early 20th century (Tiana Ferrer 1992, 67).

Our estimates however constitute only an upper bound. Individuals' innate ability and effort influence both the likelihood of becoming literate and their job market prospects. Our data does not allow controlling for these individual characteristics, so these estimations are likely to be upward biased. In order to mitigate this concern, we control for other individual characteristics that might be correlated with ability and effort. If more able individuals are also different in the propensity to get married and have children, controlling for civil status and number of children alleviates the endogeneity problem. The results reported in table 5 remain qualitatively unchanged when considering these issues.

Fig. 4. Predicted probabilities of moving up the social ladder
for children of unskilled workers (5)



Note: the segment allows testing whether the coefficients for each group are statistically different.

6. Conclusion

This article shows that socio-economic status was the main determinant of educational levels in late-19th-century Madrid, thus evidencing the huge social gap existing at that time. Although the expansion of public schooling during this period facilitated access to education to some of these children from disadvantaged background, the public initiative was insufficient and could not suppress the barriers that these children faced to access education. Due to their economic situation, they were likely to leave school early and start working. As a result, a significant fraction of the schooling-age population was out of school and the educational gap between children from different social classes remained still substantial in the early 20th century. This has profound implications because getting education paid off and was a means to climb up the social ladder. Those children than managed to overcome their social background and got literate were more likely to end up in a higher social class than that of his or her parents. High inequality levels, together with an inadequate schooling system, thus limited subsequent economic growth.

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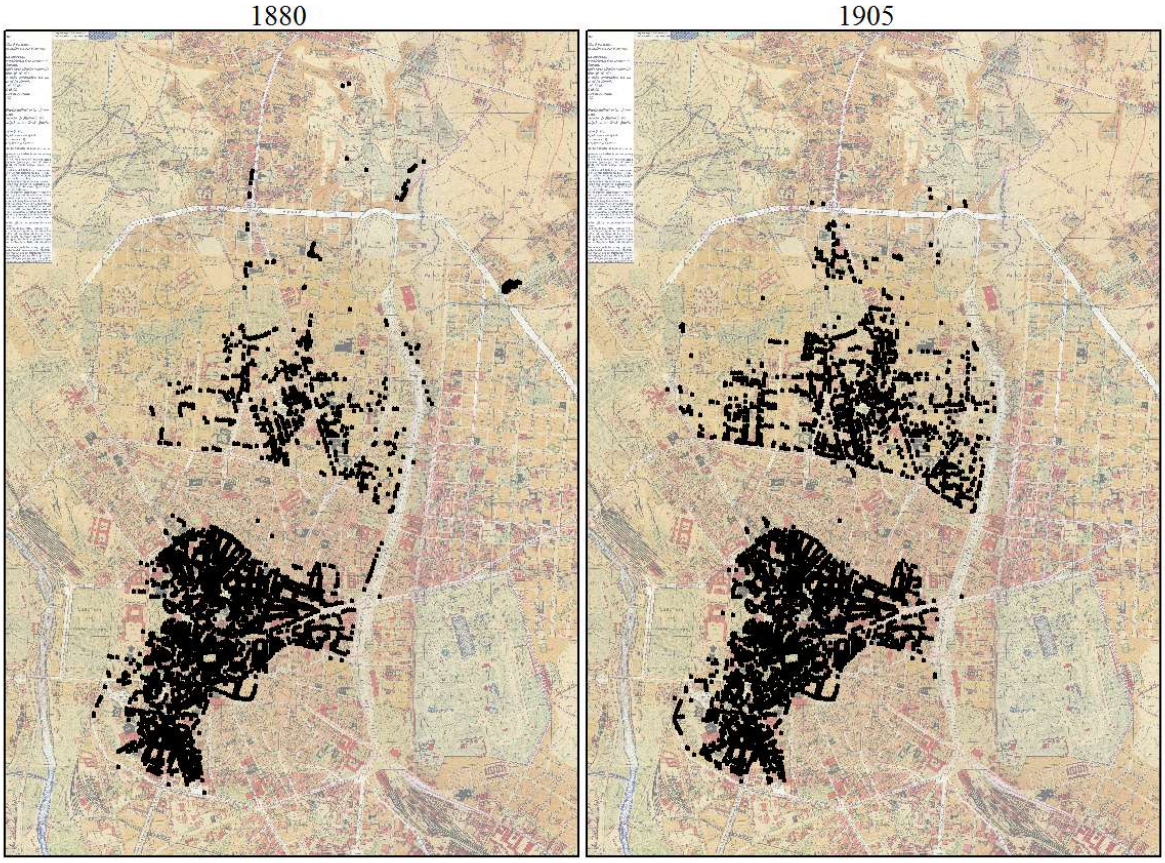
APPENDIX

Map A1. Location of all the observations in the data set



Map A2. Average rent, by neighbourhood, 1880-1905

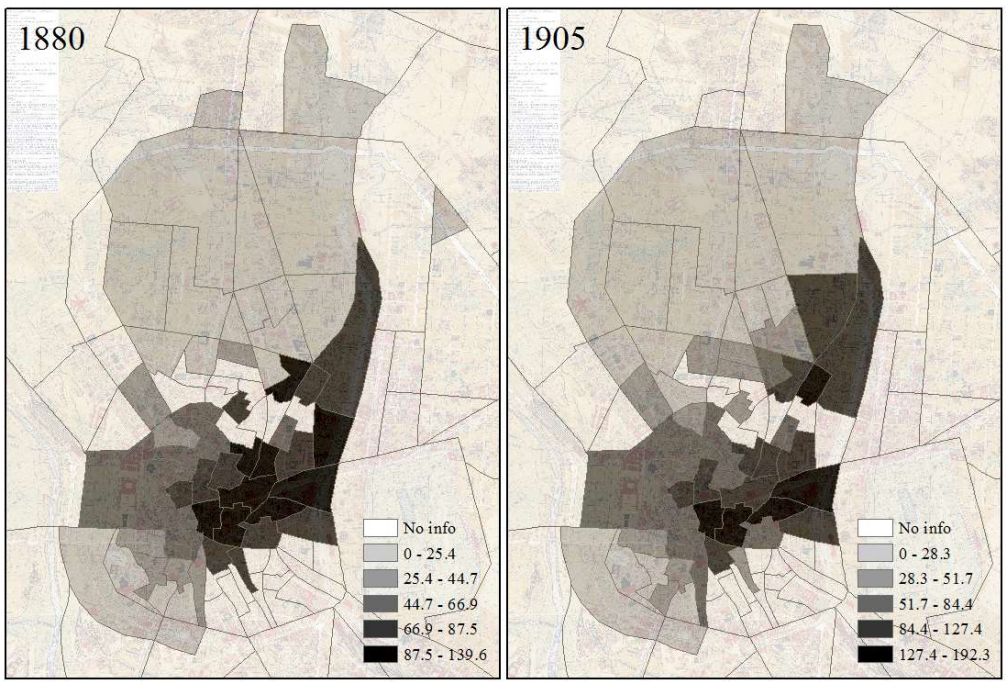
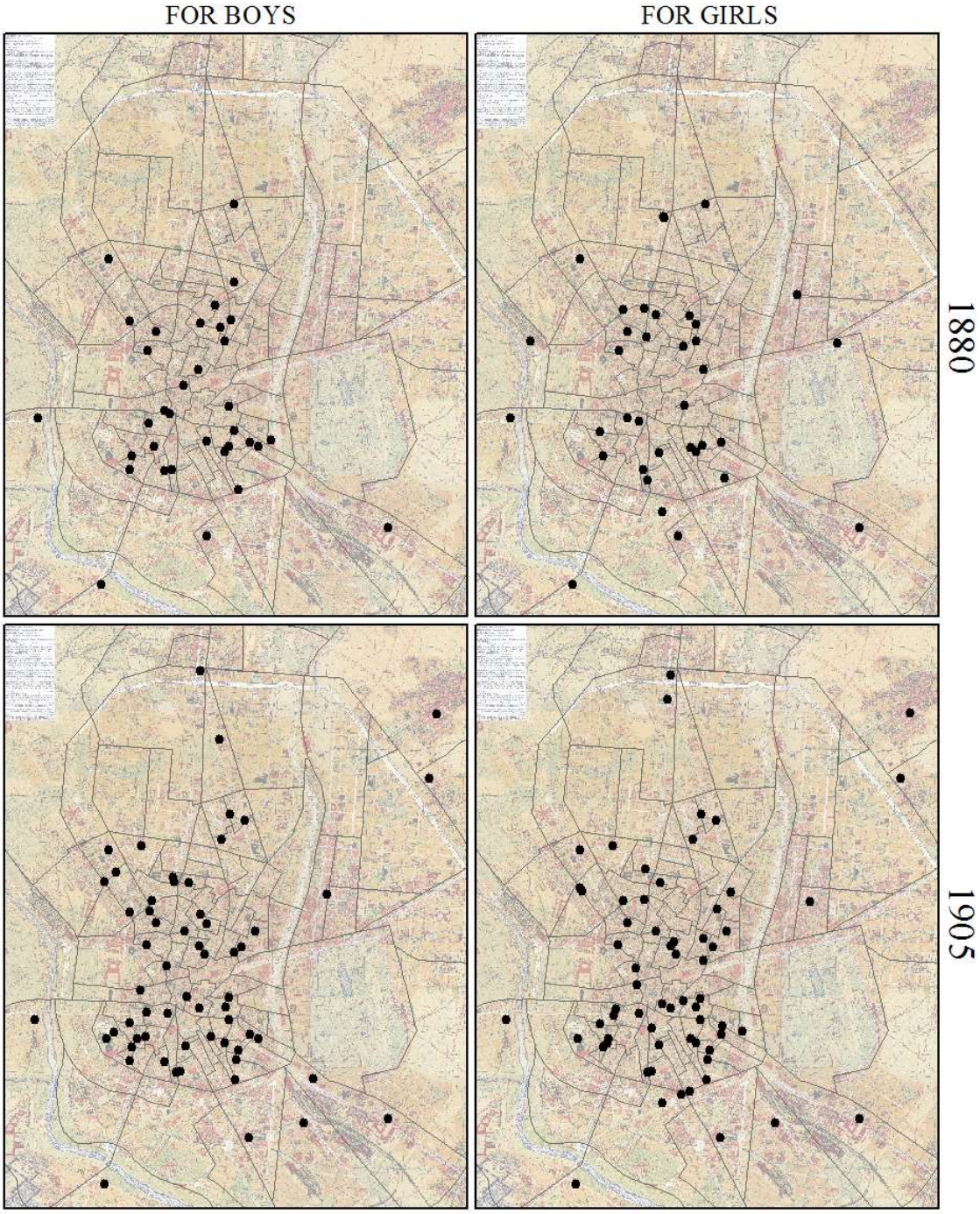


Table A1. Socio-economic status in Madrid, 1880 & 1905

Panel A		*Padrón* 1880					
		Men			Women		
	Hisclass	Obs.	%	Lit. (%)	Obs.	%	Lit. (%)
Higher managers & professionals	1, 2	4,988	9.42	92.7	974	4.02	88.4
Lower managers, professional, clericals, and sales personnel	3, 4, 5	14,124	26.69	87.8	1,132	4.67	67.8
Foremen & medium-skilled workers	6, 7	8,904	16.82	72.5	2,208	9.10	51.9
Low-skilled workers	8, 9, 10	9,034	17.07	82.6	8,098	33.39	36.0
Unskilled workers	11, 12	15,878	30.00	45.8	11,839	48.82	35.1
Total		52,928	100.00	72.2	24,251	100.00	40.6

Panel B		*Padrón* 1905					
		Men			Women		
	Hisclass	Obs.	%	Lit. (%)	Obs.	%	Lit. (%)
Higher managers & professionals	1, 2	5,324	9.40	98.7	1,055	5.15	95.6
Lower managers, professional, clericals, and sales personnel	3, 4, 5	16,51	29.15	97.0	941	4.59	79.1
Foremen & medium-skilled workers	6, 7	7,296	12.88	93.1	1,941	9.47	76.6
Low-skilled workers	8, 9, 10	6,812	12.03	93.4	6,845	33.41	56.7
Unskilled workers	11, 12	20,697	36.54	83.2	9,705	47.37	58.9
Total		56,639	100.00	91.2	20,487	100.00	62.7

Map A3. Schools for boys and girls in Madrid, 1880-1905



Map A4. School density in the children sample
Number of schools within a 500-meter radius from children's residence

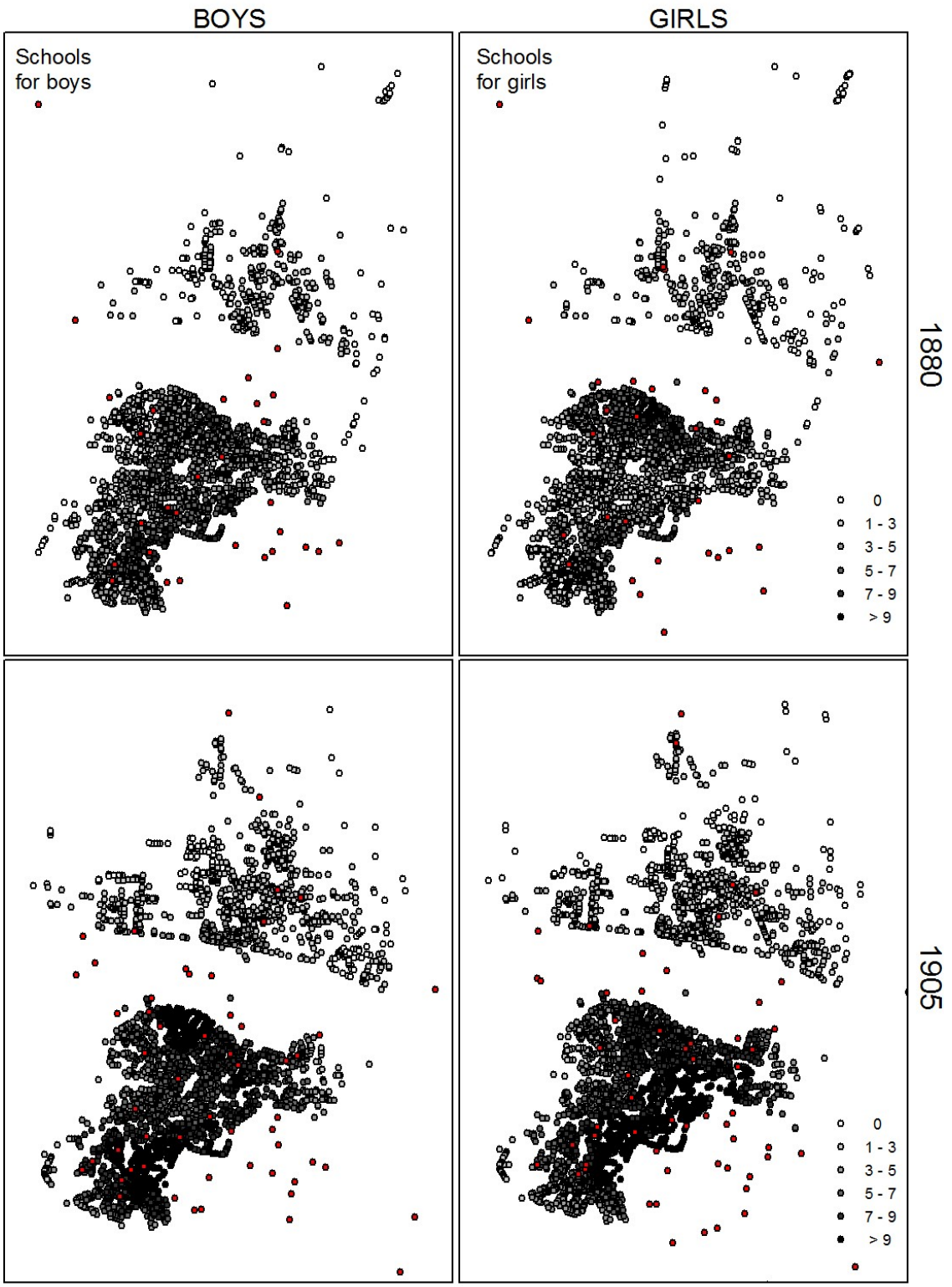


Table A2. Disparities in literacy by socio-economic status, 1880 & 1905

	Padrón 1880				Padrón 1905			
	Boys		Girls		Boys		Girls	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parents' socio-economic status (Ref. Cat.: Higher managers & professionals)								
Lower managers, professional, clericals, and sales personnel	-1.09**	-0.97**	-1.02**	-0.78**	-1.35**	-1.24**	-0.88**	-0.75**
	(0.17)	(0.17)	(0.21)	(0.19)	(0.29)	(0.28)	(0.19)	(0.18)
Foremen & medium-skilled workers	-1.93**	-1.63**	-1.80**	-1.39**	-2.00**	-1.74**	-1.68**	-1.40**
	(0.20)	(0.19)	(0.23)	(0.18)	(0.32)	(0.30)	(0.20)	(0.16)
Low-skilled workers	-1.61**	-1.36**	-1.64**	-1.36**	-1.86**	-1.59**	-1.42**	-1.09**
	(0.22)	(0.20)	(0.22)	(0.19)	(0.30)	(0.30)	(0.22)	(0.17)
Unskilled workers	-2.72**	-2.09**	-2.82**	-2.06**	-2.54**	-2.09**	-2.25**	-1.74**
	(0.24)	(0.21)	(0.24)	(0.19)	(0.31)	(0.30)	(0.22)	(0.18)
Public school density		0.31**		0.26**		-0.01		0.01
		(0.10)		(0.08)		(0.03)		(0.03)
Average rents (Ref. Cat.: Rent=1)								
Rent=2		0.35		-0.04		0.45**		0.76**
		(0.35)		(0.50)		(0.17)		(0.22)
Rent=3		1.70**		1.40**		0.96**		1.02**
		(0.42)		(0.60)		(0.22)		(0.29)
Rent=4		1.28**		1.21**		1.20**		1.17**
		(0.33)		(0.44)		(0.22)		(0.28)
Rent=5		1.90**		1.90**		1.09**		1.61**
		(0.40)		(0.51)		(0.21)		(0.23)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	5,531	5,531	5,477	5,477	4,184	4,184	4,474	4,474
Pseudo R-squared	0.136	0.239	0.152	0.250	0.117	0.142	0.119	0.157

Logit regression. Clustered standard errors in parentheses; ** p<0.01, * p<0.05. The reference category is top socio-economic status: Higher managers & professionals. Controls include children's age and parents' place of origin (see text for more details).

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