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Landed elites and education provision in England: evidence from school boards, 1871-99

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Abstract
I study the relationship between land concentration and the expansion of state education in 19C England. Using a broad range of education measures for 40 counties and 1,387 School Boards, I show a negative association between land concentration and local taxation, school expenditure, and human capital. I estimate reduced-form effects of 19C land concentration, geographic factor endowments, and the land redistribution after the Norman conquest of 1066. The negative effects on state-education supply are stronger where rural labour can easily migrate, where landowners had political power, is not offset by voluntary schooling, and not driven by a demand channel. This suggests that landowners opposed taxation in order to reduce state education provision.

Keywords State education · Land concentration · Persistence · Taxation

JEL Classification I24 · O43 · Q15 · N33

1 Introduction

Inequality can be harmful for economic growth (Galor and Zeira 1993). One reason is that growth-promoting institutions, such as state education, may be difficult to implement where wealth is concentrated in the hands of a small elite (Galor and Moav 2006). Galor et al. (2009) formalize a negative relationship between state education and land concentrated in the hands of a small group of landowners. This relationship is explained by landowners

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influencing the political process in order to prevent the expansion of education and, hence, to reduce the mobility of the rural labour force.

This paper investigates the relationship between land concentration and education provision in England. I show that the expansion of state education in the late 19C is strongly negatively associated to two deep-rooted factors which laid the groundwork for inequality: geographical factor endowments and the Norman conquest of 1066, a historical event that massively redistributed landownership. I document empirically the sheer persistence of land inequality from 1066 to 1870, and examine the contemporaneous effect of land concentration on state education and the mechanisms behind it. My results support Galor et al. (2009)'s proposed mechanism: the opposition of great landowners to state education provision through the political process.

To study these questions, I focus on the 1870 Education Act. Prior to 1870, elementary schooling was provided by religious societies, who established and ran voluntary schools funded by non-tax donations, school fees, and government subsidies. The 1870 Education Act sought to expand elementary schooling to the entire school-aged population. To do so, it introduced new, state-run, non-denominational board schools funded by local taxation (henceforth board schools).[1] Between 1870 and 1902, ca. 5,700 board schools for 2.6 million children were created. This setting offers a number of advantages. First, the expansion of education was decentralized: in each education district, a School Board taxed local residents through a tax on property (e.g., land) to fund the building and expenditures of board schools. Historical evidence suggests that large landowners opposed local taxes for education and that, in some areas, they took over School Boards by placing individuals favourable to their interests in the Boards (Stephens 1998). The local nature of education provision allows me to examine the relation between land concentration and the expansion of education at a highly disaggregated local level.

Second, my data on education provision is very rich. I digitize a source that, to the extent of my knowledge, remains unexplored by economists: the reports of the Committee of Council on Education. These reports provide yearly data on the taxes set by 1,387 local School Boards in 1873–78 and on 22 different education measures for 40 counties in 1871–99: On board schooling, I record all sources of funding and expenditures. On board and voluntary schooling, I record the number of schools, teachers hired and expenditures on their salaries, pupils enrolled and attending, and measures of human capital accumulation in arithmetics, reading, and writing. This rich data allows me to disentangle the mechanisms behind the relationship between land concentration and education to which the existing literature—mostly restricted to literacy and enrolment rates—remains silent.

My first contribution is to evaluate the relationship between education provision and two deep-rooted determinants of land concentration: one historical, another geographical. The historical determinant is the Norman conquest of 1066. Before 1066, England was a mosaic of landowners. After the conquest, more than half of the land was given to 190 Norman nobles, laying the groundwork for future land inequality. The main geographical determinant of land concentration is soil texture, a factor deemed important for land concentration in England (Clark and Gray 2014).[2] In addition, I consider a broad set of

[1] I distinguish board schools – state-run and funded mostly by local taxes – from voluntary schools – established and ran by religious societies and funded mostly by non-tax donations and school fees (see Appendix Table A2). That said, voluntary schools were eligible for government aid in the form of Parliament grants.

[2] Similar effects have been found in Prussia (Cinnirella and Hornung 2016) and India (Bhalla 1988; Bhalla and Roy 1988; Benjamin 1995; Barrett et al. 2010).

geographic and climatic covariates which, in Engerman and Sokoloff (2000)'s framework, may also be important determinants of land concentration and later education provision: terrain ruggedness, suitability for each of the main crops grown in England, temperature, precipitation, distance to rivers and to the coast.

I document a strong reduced-form effect of land concentration in 1086 on all my education measures. Using digitized data from the *Domesday book*, I construct measures of land concentration in 1086 in the areas around each School Board and at the county level. I show that local taxes for education, aggregate board and voluntary schooling expenditures, and human capital accumulation were lower where the largest Norman landowners received more lands. The geographic determinants of land concentration are also associated with education provision, but the relationship is weaker.

I show that these reduced-form effects are likely driven by a strong persistence of land inequality from 1086 to 1870. I construct measures of land concentration in 1870 from Bateman (1883) and show that the estates of 19C great landowners (i.e., peers with 2,000 acres or more) emerged where land was given in a more concentrated manner in 1086.[3] I discuss institutional arrangements that contributed to this persistence by restricting access to land, and rule out alternative persistence channels empirically. Specifically, I show that local differences in land concentration in 1086 are not associated to pre-conquest economic development—proxied by the density of Roman roads—nor to a range of economic and religious county characteristics in the 1871 Census.[4]

My second contribution is to examine the contemporaneous relationship between education provision and land concentration, as well as the mechanisms behind it. After controlling for local geographic, climate, and population characteristics, I find that School Boards located near the 19C great landowners set lower taxes to fund the expansion of education. The estimated effects are quantitatively important: Increasing land concentration by one standard deviation is associated with a reduction in tax rates by 8%. I also exploit cross-county variation to examine the relationship between landownership and a wider range of education measures. I find that in counties where land was more concentrated School Boards raised fewer funds from taxes, and that funds from other sources (e.g., Parliament grants) did not compensate. Less money was invested per child in board schools. Aggregate measures of board and voluntary schooling are also negatively associated with land concentration: overall, fewer teachers and class assistants were employed and expenditures on their salaries were lower. This suggests that voluntary schooling could not fully compensate the under-provision of board schools. This had important consequences on human capital accumulation: children were less likely to pass the reading, writing, and arithmetics' national exams.

Although these reduced-form effects are based on the predictions of well-founded theoretical models, I avoid causal language in their interpretation. I gain insights into identification from an IV-estimation using the two deep-rooted determinants of land inequality as instruments for land concentration in 1870.

[3] I also use genealogical records from Shirley (1866) to show a strong effect of the Norman land redistribution to the estate size of old families who held land in the 1500s.

[4] This is consistent with historical evidence that land was not given in a more concentrated manner in richer areas but in areas with military threats specific to 1066 (Brooke 1961). It also reflects the fact that the Norman conquest homogenized formal institutions across England, and that local institutional differences emerged later (Angelucci et al. 2017).

Finally, I examine the contemporaneous mechanisms through which land concentration affected education provision. Land concentration can affect the expansion of education through a supply or a demand mechanism. The former emphasizes the landowner's economic incentives to oppose education provision through the political process (Galor et al. 2009). The latter, the individuals' underinvestment in human capital in areas where land is concentrated (Cinnirella and Hornung 2016; Ashraf et al. 2017). Another mechanism through which landowners may affect education provision is by favouring voluntary vs. board schooling. Finally, the relation may also be affected by smaller landowners (Tollnek and Baten 2017). These different mechanisms have critically different implications for economic growth and to evaluate available policy instruments, e.g., land reform or public delivery systems. But disentangling these mechanisms is difficult. The reason is that in most settings the available data is limited to enrolment or literacy rates—measures related both to education supply and demand—and does not distinguish different types of schooling. My rich dataset allows me to overcome these issues.

On the supply mechanism, the evidence supports Galor et al. (2009)'s mechanism. Because of the lack of complementarity between human capital and land, the expansion of education is associated with a loss of rural labour force which landowners try to prevent. Consistently, I find stronger, more negative effects of land concentration on School Board activity near large towns which could attract rural labour force. Next, I use School Board taxes to show that the great landowners' opposition to taxation was stronger where they held local political power. I code the biographies of 369 great landowners and record their appointments to political offices that reflect local power. I find that the effect of land concentration on local taxes is 1.6% stronger for School Boards ten miles closer to a great landowner who held important local offices (e.g., Lord Lieutenant) or who was elected Member of Parliament. This differential effect is entirely driven by Conservative great landowners. This lends credence to the hypothesis that landowners opposed the expansion of education through the political process.

On the board vs. voluntary schooling mechanism, I use the number of board and voluntary schools in each county, as well as aggregate expenditures in all schools. The evidence suggests that great landowners' supported voluntary schooling, but this support did not offset the negative impact on School Board activity. This likely reflects the fact that voluntary schooling partly relied on non-tax charitable donations, which are subject to externalities and market failures similar to those in private schooling provision (Galor and Zeira 1993).

On the demand mechanism, I use a supply-side instrument to correct for the fact that enrolment and attendance can be affected by supply factors. The instrument is the Fee Grant Act (1891), which increased school funds nationally in order to eliminate school fees. I use this supply-side instrument to estimate the demand for education—that is, the intercept and the slope of the relationship between enrolment (or attendance) and school fees. The estimated demand schedules are almost identical in counties with low and high land inequality. That is, where land was concentrated the demand for education was not lacking.

On the role of smaller landowners, I show that yeomen had positive effects on education provision, yet these did not offset the impact of great landowners.

Relative to the existing literature, I make the following contributions. First, previous work has documented a negative effect of inequality on education in the Americas.[5] For

[5] Coastworth (1993), Nugent and Robinson (2010), Easterly (2007). In contrast, Dell (2010) shows that landowners in Peru ensured public goods' provision under a highly extractive state.

industrial economies, the evidence in favor of the hypothesis of a negative relation appears overwhelming, in the time period in which industrial demand for human capital is significant. Galor et al. (2009), Vollrath (2009), and Ramcharan (2010) show that land inequality distorted education provision in the United States during the Second Industrial Revolution. Cinnirella and Hornung (2016) find a similar relationship in 19C Prussia, driven by a demand mechanism. Baten and Hippe (2018) confirm a negative relationship between land inequality and numeracy in a large sample of European regions, and show that this relationship is altered in industrial economies.[6] My paper is the first to show that land concentration distorted state education in England. Since England was the cradle of the Industrial Revolution, this result has implications for unified growth theories that emphasize the role of human capital for technological progress and the demographic transition (Galor and Weil 2000; Galor and Moav 2002). Specifically, my findings support (1) that land–human capital complementarity can affect education supply, (2) that land concentration is important for the changes initiated after the Industrial Revolution, and (3) that the structural relationship between landownership and the expansion of education had not broken before the Second Industrial Revolution (1870–1914). This is in line with Galor et al. (2009)'s prediction that the balance of power between landed and industrial elites is crucial for education reforms. It is also consistent with the fact that he landed aristocracy retained substantial local political power in the late-19C (Allen 2009).

My second contribution is to bring together two literatures studying the relation between inequality and education: one that emphasizes contemporary mechanisms;[7] another that emphasizes its deep roots (Engerman and Sokoloff 2000). Specifically, Engerman and Sokoloff (2000) suggest that in certain areas of Latin America, factor endowments favored the emergence of intensely unequal societies after colonization. There, the elite attempted to deprive masses from tools, such as voting rights and education, that could alter the political status quo and permit redistribution. I find that deep-rooted historical and geographic factors were important in England, but that history tops geography. This finding contributes to a large literature highlighting the importance of history and critical junctures for later economic outcomes, over and above unchanging geographic factors (Nunn 2014). In detail, I show that inequality originated in the Norman conquest eventually distorted a large redistributive policy in the 19C. This illustrates how deep-rooted land inequality can transform itself into regional differences in human capital, and hence, persist through periods of transformation like the Industrial Revolution. Similarly, Heldring et al. (2021) show that the dissolution of the English monasteries in 1535 redistributed land from the Church to the gentry and triggered local differences in industrialization by 1830.[8]

My third contribution is to build a new dataset with several measures on board- and voluntary-education provision and human capital. This allows to me to study the different causal mechanisms proposed in the literature in a unified framework. I find that land concentration affected education provision through the political process (Galor and Moav 2006; Galor et al. 2009). This supports the idea that political inequality may be more

[6] In earlier periods, when industrial demand for human capital was insignificant, and landowners had no direct incentive to block education reforms, the effect appears to be absent. For example, Cvrček (2020) documents that 18C-landowners in the Austrian empire were not hostile to education reforms, and Clark and Gray (2014) that geography and landownership did not substantially affect literacy in 1815-45 in England.

[7] Galor et al. (2009), Cinnirella and Hornung (2016), Ashraf et al. (2017).

[8] See also Finley et al. (2021) on the confiscation of Church estates in France.

important than economic inequality for long-run development (Acemoglu et al. 2008).[9] Voluntary schooling did not compensate this lack of provision and the masses' demand for education was not the binding factor for the expansion of schooling in my setting.

The paper proceeds as follows. Section 2 presents the underlying theoretical framework and the historical background. Section 3 describes the data. Section 4 examines the persistence of land concentration from 1066 to 1870. Section 5 presents estimates of the reduced-form relationship between education provision, historical land concentration, and geography. Section 6 examines the contemporaneous relationship and the mechanisms behind it. Finally, Sect. 7 concludes.

2 Theoretical and historical background

Different conceptual frameworks predict a negative relation between inequality and education provision. Engerman and Sokoloff (2000) emphasize the deep roots of this relation. They suggest that early inequality can persist over centuries through institutions that restrict land access, limit suffrage, and block education reforms aimed at the masses. Their case study considers two deep-rooted determinants of inequality: one historical (colonization), another geographic (factor endowments).[10] Hence, two predictions stem from this theory: First, a persistence of inequality over long periods. Second, a negative reduced-form relation between historical and geographical deep-rooted determinants of inequality and later education provision.

Galor et al. (2009) also predict a negative relation between land inequality and state education. For them, the relation is driven by a contemporaneous mechanism: the lack of complementarity between human capital and land. In detail, state education increases the human capital of the masses which, due to the lack of complementarity with land, boosts labour productivity and wages in industry more than in agriculture. In turn, migrating to cities becomes attractive for the rural labour force, which raises wages in agriculture. The loss of rural labour force and the rise of wages in agriculture reduces the value of land. Landowners, hence, have economic incentives to oppose state education. The theory shows that the adverse effects of state education for landowners are aggravated if landownership is concentrated. In addition, if the tax burden to fund state education falls on landowners—e.g., via a tax on land—the value of land falls further, magnifying the landowners' losses.[11] Altogether, two predictions stem from this theory: that landownership concentration leads to lower taxation to ensure lower state education provision and that a crucial mechanism behind this relation is the landowners' political power to effectively oppose education taxes.

Finally, the relation may be driven by a demand channel. Where inequality is high, landowners may use labour coercion to reap the returns of their workers' private investments.

[9] Similarly, extending the suffrage increased the demand for schooling (Acemoglu and Robinson 2000; Mariscal and Sokoloff 2000; Gallego 2010; Go and Lindert 2010).

[10] They argue that the European colonization laid the groundwork for inequality in America. Where factor endowments (e.g., soil, climate) favoured large-scale crops, colonialists introduced slave-based plantations, leading to high inequality. Where factor endowments favoured family farming, colonialists established more equal societies.

[11] Elsewhere it has been argued that landowners had similar economic incentives to oppose child labour laws (Doepke and Zilibotti 2005; Galor et al. 2009). Hence, child labour could have reinforced the landowners' incentives to oppose the expansion of education.

As a result, rural workers may underinvest in their human capital (Cinnirella and Hornung 2016; Ashraf et al. 2017).[12] The testable prediction is that the demand for education is lower where land is more concentrated.

2.1 Education provision in late-19C England

In the Second Industrial Revolution, the demand for skilled labour increased. For example, job advertisements in the 1850s mentioned literacy as a desired characteristic (Mitch 1993, p. 292). At that time, however, England's education system struggled to meet this demand. The illiteracy rate in 1852 was higher than in Prussia and the US, countries that had introduced a state education system at least 50 years before England (Sanderson 1995).[13]

Before 1870, elementary education was provided almost exclusively by two religious societies: the Church of England's *National Society* and the nonconformist *British and Foreign School Society*. These societies established and ran voluntary schools, which operated with "limited and indirect state support" (Sanderson 1995, p.77). From 1833, many voluntary schools (not all) received Parliament grants,[14] but 2/3 of their funds still came from non-tax donations and school fees by 1873 (see Appendix Table A2).[15] These schools enjoyed considerable autonomy. The state had no control over the curricula until 1862, when Parliament grants were conditioned on children's reading, writing, and arithmetics' results ('payment by results').[16] State supervision was often limited by the sparsity of inspectors,[17] whom bishops could veto for anglican voluntary schools (Mitch 2019, p.304). Even in cases of severe mismanagement, voluntary school governance could not be replaced (Gordon 1974, p.8). Overall, although a significant network of voluntary schools was created before 1870, there was "a clear limit to their potential expansion" (Green 1990, p.16). Hurt (1974) estimates that voluntary schooling did not reach 1 in 3 children (p.34).[18]

The 1870 Education Act (Forster's Act) aimed to expand elementary schooling to the entire school-aged population, "filling in the gaps" of the voluntary system (Mitch 2019, p.305). The main motivation was to meet the industrialists' and trade unions' demand for an educated workforce (McCann 1970).[19] This is illustrated by Forster's address to the House of Commons: "Upon the speedy provision of elementary education depends our industrial prosperity" (Hurt 1971, p.223-4). That said, the Act was supported by a diverse coalition which also included liberals and non-conformists. Liberals sought

[12] More generally, Galor and Zeira (1993) show that, under credit market imperfections, economic inequality and human capital investments are negatively related.

[13] Illiteracy was 30% in England, 20% in Prussia (1849) and 9% for white Americans (1860).

[14] For example, in 1859, one in four voluntary schools did not receive any Parliament grants (*Newcastle Report* 1861 , Part VI, p.671, Table A).

[15] State spending in education was small before 1870; e.g., in 1861 England spent only £250,000, less than the £600,000 spent by the smaller Prussia 30 years earlier (Green 1990, p.16).

[16] This policy was criticized for limiting education to the three Rs—reading, writing, and arithmetics (Green 1990, p.7), which partly explains the high scores in these exams (see Table A1).

[17] In 1860, 60 inspectors had to visit 10,403 schools; many were uninspected (Green 1990, p.271).

[18] In addition, inspectors reported that voluntary schools often filled available school places with children from more prosperous backgrounds who could afford higher fees (Hurt 1974, p.12).

[19] England's education reform was less instrumental to nation-building than those of Prussia (Cinnirella and Schueler 2018) or the United States (Bandiera et al. 2018).

to educate the men newly enfranchized in 1867 (Lawson and Silver 2013, p.308). Non-conformists supported the non-denominational board schools to undermine the anglican control of the school system through voluntary schools. The stalemate between non-conformists and anglicans was broken by the agreement to fund board schools with local taxes and, in return, increase Parliament grants to anglican voluntary schools.

The Education Act created 5,700 schools for 2.6 million children in 1870–1902 (Maclure 1968, p.152). This expansion of schooling was decentralized and funded mostly by local taxes. Specifically, School Boards were created and given the power to tax local residents with a tax on property similar to the poor rate. This tax was mostly levied on land, especially in rural areas. In addition, School Boards were eligible for Parliament grants. These grants were based on children's grades in the national exams, which limited education to exam topics (Green 1990, p.7). All these funds were then used by School Boards to build board schools. In addition, School Boards had discretion over expenditures in board schools, could pay the school fees of poor children, and pass by-laws making attendance compulsory in their district (Stephens 1998). As explained above, the 1870 Act did not fully break with the past. The new, non-denominational board schools coexisted with voluntary schools, which were ran mostly by the Church of England, funded through non-tax donations, and continued receiving Parliament grants.

Initially, School Boards were created in municipal boroughs, parishes, and Poor Law districts where existing voluntary schools could not accommodate all school-age children.[20] Much of the initial impetus came from municipal boroughs (e.g., London, Birmingham) and from a 1871 survey reporting school needs in most parishes. By 1878, School Boards spanned most of England, including rural areas—90% of my sampled School Boards were in parishes with less than 5,000 inhabitants. Later, several Acts extended education, making it compulsory at ages 3-11 (1880) and free (Fee Grant Act 1891).[21] Overall, School Boards had a positive impact on schooling (Mitch 1992). Where School Board activity was effective, intergenerational mobility increased (Milner 2022). That said, School Boards did not reach everyone—by 1895, as many children attended board schools as voluntary schools run by Church of England (Sutherland 1973, p.350). In this paper, I will show that differences in land concentration resulted in an uneven expansion of schooling within England.

2.2 Great Landowners' incentives

The historical evidence lends credence to the conceptual framework of Galor et al. (2009). Universal compulsory schooling generally met the resistance of rural, landed interests in late-19C England (Sutherland 1973, pp.115-125). Great landowners opposed local taxes by School Boards. The main reason was a lower complementarity between land and human capital; they argued that schooling did not increase the value of land. Offer (1981, p.164) summarizes this view when describing the dogma of the Conservative party, to which most landowners adhered[22]:

[20] The ballpark number for school-age children was one sixth of the population (Milner 2022).

[21] See Appendix Table A3 for details.

[22] Most great landowners in my sample belonged to Conservative Clubs. Of those elected MP, 60% were affiliated with the Conservative party.

> 'Local' or 'beneficial' taxation for paving the streets, laying sewers and similar expenditure was admissible; it increased the value of land and was therefore a legitimate charge on tenure. Not so the poor rates and the costs of prisons, asylums, hospitals, trunk roads, and schools.

Appendix F presents additional evidence on the lower complementarity between land and human capital than between human and physical capital based on the distribution of employment. Data from Long (2006) shows that 47.7% of those employed in agriculture in 1881 had attended school in 1851. The corresponding figure for those employed in manufacturing was 60.7%.[23] The appendix also presents evidence on the raising demand for human capital in the industrial sector after 1870. Finally, it examines urban-rural wage differentials (Clark 2005) and reviews research showing that rural migration increased rural wages and responded to changes in the industrial sector—particularly, to a higher demand for education (Williamson 1990; Boyer and Hatton 1997). Specifically, by 1881, rural migrants where positively selected in terms of education and the benefits of migrating from rural to urban areas were two times larger for those who had attended school in 1851 (Long 2005). Altogether, this suggests that the expansion of education could exacerbate the loss of rural labour force, which provided landowners with economic incentives to oppose the 1870 Education reform.

In addition, great landowners disliked School Board taxes even though the *formal* liability fell on the occupiers of land, i.e., the tenant farmers that rented most of their lands. The Conservative party, representing landowners' interests, argued that such land taxes were ultimately shifted to landowners (Offer 1981, p. 163-4). Ricardian economics was used as proof. Liberals admitted that landowners were *effectively* liable, but argued that this burden was their hereditary obligation (ibid). These different dogmas show that, beyond taxation, the landowners' ideology (Liberal or Conservative) shaped their view on School Boards.

After 1870, great landowners were galvanized into "a flurry of activity to ward off the dread intrusion of a School Board" (Thompson 1963, p. 208). One way in which they opposed School Board activity was by capturing them. Great landowners used their local power to secure the election of Board members pledged to their interests, who would then lower local taxes for education. Lawson and Silver (2013, p. 319) describe board elections as:

> sectarian battles between Church of England and nonconformity, between candidates pledged to educational development and those pledged to save the ratepayers' money, or between political parties ... Some of the smaller boards in rural areas were controlled by people who had opposed their creation, and were pledged to restrict their activities.

The election system facilitated the capture of School Boards by great landowners: First, because only those paying an annual rent of £10 or owning land valued at £10 could vote in Board elections. Second, because Board elections were based on cumulative voting, which favoured the election of candidates supported by great landowners (Stephens 1998). In addition, many great landowners were peers, a political elite that dominated local politics in rural areas. According to Allen (2009, p. 301), "[i]t is hard to exaggerate the extent

[23] While the complementarity between human capital and land was lower than between human and physical capital, the former is not necessarily zero (e.g., Foster and Rosenzweig 1996). That said, in Galor, Moav, and Vollrath's framework, landowners have economic incentives against education expansion as long as land and human capital have a lower complementarity.

to which [the peerage] ruled Britain through its control over ... public offices." The large political power of great landowners likely helped them influence Board elections.

Another way in which great landowners opposed School Boards is by increasing their non-tax donations to anglican voluntary schools (Thompson 1963, p. 208). This was intended to foster voluntary schooling and, hence, reduce the need to introduce new board schools; which were not managed by religious societies and where no religious catechism was taught. This suggests that landowners were not openly hostile to schooling (Clark and Gray 2014), but preferred a voluntary-provision system with anglican religious schools.[24] A testable implication is whether the landowners' support for voluntary schooling offset their negative effects on School Board activity. If not, this would reflect externalities and market failures similar to a private-provision system (Galor and Zeira 1993).[25]

A full account of all the interest groups is beyond the scope of this paper, but I highlight three beyond great landowners. First, the Church of England was mostly aligned with great landowners' interests, particularly in supporting voluntary schools (Stephens 1998). Second, the tenants who rented the great landowners' lands usually complied with the latter's political views.[26] Since they shared the burden of taxation, great landowners would likely hire tenants with similar views on key issues like School Boards and support their election to the Boards. In 1871, the Liberal party tried to break the tenant-landowner unity of action, but their policies "failed completely as political banners" (Offer 1981, p. 179). Third, yeomen, as other smaller landowners in Europe (Tollnek and Baten 2017; Baten and Hippe 2018), were supportive of schooling. Yeomen's children, especially those with non-conformist beliefs, were more likely to attend board schools than great landowners, 95% of whom attended five Public Schools—Eton, Harrow, Rugby, and Westminster (Bateman 1883). Hence, one would expect more board schooling where yeomen owned a larger share of land.

In sum, the theoretical frameworks and historical evidence suggest a negative relation between land concentration and education provision. I empirically investigate this relation using deep-rooted historical and geographic determinants of land concentration (Sect. 5) as well as contemporaneous, 19C land concentration (Sect. 6). I then explore the mechanisms outlined here: the great landowners' economic incentives; their political power and Conservative affiliation; their support for voluntary and opposition to board schooling; a demand channel; and the role of smaller landowners.

3 Data

3.1 Sources and main variables

State education data to study the expansion of state education, I computerize the annual reports of the Committee of Council on Education. The reports cover 1871-1899, most of

[24] Elsewhere it has been argued that landowners preferred this system for religious motivations and that their donations responded to emulation (Hurt 1968; Thompson 1963).

[25] Although it received some government aid, voluntary schooling reflects elements of a private-provision system both in terms of funding—their largest income source were non-tax donations and school fees—and management—they were run by autonomous religious societies.

[26] According to Edward Stanley, the result of a county election could be asserted "by calculating the number of the great landed proprietors in the county and weighing the number of occupiers [tenants] under them" (Baland and Robinson 2008, p. 1738).

the period when School Boards were active. They provide a wide range of education measures. On School Board funding, I compile the local tax rate and the total funds raised from taxation, Parliament grants, school fees, and other sources. On expenditures, I collect the money spent in board schools and aggregate investments in all schools (board and voluntary): the number of certified teachers and female class assistants and their salary expenditures. I normalize all monetary amounts by the number of children aged 5 to 10, based on the 1881 Census. On schools, I record the number of board and voluntary schools (anglican, wesleyan, non-conformist, and catholic). On human capital of children in all schools, I record the percentage passing the reading, writing, and arithmetics' national exams. On proxies of education demand in all schools, I record the number of pupils attending, enrolled, or examining, broken down by age and by standards (see Appendix Table A4). For illustration, Appendix Figure A1 shows parts of a report.

I compile the data at two different levels: at the local and at the county level. First, I digitize the local tax rates set by all 1,387 School Boards operating in 1873–78;[27] the initial years after the 1870 reform. Second, I add the other variables for all 40 counties in England in 1871–99.[28] This is because all aggregate investments in board and voluntary schools, their numbers, and exam results are only reported at the county level. Overall, my dataset contains 23 different education measures. This allows me to evaluate many dimensions of education on which existing historical studies—restricted to literacy and enrolment rates—remain silent.

Historical land concentration I use the *Domesday Book*, a survey of all landholdings commissioned after the Norman conquest (1086). No survey approaching its extent was attempted until the nineteenth century. The *Domesday* covers most of England—except northern counties, London, and Winchester (Harvey 1971: 770). For each manor, it lists the owner and the value of the land before and after the conquest.[29] Here, I use the *Domesday* electronic version digitized by Palmer (2010), which provides records for 22,634 manors in 1086.

I measure historical land concentration as the percentage of land value owned by the five largest landowners in each 25-mile radius around the 1,387 School Boards for the local-level analysis (in each county for the county-level analysis).[30] To capture land inequality generated by the 190 Norman landowners that received land from William the Conqueror, I exclude Church and Crown estates from both numerator and denominator of the percentage. I measure land concentration in land values, not landholdings' size because the *Domesday* only provides the former. These land values are based on taxes. To get a measure similar to concentration in landholdings' size, I use land values based on taxes on the landholdings' size and ignore taxes on the presence of mills, markets, or justice (Palmer 2010).[31]

Contemporaneous land concentration I digitize a new dataset on 19C landownership from Bateman (1883). Bateman provides an entry for each owner of 3,000 acres or more

[27] The total number 1,471, but 84 School Boards were in areas not surveyed by the *Domesday*.

[28] Throughout the paper, counties are based on their 1870 borders.

[29] Owners are the immediate lords of the peasantry; i.e., either the tenant-in-chief or a tenant to whom the tenant-in-chief had granted the estate.

[30] In the county-level analysis, I exclude counties not fully surveyed: Cumberland, Durham, Lancashire, Monmouthshire, Northumberland, Westmoreland, Middlesex, and Hampshire.

[31] Specifically, I use 21,036 farms paying the geld and 43 farms paying taxes on carucates. Considering the remaining taxes does not alter my main results (available upon request).

and for 1,300 owners of 2,000 acres or more in the 1870s (henceforth, great landowners). Entries list the the great landowner's family seat, the acres he owned in each county, and other information—see Appendix Figure A2.[32] I compile this individual-level data for all great landowners who were also in the peerage. I add geo-references for 532 seats listed in the book or in Burke (1826), and indicators for old families based on Shirley (1866).[33] Old families are those which by 1870 held land in England in unbroken male line since Henry VII's reign (1485–1509). Finally, Bateman's appendix reports the total arable acres owned by great landowners, squires (1,000-3,000 acres), yeomen (100-1,000), and small proprietors (1-100) in each county. I compile this data for all counties in England.

I measure land concentration at two levels: For the analysis at the local level, I use the average acres of all great landowners whose seats are located in a 25-miles radius around each School Board. I consider acres only in the county where a great landowner's seat is located rather than his total acreage, which may include estates elsewhere in Britain or Ireland. Note that this measure only includes peer great landowners. For the analysis at the county level, I use the percentage of arable land in each county owned by all great landowners.[34]

Geographic determinants of land inequality In addition to the Norman conquest, I consider another deep-rooted determinant of land inequality: geographical variation in soil texture. Specifically, sandy and chalky soils are associated with landownership concentration (Cinnirella and Hornung 2016). Since soil texture does not change over time and cannot be altered by human intervention, I use modern-day soil textures from the British Geological Survey, reported by 1x1km cells. For the local-level analysis, I use an indicator for sandy and chalky soils in the cell where each School Board is located. For the county-level analysis, I compute the percentage of sandy and chalky soils in each county.[35]

Peers' biographies I measure the political power of the 19C great landowners using their biographies in thepeerage.com (Lundy 2018), which are based on several peerage records (see Figure A3). Using regular expressions, I record appointments to Lord Lieutenant, Deputy Lieutenant, High Sheriff, Sheriff, and Member of Parliament (MP). I record the political affiliation of great landowners, and whether they gained or lost a seat in Parliament in the 1874 general election.

Other I collect geographic and climate covariates at a highly disaggregated level: terrain ruggedness (Nunn and Puga 2012), suitability for cereal, pasture, and tubers (FAO 2007), 19C temperatures (mean and standard deviation; Luterbacher et al. 2006), precipitation (ESRI), and distance from School Boards to the sea and rivers (Ordnance Survey 2018).[36] I compute the distance to industrial centres and cathedrals. I collect the population of the district served by each School Board from the Reports of the Committee of Council on

32 Bateman (1883) does not report the share of the estates that was rented to tenants.

33 Out of the 532 seats, 46 are in areas not surveyed by the *Domesday*.

34 In my setting, these measures are preferable to the Gini index. First, the Gini index is biased in small sub-samples (Deltas 2003), such as some areas of my local-level analysis. Second, the Gini index measures between- and within-group inequality. My measures consider only the former, which is more relevant for redistributive policies like state education. That said, results are robust to using measures akin to decile dispersion ratios (Sect. 6.1.5).

35 Conversely, the 'reference group' are soils in which sand is not the largest component—silty loam (0-50% sand), clay (0-40% sand), and silt (0-40% sand)—soils with peat fragments, and *pure* sand near rivers and the coast, where access to trade lead to less land concentration.

36 These are over 5 arc-minutes (cereal, pasture, tuber suitability), 30 arc-seconds (ruggedness, precipitation); and 100 grid cells over England (temperature).

Education, and the county-level population density (children under 5 per sq. km) from the 1881 Census. I also use county-level employment in manufacturing, income p.c., religiosity, and the share of non-conformists from the 1871, 1881, and 1891 Census (Hechter 1976). Finally, I use Roman roads (McCormick et al. 2013) to construct proxies for pre-1066 economic development. All variables are described in detail in Appendix B.

3.2 Data descriptives

Here I discuss descriptive statistics for my main variables (see Appendix Table A1 for complete descriptives). Most of the funds raised by School Boards came from taxation. In 1873–78, the average tax rate was 2.5 percent. This amounted to 80 pence per child in the average county. Other sources of School Board funding, e.g., Parliament grants and fees, have a lower mean and standard deviation, suggesting that local differences were mostly associated with differences in taxation.

School Boards in the average county spent 150 pence per child in board schools. As explained above, board schools coexisted with voluntary schools, funded through non-tax donations and Parliament Grants. Specifically, the average county had 103 board vs. 353 voluntary schools per square kilometre.

The percentage of children passing the national exams in both board and voluntary schools was high. Rather than educational progress, this reflects the fact that Parliament grants were partly based on children's grades (Green 1990, p. 7). That said, there is meaningful variation across counties, especially in arithmetics. Hence, I can assess whether underinvestment in schooling affected human capital accumulation in this dimension.

Anecdotal evidence suggests that education provision is negatively associated to landownership concentration. Figure 1 shows the case of Macclesfield and Cottenham. The lands around these two School Boards were distributed differently. This can be traced back to the land redistribution that followed the Norman conquest. In 1086, around Macclesfield, 40% of the land was given to five landowners. Around Cottenham, the corresponding figure was 'only' 25%. These differences persisted over centuries. By 1870, Macclesfield was surrounded by seats of great landowners (blue circles). Larger landholdings (larger circles) emerged where the Normans redistributed land more unequally (darker cells). On average, great landowners near Macclesfield owned 11,700 acres in the county. Differently, Cottenham was surrounded by fewer 19C great landowners who, on average, owned 'only' 5,000 acres in the county. These persistent differences in landownership are associated with different levels of education provision. Macclesfield set taxes at only 0.96% between 1873 and 1878. Instead, the lower land concentration around Cottenham seemingly facilitated the expansion of education. Cottenham set taxes at 3.3%—more than three times larger than that in Macclesfield.

These examples are not exceptional. Figure 2 shows the geographical distribution of land concentration in 1086 (panel a), land concentration in 1870 (panel b), and School Board taxes and the funds raised from taxation (panel c). The top panels use local-level data from 1,387 School Boards and 532 great landowners' seats, the bottom panels use county-level data. Although there is variation across and within areas, three general patterns emerge:

First, it is hard to exaggerate the extent to which land was concentrated in 19C England: The average great landowner owned an estate of 8,000 acres in the county where his seat was located. Overall, 40% of all the lands belonged to them.

Second, land concentration in 1870 is remarkably similar to that in 1086. The largest 19C estates (dark blue dots) emerged in areas where large Norman landowners received a higher percentage of land (dark purple dots). The persistence of land inequality is also evident at the county level. For example, in Cheshire, 68% of the land was owned by the five largest Norman landowners. Eight centuries later, 52% of the land was owned by great landowners. In contrast, in counties between the Walsh and the Severn estuaries, the Norman land grab was smaller and so was landownership concentration in 1870.

Third, the spatial distribution of education funds and land concentration are opposite. At the local level, landownership was more concentrated in 1086 and in 1870 mostly in the north. In contrast, School Boards imposing the largest tax rates (dark brown dots) were mostly in the south-east, where the land distribution was historically relatively more equal. This is also visible at the county level. For example, counties in the West Midlands only raised 7-21 pence per child and land there was heavily concentrated: 30-80% of the land belonged to the five largest Norman landowners and 40-70% to 19C great landowners.

To visualize these two patterns, Figure 3 presents binned scatter plots.[37] Panel (a) uses local data to show that areas where land was more concentrated in 1086 are also the areas where great landowners own the largest estates in 1870. In turn, where land was more concentrated in 1086, we observe lower tax rates for education. Panel (b) reproduces these two patterns at the county level.

Taken together, these descriptives suggest that the Norman conquest laid the groundwork for inequality in England. This land inequality persisted until the 19C, when it distorted education provision by local School Boards.

4 Persistence of land inequality

My first goal is to investigate the deep roots of the relationship between inequality and education provision. Here I examine Engerman and Sokoloff (2000)'s prediction that land inequality can persist over centuries and is deep-rooted in historical and geographic factors (Sect. 5 examines the reduced-form effect of these deep-rooted factors on 19C education provision). Specifically, I discuss how the Normans redistributed landownership in 1066 and how much this reshaped land inequality. I then examine empirically the persistence of historical land inequality from 1066 to the reign of Henry VII (1485–1509) and to the 19C. I contrast these estimates with the contribution of geographical factors to land inequality. Finally, I test alternative channels of persistence that, potentially, could confound the reduced-form effect of historical land inequality on 19C education provision.

4.1 The Norman land redistribution

In 1066, William the Conqueror crossed the Channel from Normandy, defeated the Anglo-Saxons in Hastings, and became King of England. One of his first acts was to redistribute landownership: He took one fifth of the land for himself, gave a quarter to the Church, and divided the remaining 55% among 190 Norman nobles. How were these lands assigned? Brooke (1961) suggests that William gave land in a more concentrated manner in areas with threats specific to the eleventh century. The receivers of land had to provide the King

[37] To construct the scatter plot, I residualize variables with respect to the full set of controls in Tables 4 and 5; divide the sample into 20 equally sized bins (a) or 32 counties (b); plot the mean of the residuals in each bin, adding back the estimation-sample mean.

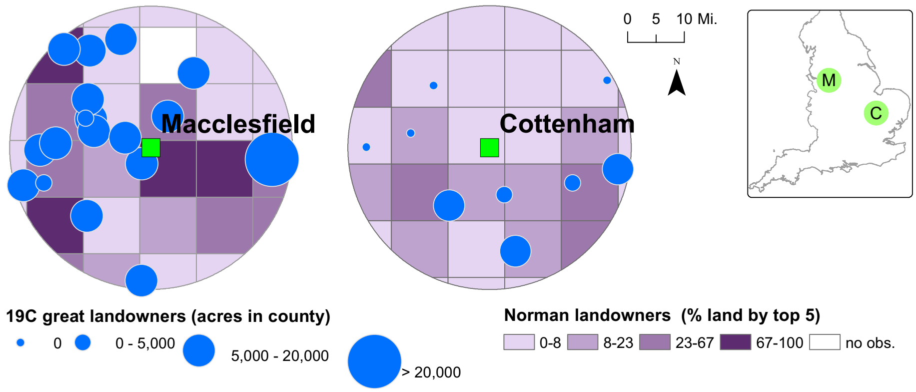

Fig. 1 Macclesfield and Cottenham School Boards

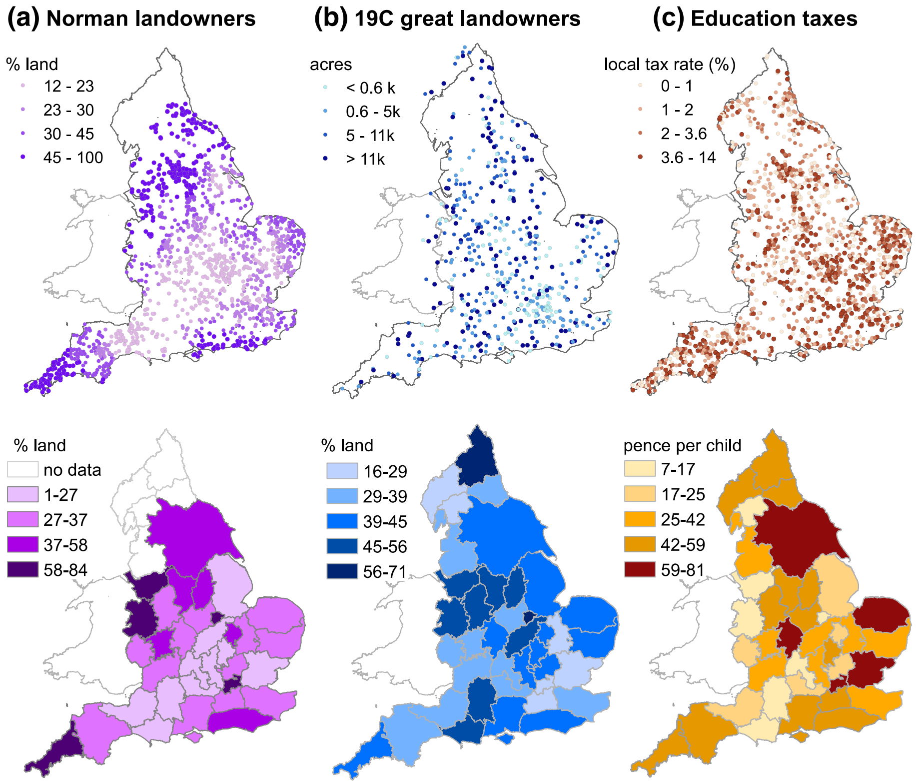

Fig. 2 Spatial distribution of local taxes for education and land concentration. *Notes*: Top for local-level data: (a) av. tax rate in 1873-78 by 1,387 School Boards; (b) land concentration in 1086; (c) acres in county by 532 seats. Bottom for county-level data: (a) av. funds from taxes in 1871-94; (b) land concentration in 1086; (c) land concentration in 1870

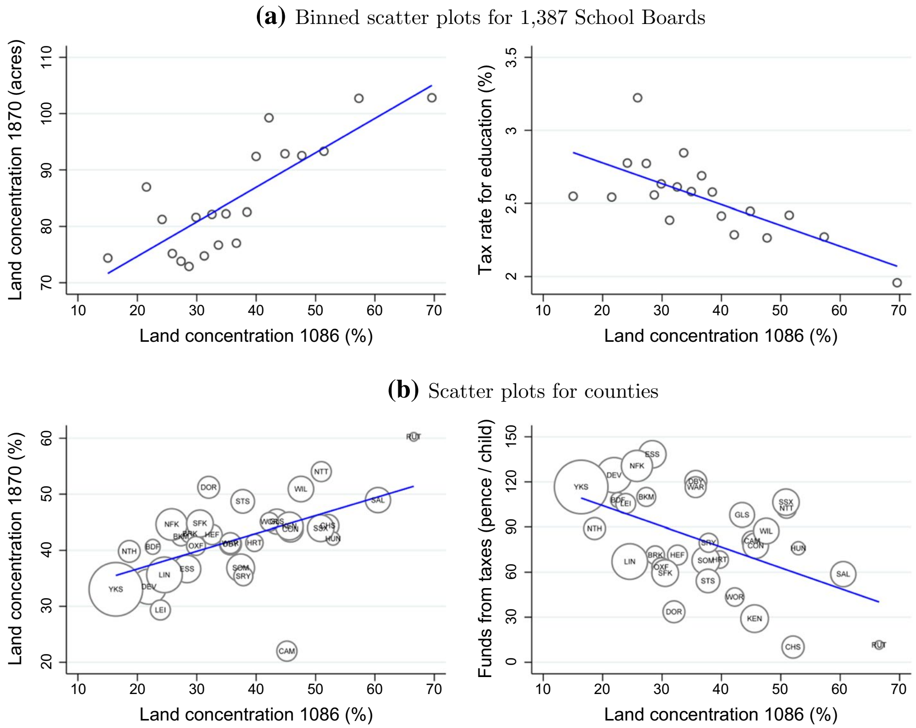

Fig. 3 Scatterplots. *Notes*: All variables are residualized with respect to the full set of controls in Tables 4 and 5, then mean is added back. In (b), the size of each point is proportional to the county area

Table 1 The redistribution of land after 1066

County	Sample farms	Landowners Before 1066	Landowners After 1066	% Change
Buckinghamshire	285	181	10	−94.5
Cambridgeshire	207	101	9	−91.1
Essex	389	187	12	−93.6
Lincolnshire	421	106	9	−91.5
Norfolk	1032	224	11	−95.1
Northamptonshire	186	71	9	−87.3
Oxfordshire	113	16	9	−43.7
Somerset	193	90	8	−91.1
Suffolk	1724	468	13	−97.2
Warwickshire	140	72	10	−86.1
Total	4690	1516	100	−93.4

The sample is 4,690 farms given to 29 Norman nobles who fought in Hastings and/or appear in the Bayeux Tapestry (see Appendix B for details) with a number of knights proportional to the size of their landholdings.[38] Hence, larger landholdings were given in conflict-prone areas—e.g., where Anglo-Saxons threatened with rebellion.

William's land redistribution laid the groundwork for inequality. Before the conquest, England was a mosaic of landowners (Cahill 2001). To illustrate this, I identify the 4,690 farms given to 29 Norman nobles who fought in the Battle of Hastings and/or appear in the Bayeux Tapestry—a Norman embroidery depicting the conquest. Table 1 lists the number of owners in these farms before and after the conquest. For example, in Buckinghamshire, 285 farms that used to have 181 different owners were given to 10 Norman nobles. Overall, the surveyed farms saw a 93% reduction in the number of landowners. In other words, the conquest resulted in a massive increase in landownership concentration.

4.2 Land persistence estimates

Here I examine empirically the persistence of land inequality from the Norman conquest to the 19C. I also discuss the evolution of the land market and the legal mechanisms that enforced the persistence of the great estates.

Formally, I examine the persistence of land inequality by estimating:

$$L_i^{1870} = \alpha + \beta\, L_i^{1086} + \gamma\, G_i + \mathbf{X}_i'\, \delta + \ e_i\ , \tag{1}$$

where i indicates a 25-miles area around each of the 1,387 School Boards under analysis. Land concentration in 1870, L^{1870}, is the average acres of all 19C great landowners whose seats are located in i. I consider acres only in the county where a landowner's seat is located rather than his total acreage, which may include estates elsewhere in Britain or Ireland. The variables L_i^{1086} and G_i capture two deep-rooted determinants of land inequality: one historical, another geographical. The historical determinant of land inequality, L_i^{1086}, is the percentage of land value that in 1086 was given to the largest five landowners in i. The main geographical determinant of land inequality, G_i, captures variation in soil texture, a factor that Clark and Gray (2014) deem important for land concentration in England. Specifically, G_i is an indicator for the presence of sandy and chalky soils over 1x1 km cells. Sandy and chalky soils are typically associated with land concentration because these soils do not retain water well, are drought-prone, and, hence, worse for agriculture (Leeper and Uren 1993). In turn, areas with less productive agriculture are subject to lower population pressure and a weaker land demand. As a result, landownership tends to be concentrated in the long run. In extended specifications, $\mathbf{X}_i$ includes a broad set of geographic and climate covariates which, under Engerman and Sokoloff (2000)'s framework, may also be important determinants of land inequality and of later education provision.

I also examine the persistence of land inequality at the county level:

$$L_c^{1870} = \alpha + \beta\, L_c^{1086} + \gamma\, G_c + \mathbf{X}_c'\, \delta + \ e_c\ , \tag{2}$$

where L_c^{1870} and L_c^{1086} are the percentage of land in county c owned, respectively, by great landowners in 1870 and by the county's largest five landowners in 1086. The variable G_c

[38] For example, Richard Fitz Gilbert received land in Kent, Essex, Surrey, Suffolk and Norfolk. In return, Richard had to send 60 knights to the King when requested (Cokayne 1913).

is the percentage of sandy and chalky soils in county c and $\mathbf{X}_c$ includes geographic and climate covariates at the county level.

Table 2 documents a strong persistence in land inequality from the Norman conquest to the 19C. Panel A reports standardized beta coefficients from estimating Eq. (1). The largest estates in 1870 arose in areas where land was more concentrated in 1086. A percentage point increase in historical land inequality is associated with an increase of 70 acres in the size of the landholdings of an average 19C great landowner around a School Board (column [1]).

Geographic characteristics are also important long-run determinants of land inequality. Larger estates emerged in areas with sandy and chalky soils. This relation between soil texture and land inequality is consistent with previous findings for England but also for Prussia and India.[39] Importantly, the coefficient on soil texture remains significantly different from zero *conditional* on land concentration in 1086. In other words, soil texture seems to have a compound effect over time, increasing 19C land concentration over and above the level of land concentration already present in 1086. In contrast, in Engerman and Sokoloff (2000)'s framework geography determines the level of land concentration around critical junctures rather than as part of a process of continuing concentration.

Beyond soil texture, I consider a broad set of geographic and climate covariates which can also be considered long-run determinants of land inequality. In column [2], I add terrain ruggedness and the geographic suitability for cereal, pasture, and tuber production—the main crops grown in England. Rugged terrains were dominated by small family farms in England (Clark and Gray 2014). Cereals dominate in the midlands and in the south east. The south west was predominantly pastoral and tubers were grown in the north east. These different crops are associated with different economies of scale, and hence, with different landownership structures. Consistent with Clark and Gray (2014)'s predictions, I find that terrain ruggedness is negatively associated with large estates and that the suitability for different crops predicts regional differences in land concentration in 1870. In column [3], I add climatic covariates: precipitation and the mean and standard deviation of temperature. Precipitation is an important pre-condition for large-scale agriculture (Baten and Hippe 2018, p. 15). Together with temperature, it affects the length of the growing season, which Clark and Gray (2014) identify as an important determinant of land concentration in England. I find that precipitation is positively associated with land concentration, reflecting the fact that it is a pre-condition for large-scale agriculture. That said, the F-statistic of the joint test of all these geographic and climate covariates is around 20, half of that corresponding to land concentration in 1086. Similarly, the estimated effect for soil texture is smaller than that of land concentration in 1086 across specifications. This suggests that historical determinants of land inequality top geographic determinants in this setting.

In columns [4] and [5], I add the distance to the coast, rivers, 19C industrial centres, and cathedrals as well as population served by each School Board in the 19C. These covariates have little impact on the main coefficients of interest. Yet, some of the estimates are interesting in its own right: Land inequality is larger in areas further from industrial centres, rivers, and the coast. Overall, the Conley (1999) and robust standard errors are similar, suggesting that my estimates are not driven by spatial correlation. In addition, results

[39] Clark and Gray (2014) for England, Cinnirella and Hornung (2016) for Prussia, and Bhalla (1988), Bhalla and Roy (1988), Benjamin (1995), Barrett et al. (2010) for India.

Table 2 Persistence of land inequality

	[1]	[2]	[3]	[4]	[5]
Panel A. Local level	Dep. Var: Land concentration in 1870 (acres)				
% Land concentration 1086	0.299	0.289	0.182	0.218	0.228
	(0.021)***	(0.023)***	(0.032)***	(0.036)***	(0.036)***
	[0.079]***	[0.072]***	[0.103]*	[0.103]**	[0.103]**
Sandy and chalky soil	0.066	0.068	0.061	0.057	0.054
	(0.027)**	(0.028)**	(0.027)**	(0.029)**	(0.029)*
	[0.047]	[0.048]	[0.045]	[0.047]	[0.046]
Observations	1,387	1,387	1,387	1,387	1,387
Panel B. County level	Dep. Var: % Land concentration in 1870				
% Land concentration 1086	0.474	0.619	0.555	0.634	0.631
	(0.191)**	(0.245)**	(0.221)**	(0.190)***	(0.194)***
% Sandy and chalky soils	0.427	0.628	0.578	0.415	0.411
	(0.159)**	(0.189)***	(0.216)**	(0.275)	(0.290)
Observations	32	32	32	32	32
Panel C. Old families who held land from 1500s to 1870s in unbroken male line, local level					
	Dep. Var: Estates by old families (acres)				
% Land concentration 1086	0.405	0.373	0.339	0.365	0.376
	(0.036)***	(0.038)***	(0.035)***	(0.036)***	(0.037)***
	[0.101]***	[0.100]***	[0.094]***	[0.092]***	[0.094]***
Sandy and chalky soil	0.095	0.082	0.077	0.079	0.076
	(0.023)***	(0.023)***	(0.022)***	(0.021)***	(0.021)***
	[0.057]*	[0.051]	[0.047]*	[0.043]*	[0.043]*
Observations	1,387	1,387	1,387	1,387	1,387
Ruggedness	–	Yes	Yes	Yes	Yes
Cereal suitability	–	Yes	Yes	Yes	Yes
Pasture suitability	–	Yes	Yes	Yes	Yes
Tuber suitability	–	Yes	Yes	Yes	Yes
Precipitation	–	–	Yes	Yes	Yes
Average temperature	–	–	Yes	Yes	Yes
S.D. temperature	–	–	Yes	Yes	Yes
Rivers	–	–	–	Yes	Yes
Coast	–	–	–	Yes	Yes
Distance to cathedral	–	–	–	Panel A &C	Panel A &C
Distance to industrial centre	–	–	–	Panel A &C	Panel A &C
Population	–	–	–	–	Yes

Sample and indep. vars. as in Table 4 (Panels A and C) or as in Table 5 (Panel B). In Panel C, estates by old families is the av. acres of old families in each 25-miles around a School Board. Effect sizes in std. deviations. Robust SE (parenthesis), SE adjusted for spatial auto-correlation within 50 miles (brackets). Constants not reported; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

are robust to calculating land concentration using a 10-, 15-, and 20-miles' cut-off around School Boards.

Panel B reports standardized beta coefficients from Eq. (2). The persistence of land inequality is also visible at the county level. Counties where land was more concentrated in

1086 also had a more concentrated landownership in the 19C. A one ppt increase in the land owned by the five largest landowners in 1086 is associated with an increase of 0.26-0.35 ppts in the land owned by great landowners in 1870. The magnitude of the persistence is large: increasing land inequality in 1086 by one standard deviation would increase land inequality in 1870 by more than half a standard deviation. As before, this effect is larger than that of soil texture and geographic and climate factors (cols. [2]-[3]). The combined F-statistic is 3.8 for the latter vs. 10.6 for land concentration in 1086. Including the full set of controls does not alter the persistence in land inequality (cols. [4]-[5]).

Admittedly, land was not transferred directly from the 1066 Norman lords to the nineteenth-century great landowners. Some Norman families died out and their lands were acquired by other landowners. This gave rise to new landowning classes, like the yeomen (Mokyr 1993), in the late-middle ages. In the early-modern period, the gentry benefited from the dissolution of the monasteries (Heldring et al. 2021), but the aristocracy's share of land in England remained virtually unchanged from 1436 to 1688 (Overton 1996, Table 4.8). In contrast, in the 18C, there was "a drift in property ... in favor of the great lord" (Habakkuk 1940, p. 2,4). From 1750, the great estates were stable (Beckett 1977, p. 567). Despite these episodes, the strong spatial correlation between the land inequality in 1086 and in 1870 suggests that the large Norman estates consolidated and, to some extent, survived over eight centuries—even if the families owning them changed or, in some periods, sold parts of their lands.

To evaluate this hypothesis quantitatively, I examine the persistence of land inequality from 1086 to the 1500s. This midpoint absorbs the early processes discussed above, e.g., the rise of yeomen, but stands before Henry VIII's dissolution of the monasteries and the 18C property drift towards great lords. Unfortunately, no land survey approaching the extent of the *Domesday* is available for this time. Instead, I proxy for land inequality in the 1500s using Shirley (1866). This genealogy identifies the families who held land in England from Henry VII's reign (1485–1509) to the 19C in unbroken male line.[40] I combine this information with the landholdings in Bateman (1883) and evaluate the size (in 1870) of the estates owned by old families who held land from the 1500s to 1870.

Panel C reports standardized beta coefficients from Eq. (1) using the measure defined above as dependent variable. I find a strong persistence from 1086 to the 1500s. The estates of old families who held land from the 1500s to 1870 arose where land was more unequally redistributed in 1086. Specifically, one ppt increase in land concentration in 1086 is associated with an increase by 110-120 acres in the estates of these old families. As expected, this estimate is larger than that capturing persistence from 1086 to 1870. As before, this relationship is robust to controlling for the full set of geographic, climate, and population controls.

In addition, Appendix Table A12 shows that the land redistribution in 1086 is associated with the share of land in a county owned by great landowners, but not to the corresponding share by squires, yeomen, and small proprietors.[41] Hence, although some of the lands redistributed in 1086 were later acquired by smaller landowning classes, this did not happen systematically where land inequality was higher. In other words, it did not break the large concentration of landownership in some areas of England. I discuss small landowners in more detail in Sect. 6.1, where I evaluate their role for education provision.

[40] A quarter of the 19C great landowners belonged to these families.

[41] Formally, I fit a Dirichlet distribution on these shares by maximum likelihood. This addresses the issue that, by construction, shares are negatively correlated.

Altogether, the evidence suggests that land inequality, particularly at the top of the distribution, survived over eight centuries—despite the extinction of some Norman families and the emergence of other landowning classes. Engerman and Sokoloff (2000) suggest several institutional mechanisms through which inequality can persist over such long periods. One such mechanism is norms and legal instruments that consolidate large estates and restrict land access. In my setting, social norms partly enforced the persistence of great estates. Selling land was stigmatized among the landed elite (e.g., Stone and Stone 1984, p. 78). In addition, most estates remained unbroken from 1650 thanks to the strict settlement. With this contract, aristocrats forced their heirs to pass down the family estate intact to the next generation—estates could not be partitioned, sold, or mortgaged (Habakkuk 1994). According to Habakkuk (1950, p. 18), "about one-half of the land of England was held under strict settlement in the mid-eighteenth century." This legal instrument likely contributed to the persistence in land inequality documented here.

4.3 Other channels of persistence

So far, I argued that land inequality in England was deep-rooted in the Norman land redistribution. Before examining its reduced-form effect on 19C education provision, I test alternative channels of persistence which, potentially, could directly affect education provision without resort to the persistence of land inequality.

Pre-conquest economic development The land distribution after the Norman conquest may have reflected local differences in pre-conquest economic development. If these differences persisted up to the 19C, they could directly affect state education provision. That said, Darby et al. (1979) show that the regional distribution of income changed substantially after the Norman conquest. In addition, Brooke (1961) suggests that land was not given in a more concentrated manner in richer areas but in areas with military threats specific to post-conquest England that were eventually controlled.

To substantiate this, I show empirically that land concentration in 1086 is orthogonal to local pre-conquest economic development. To proxy for the latter, I use the density of Roman roads—which promoted development through trade and city growth. Importantly, even though Roman Britain collapsed long before the Norman conquest, elsewhere it has been shown that the density of Roman roads reflects economic conditions centuries later (Wahl 2017; Dalgaard et al. 2022).

Table 3 shows regressions of the density of Roman roads in 410 on land concentration in 1086 and the full set of geography and climate controls. The unit of observation is a 10x10 mile cell (see Appendix Figure A5). Associations are close to and not significantly different from zero: a one standard deviation increase in land concentration in 1086 is associated with a 0.06-0.08 standard deviation reduction in Roman road density (cols. [1]-[2]). The magnitude is substantially lower than the persistence of land inequality (Table 2).

Post-1066 institutions, religion, and local development Norman reforms—other than redistributing land—could have triggered local differences in institutions, religion, or development within England which persisted until the 19C. This is unlikely. According to Angelucci, Meraglia, and Voigtländer (2017, p.1), the conquest "resulted in largely homogenous formal institutions across England." The Normans introduced institutional and religion reforms (e.g., feudalism, church reform), but they did so nationwide. The authors show that local differences in institutions emerged when some boroughs were granted a *Charter of Liberties* (before 1348). These boroughs were typically close to Roman roads (ibid, p. 3)—which, as shown before, is orthogonal to the land concentration in 1086.

I confirm this hypothesis empirically by showing that land concentration in 1086 is not associated with a range of regional economic and religious characteristics from the 1871 Census. Table 3 presents regression results with my full set of controls. All variables are at the county level and are standardized to facilitate the interpretation of the magnitudes. Columns [3] and [4] show that a one standard deviation increase in land concentration in 1086 is associated with a 0.04 standard deviation increase in income per capita and with a 0.03 standard deviation reduction in the share manufacturing workers in the late 19C. These two estimates are 15-20 times smaller in magnitude than the persistence of land inequality and are not significantly different from zero. This suggests that the Norman land redistribution neither triggered differences in local development nor significantly affected the pace of industrialization. In columns [5] and [6], I look at the share of non-conformists and religiosity. As explained in Sect. 2, non-conformists played an active role in the expansion of state education in 1870. That said, land concentration in 1086 is not significantly associated with these variables: estimates are three times smaller than those for the persistence of land inequality.[42] Finally, column [7] shows that soil texture is also balanced across counties with different levels of land concentration in 1086.

Capital destruction in 1066 If the capital destruction brought by the Norman conquest triggered long-run local differences in economic development, outcomes such as education provision may be affected. This caveat is important: my measure of historical land inequality is based on land values in 1086, which might reflect capital destruction or casualties related to the conquest. To address this, Appendix D defines historical land inequality using the pre-conquest values reported by the *Domesday* for a sub-sample of manors. Although the number of observations is reduced, my main conclusions are robust.

Church and Crown estates A reduced-form effect of historical land inequality on later outcomes may be driven by the lands that William took for himself or gave to the Church instead of those given to Norman nobles. Some Crown estates were sold to the gentry in 1436–1688 and monasteries were dissolved in 1535 (Overton 1996: Table 4.8). These events triggered local differences in development (Heldring et al. 2021) which, in turn, may have affected 19C education provision. My results are not confounded by these effects because I measure historical land inequality excluding Church and Crown estates from both numerator and denominator of the land concentration percentage.

Altogether, these results suggests that, while the Norman land redistribution was not random, it neither reflected underlying economic factors nor triggered persistent *local* differences in income per capita, industrialization, or religious composition. Only land inequality seems to have deep roots in the Norman conquest. This evidence suggests that the relation between historical land concentration and later education provision is plausibly not driven by omitted factors.

[42] Appendix Table A5 performs a similar balancedness exercise for the pre-conquest land concentration recorded in the *Domesday book*. Because the conquest reshaped the distribution of landownership in England, we expect the pre-conquest land concentration to have no long-run effects. The results confirm this hypothesis, showing that late-19C economic and religious characteristics are balanced in counties with different pre-conquest inequality levels.

Table 3 Test for other channels of persistence

	Roman road density		Late-nineteenth century				Soil
	All	Major	Income pc	% manuf.	% non-conf.	Relig.	Texture
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Land concentration 1086	−0.06	−0.08	0.04	−0.03	−0.23	0.23	−0.14
	(0.05)	(0.06)	(0.22)	(0.14)	(0.19)	(0.19)	(0.21)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pop. density	No	No	Yes	Yes	Yes	Yes	Yes
Observations	442	442	32	32	32	32	32
Unit	Cell	Cell	County	County	County	County	County

Grid is 473 cells of 10x10 miles, excluding cells with ≥ 70% in sea. Road density in *km/sq.km*. All variables calculated over grid cell ([1]-[2]) and counties ([3]-[7]). Effect sizes in standard deviations. Controls as in Table 5; SE in parenthesis; $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

5 Reduced-form effects

This section examines Engerman and Sokoloff (2000)'s prediction of a negative reduced-form relation between historical and geographical deep-rooted determinants of land inequality and later education provision. To do so, I estimate:

$$y_i = \alpha + \beta\, L_i^{1086} + \gamma\, G_i + \mathbf{X}_i'\, \delta + \epsilon_i\,, \tag{3}$$

where y_i is the average education tax rate set by School Board i in 1873–78. The historical determinant of land inequality, L_i^{1086}, is the land concentration after the Norman conquest. The main geographical determinant of land inequality, G_i, captures variation in soil texture. Both variables are defined as in Sect. 4. In extended specifications, $\mathbf{X}_i$ includes the same geographic and climatic determinants of land inequality as before. The full specification includes the distance to cathedrals and industrial centres and the population served by each School Board.

I also examine the relation between land inequality and other sources of School Board funding, and aggregate expenditures and human capital accumulation in both board and voluntary schools. Unlike the education tax rates set by School Boards, this data is on the county level. I use a panel of 32 counties to estimate:

$$y_{c,t} = \alpha + \beta\, L_c^{1086} + \gamma\, G_c + \mu_t + \mathbf{X}_c'\, \delta + \epsilon_{c,t}\,, \tag{4}$$

where $y_{c,t}$ is an education measure, e.g., teachers' salaries, in county c at year t. The remaining variables are analogous to those defined above but calculated at the county level. To account for the panel structure, I include year fixed effects, μ_t. Hence, the β-estimate is obtained by pooled cross-section OLS.

Table 4 presents estimates of Eq. (3) for 1,387 School Boards.[43] In column [1], I show a strong negative association between historical land concentration and local education

[43] To facilitate the interpretation of the effect's magnitude, all independent variables in Table 4 are standardized to have mean zero and a standard deviation of one.

provision: School Boards set lower education taxes in 1873-78 where land was more unequally distributed by the Normans. Specifically, increasing historical land concentration by one standard deviation is associated with a reduction in tax rates of 0.2-0.25 percentage points (ppts). Given that the average tax rate was only 2.5, the estimated effects amount to a decrease of 8-10%.

Education taxation is more strongly associated with historical than with geographic determinants of land inequality. My estimates suggest that the presence of sandy and chalky soils is associated to a 0.1 ppts reduction in tax rates for education. The estimated coefficient is marginally significant and smaller in magnitude than that of land concentration in 1086. Note that this smaller magnitude does not imply that soil texture was unimportant for education provision, but that it did not have a large direct effect *conditional* on land concentration in 1086. Appendix Table A6 shows the unconditional effect of soil texture on education provision. That is, it shows separate regressions using soil texture or historical land concentration as the main explanatory variable. The unconditional estimates for soil texture (i.e., excluding the historical land concentration variable) are 40% larger in magnitude than those in Table 4. Specifically, the presence of sandy and chalky soils is associated to a 0.15 ppts reduction in tax rates for education, an effect that is significantly different from zero. That said, this unconditional effect is smaller in magnitude than the unconditional effect of historical land inequality. This suggests that soil texture, a geographical determinant of land inequality, was important for later education provision, but that most of its effect acted through land inequality in 1086. In other words, soil texture may have affected land inequality after 1086, but this did not have a large direct effect on education provision over and above the degree of land concentration in 1086.

In columns [2] and [3] of Table 4, I consider a broad set of geographic and climate covariates: terrain ruggedness, suitability for cereal, pasture, and tuber production, precipitation, and the mean and standard deviation of late-19C temperatures. As shown before, these factors are associated with land inequality. Hence, under the Engerman and Sokoloff (2000) framework, we would expect them to have a reduced-form effect on education provision. Consistent with Clark and Gray (2014), however, I find that the geographic and climate factors above are poor predictors of 19C education provision in England. A joint hypothesis test for these covariates suggests they are marginally significant predictors. Specifically, the F-statistic of the joint test is 1.81, with an associated p-value of 0.08.[44]

Importantly, geographic and climate covariates are also potentially correlated with agricultural productivity and local incomes, and hence, may have determined the wealth available for taxation in rural areas. That said, the estimates on land concentration in 1086 are similar in magnitude in columns [1] to [3]. This suggests that the relationship between historical land concentration and later education provision is not driven by systematic geographic and climatic differences between areas where the Normans redistributed land more unequally.

In column [4], I add location covariates: the distance from each School Board to the closest river, coast, industrial centre, and cathedral. Proximity to the water bodies may have been important for local development in the long run by fostering trade, the use of steam power, or early industrialization. Proximity to an industrial centre may have provided

[44] Appendix Table A6 shows the unconditional effect of geographic and climate factors excluding land concentration in 1086. The corresponding F-statistic of the joint test is 2.8, suggesting that, as with soil texture, the effect of these geographic covariates on education provision acted mostly through land inequality in 1086. Appendix Table A7 reports all individual coefficients.

Table 4 Reduced-form effect of entrenched land inequality, local data

	Dep. Variable: Av. tax rate for education (1873–78)				
	[1]	[2]	[3]	[4]	[5]
Land concentration in 1086	−0.214	−0.184	−0.193	−0.222	−0.251
	(0.056)***	(0.059)***	(0.076)**	(0.076)***	(0.076)***
	[0.067]***	[0.062]***	[0.082]**	[0.079]***	[0.079]***
Sandy and chalky soil	−0.103	−0.112	−0.127	−0.095	−0.087
	(0.060)*	(0.061)*	(0.061)**	(0.064)	(0.064)
	[0.068]	[0.066]*	[0.067]*	[0.068]	[0.068]
Ruggedness	–	Yes	Yes	Yes	Yes
Cereal suitability	–	Yes	Yes	Yes	Yes
Pasture suitability	–	Yes	Yes	Yes	Yes
Tuber suitability	–	Yes	Yes	Yes	Yes
Precipitation	–	–	Yes	Yes	Yes
Average temperature	–	–	Yes	Yes	Yes
S.D. temperature	–	–	Yes	Yes	Yes
Distance to river	–	–	–	Yes	Yes
Distance to coast	–	–	–	Yes	Yes
Distance to cathedral	–	–	–	Yes	Yes
Distance to industrial centre	–	–	–	Yes	Yes
Log-population	–	–	–	–	Yes
Observations	1387	1387	1387	1387	1387
Moran p-val.	0.702	0.776	0.696	0.699	0.661

The sample is 1,387 School Boards. The Dep. Var. is the average tax rate set by each School Board in 1873-78. Historical land concentration is the % of land value given in 1086 to the largest five landowners in each 25-miles radius around a School Board. The main geographic determinant of land inequality is an indicator for sandy and chalky soils over 1x1 km cells. Geographic and climate covariates over 5 arc-minutes (cereal, pasture, tuber suitability), 30 arc-seconds (ruggedness, precipitation); and 100 grid cells over England (temperature). Log-population at the School Board level. All independent variables are standardized. Robust SE (parenthesis) and SE adjusted for spatial auto-correlation within 50 miles (square brackets); Constants not reported; ***p < 0.01, **p < 0.05, *p < 0.1

families with incentives to acquire schooling because migrating to an industrial centre was easier. Proximity to a cathedral proxies for cultural and religious factors. The estimate for land inequality is robust.

In column [5], I add the population in the parish, borough, or district served by each School Board. School Boards often issued by-laws exempting children living far from a school from attending. This illustrates a provision problem in scarcely populated areas (Boucekkine et al. 2007). If the areas where land was historically more concentrated were also scarcely populated, the strong association in column [1] may be spurious. Column [5] shows that this is not the case. If anything, the estimate for land inequality increases in magnitude, suggesting that areas where land was historically more concentrated where not systematically less populated. In addition, Appendix Table A8 shows that the results are robust to excluding School Boards in urban areas.

Altogether, the estimates are very consistent across specifications. This suggests that the historical land concentration resulting from the Norman conquest was an important determinant of education taxation in the 19C—over and above a broad set of geographic, climatic, and population characteristics.

Note that Table 4 reports results from spatial regressions. Hence, we may be concerned that the relation between historical land inequality and education taxation 800 years later reflects spatial autocorrelation. To address this, I follow two strategies: First, I calculate standard errors using the Conley (1999) approach, allowing for spatial dependence within 50 miles. The Conley standard errors are not significantly larger than before. Second, I follow Kelly (2019) and conduct a Moran test of spatial autocorrelation in regression residuals.[45] The p-values for the Moran test range between 0.66 and 0.7, strongly suggesting that residuals are not spatially autocorrelated. Finally, results are robust to calculating land concentration around each School Board using different cutoffs. Appendix C shows that results are similar using a 10, 15, and 20 miles' cut-off.

Next, I examine a range of education measures beyond education taxes. In Sect. 6, I use these measures to disentangle different mechanisms through which contemporaneous landowners affected schooling. Here I briefly discuss their reduced-form relationship with historical and geographical determinants of land inequality.

Table 5 presents estimates of Eq. (4) at the county level. Panel A shows a negative reduced-form relationship for all the sources of School Board funding: Increasing land concentration in 1086 by 10 ppt is associated to a reduction in funds from taxes, Parliament grants, fees, and other sources by 15, 9, 3, and 0.5 pence per child (cols. [1]-[4]). As expected, the magnitude is larger for taxes, the main funding source. Importantly, these results show that other funding sources did not compensate for the low taxes where land was historically concentrated. Panel A also shows that fewer School Boards were established and expenditure in board schools was lower where land was historically concentrated (cols. [6]-[7]).

Panel B shows that education under-spending in board schools was not compensated by voluntary schools. The number of teachers and their salaries in all schools were lower in counties where land was historically concentrated (cols. [1]–[3]). In those counties children attending all schools were less likely to pass the national exams (cols. [4]–[7]), especially in arithmetics—a skill in demand at the time (Mitch 1993). In detail, a 10-ppts increase in historical land concentration is associated with a 7-ppts reduction of the percentage passing arithmetics.[46] This suggests that historical inequality is negatively associated with 19C human capital accumulation.

As at the local level, education provision at the county level is influenced more strongly by historical than by geographic determinants of land inequality: The percentage of sandy and chalky soil is negatively associated with all education variables, but the estimates are smaller than those of historical land inequality.[47] The F-statistic is 3.5 for the relation between tax funds and the geographic and climate covariates listed above, plus the density of rivers and coastline length. The statistic is higher than before but still lower than that of historical land inequality (12). All specifications in Table 5 include a population density control: the number of children below 5 per square kilometre. Appendix Table A11 considers an extended set

[45] Specifically, I calculate Moran statistics, i.e., the weighted sum of the covariance between every pair of residuals, using the inverse of the distance between all School Boards.

[46] Results for reading and writing are not precise, as the pass rate is huge and varies little. This is because Parliament grants were awarded on the basis of these results (Green 1990, p. 7).

[47] Appendix Tables A9 and A10 confirm this result by showing the unconditional effect of soil texture (i.e., excluding historical land concentration) on all county-level education variables.

Table 5 Reduced-form effect of entrenched land inequality, county data

Panel A: Board-education measures

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	School Board funds (in pence per child) from:					School Boards	Expense pence pc
	Taxes	Grants	Fees	Other	Total		
Land concentration 1086	− 1.5***	− 0.9***	− 0.3**	− 0.05**	− 2.7***	− 1.5***	− 2.6***
	(0.4)	(0.3)	(0.1)	(0.02)	(0.8)	(0.3)	(0.9)
Sandy and chalky soils	− 0.9	− 0.5	− 0.2	0.01	− 1.6	− 0.4	− 1.7
	(0.7)	(0.5)	(0.2)	(0.03)	(1.4)	(0.5)	(1.4)
Geo. controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	768	768	768	576	768	672	479
Reports	1871-94	1871-94	1871-94	1871-94†	1871-94	1871-94†	1879-94†

Panel B: Board- and voluntary-education measures

	Teachers			Exam (% pass)			
	Certificate	Assistant	Salary	Read	Write	Arith.	Total
Land concentration 1086	− 22.1***	− 3.1***	− 89.7***	− 0.00	− 0.02	− 0.07***	− 0.02
	(7.8)	(0.8)	(28.8)	(0.03)	(0.04)	(0.02)	(0.02)
Sandy and chalky soils	− 3.4	− 0.01	− 58.2	− 0.04	− 0.01	− 0.04	− 0.00
	(7.6)	(1.2)	(49.2)	(0.04)	(0.03)	(0.03)	(0.02)
Geo. controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	576	416	32	352	384	384	224
Reports	1879-96	1884-98†	1878	1879-90†	1879-90	1879-90	1879-90†

The sample is 32 counties and the indicated years. Historical land concentration is the % of land value given to the county's five largest landowners in 1086. The main geographic determinant of land inequality is the % of sandy and chalky soils. Geo. controls: ruggedness; cereal, pasture, and tuber suitability; precipitation; temperature (mean and SD); river density (km/sq. km); coastline length; and population density (children below 5 per sq. km). All are calculated at the county level. Constants not reported. SE clustered by county; †Dep. var. not available in some reports (see Table A1); ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

of county controls.[48] Finally, note that I report pooled-OLS estimates where education variables vary over time but landownership does not. Hence, I cluster standard errors by county (in parenthesis). In addition, Appendix Figure A4 presents estimates of Eq. (4) for each year separately. My main conclusions are robust in this cross-sectional specification.

[48] Income p.c., religiosity, and % employed in manufacturing, conservative, and non-conformist.

Table 6 Education taxes and contemporaneous land inequality, local data

	Dep. Variable: Av. tax rate for education (1873–78)				
	[1]	[2]	[3]	[4]	[5]
Panel A. OLS					
Land concentration in 1870	−0.195	−0.170	−0.128	−0.174	−0.170
	(0.053)***	(0.052)***	(0.056)**	(0.059)***	(0.059)***
	[0.078]**	[0.073]**	[0.076]*	[0.078]**	[0.078]**
Panel B. IV (second stage)					
Land concentration in 1870	−0.34	−0.30	−0.48	−0.47	−0.51
	(0.09)***	(0.10)***	(0.22)**	(0.18)**	(0.18)***
Ruggedness	–	Yes	Yes	Yes	Yes
Cereal suitability	–	Yes	Yes	Yes	Yes
Pasture suitability	–	Yes	Yes	Yes	Yes
Tuber suitability	–	Yes	Yes	Yes	Yes
Precipitation	–	–	Yes	Yes	Yes
Average temperature	–	–	Yes	Yes	Yes
S.D. temperature	–	–	Yes	Yes	Yes
Distance to river	–	–	–	Yes	Yes
Distance to coast	–	–	–	Yes	Yes
Distance to cathedral	–	–	–	Yes	Yes
Distance to industrial centre	–	–	–	Yes	Yes
Log-population	–	–	–	–	Yes
Observations	1387	1387	1387	1387	1387
Moran p-value (Panel A)	0.726	0.757	0.669	0.679	0.641
F-stat first stage (Panel B)	149.1	108.4	27.4	43.8	46.8

The sample is 1,387 School Boards. The Dep. Var. is the average tax rate set by each School Board in 1873–78. Land concentration in 1870 is the average acres of all great landowners in a 25-miles radius around each School Board. The remaining covariates are as in Table 4. In Panel A, all independent variables are standardized. In Panel B, I report effects in terms of standard deviations, as the instrument and land concentration in 1870 are in different units. Robust SE (parenthesis), SE adjusted for spatial auto-correlation within 50 miles (square brackets). $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

6 Contemporaneous effects and mechanisms

So far, I documented a strong persistence of land inequality from 1086 to 1870 and a negative reduced-form effect of historical land inequality on education provision. My second goal is to examine the contemporaneous relationship between 19C land inequality and education provision. Here I investigate Galor et al. (2009)'s prediction of a negative relationship. Next, I examine the potential mechanisms behind it highlighted in Sect. 2.

To examine the contemporaneous relationship, I estimate Eqs. (3) and (4) but instead of considering two deep-rooted determinants of land inequality (land concentration in

1086 and soil texture) I use the contemporaneous land concentration in 1870 (L^{1870}).[49] As before, L^{1870} is the average acres of all great landowners whose seats are within 25 miles of each School Board in the local-level analysis and the percentage of land by great landowners in the county-level analysis.

Table 6, Panel A presents the results at the local level.[50] Land concentration in 1870 is strongly negatively associated with contemporaneous education provision. In areas where land concentration was one standard deviation larger (i.e., where the average great landowner owned 4,200 more acres) School Boards set lower tax rates by 0.2 ppts. Given that the average tax rate in 1873–78 was 2.5, this amounts to an 8% decrease. This magnitude is very similar to that estimated for historical land concentration, suggesting that the persistence of land inequality is the main driver of Sect. 5's reduced-form estimates (Table 4).

Results are robust to including the same set of geographic, climate, and population controls as before. Estimates are very consistent across specifications. Hence, it is unlikely that results are driven by large estates emerging where education provision was unattractive for other reasons—e.g., low agricultural productivity and low local incomes associated to geography and climate; or provision problems associated with low population density. In addition, Appendix Table A8 shows that results are robust to excluding School Boards in urban areas, which concentrated much of the initial impetus in the expansion of state education. Finally, results are also not driven by spatial correlation: the Conley (1999) and robust standard errors are similar and the p-values for the Moran test are around 0.7.

Although these estimates are based on well-founded theoretical predictions, so far I have avoided causal language. I gain insights into identification from an IV estimation using the Norman land redistribution as an instrument for late-19C land concentration. The evidence in Sect. 4.3 suggests that this instrument is relevant (see Tables 1 and 2) and satisfies the exclusion restriction (see Table 3), in the sense that the Norman land redistribution did not trigger long-run local differences in development or institutions other than by affecting the land distribution. In other words, the Norman land redistribution provides variation in landownership that is plausibly unrelated to other factors making 19C education attractive. Table 6, Panel B presents second-stage estimates for the relation between education provision and land concentration in 1870 (L_i^{1870}), where the latter is instrumented with land concentration in 1086 (L_i^{1086}). The second-stage estimates show that land concentration had a strong, negative effect on local education provision. Increasing land concentration in 1870 by one standard deviation decreases the tax rates for education set by local School Boards by 0.3 standard deviations (column [1]).[51] The magnitude is similar to the reduced-form

[49] Results are robust to including soil texture. My preferred specification excludes it for consistency, as I use soil texture as an instrument for contemporaneous land inequality in Appendix E. The evidence there supports the exclusion restriction.

[50] To facilitate the interpretation of the effect's magnitude, all independent variables are standardized to have mean zero and a standard deviation of one.

[51] The causal effect is not only large, but also affected a substantial share of the school-age population. Assuming that 1/6 of the population was of school age (Parliamentary Papers 1871, Vol. 22, C.406) suggests that 40% of children lived in areas where great landowners owned 7,000 acres or more (mostly, rural areas). In a counterfactual with no land inequality and reduced landowner influence (e.g., as in urban areas), the education funds would have been 50% higher for this 40% of children, corresponding to an aggregate increase by 19% for the entire school-age population in England. By 1890, the rural population was 30% (based on the 1891 Census), but the corresponding aggregate increase would still be substantial (15% increase).

estimates in Table 4 and larger than the OLS estimates in Panel A.[52] As before, IV-estimates are robust to including the full set of geographic, climate, and population controls (columns [2]-[5]). The F-statistic in the first stage is large across all specifications, confirming that the instrument is not weak. Altogether, these results suggest that the relation between land concentration and School Board taxes is plausibly causal.[53]

Next, I examine the contemporaneous relation of land concentration and various education variables at the county level. As in Table 5, I present pooled-OLS estimates where only education varies over time. This is because Bateman (1883) does not record time variation in land concentration, which was stable in the studied period (Beckett 1977, p. 567). To account for the structure of the data, all specifications include year fixed effects and cluster standard errors by county.

Table 7, Panel A looks at School Board funding. Consistent with the results at the local level, I find that counties where land was more concentrated in 1870 raised fewer funds from taxes (col. [1]). As expected, the magnitude of the estimates is slightly larger than that for historical land inequality: increasing land concentration in 1870 by 10 ppt (i.e, by one standard deviation) is associated to a reduction in these funds by 19 pence per child. School Boards also received funds from Parliament grants and fees. One possibility is that, where land was more concentrated, these other funds substituted funds from taxes on land. This was not the case: Parliament grants, fees, and other funds are also negatively associated with contemporaneous land inequality (cols. [2] to [4]). Since local taxes were the main source of School Board funding, the magnitudes in columns [2] to [4] are lower than in [1]. Overall, the total funds of School Boards were lower by 35 pence per child where land was more concentrated by one standard deviation (col. [5]).

Counties raising less funds consequently underspent on board schools. Increasing land concentration in 1870 by one standard deviation is associated with 35 pence per child fewer expenditures in board schools (col. [7]). As expected, the magnitude is similar to that of the total funds raised by School Boards.

Table 7, Panel B shows that the education under-provision by School Boards near great landowners was not compensated by voluntary schools, the option preferred by great landowners. I examine several variables that capture education provision and human capital accumulation in all schools, including board and voluntary schools. If voluntary schooling offset the adverse effects of land inequality, we would expect these variables not to be systematically associated to land inequality. Instead, columns [1] to [3] show that land concentration in 1870 is strongly negatively associated to these variables. For example, increasing land concentration by one standard deviation is associated to 270 fewer certified teachers

[52] IV estimates tend to be larger than OLS estimates because measurement error—here, in the land distribution—only affects the latter; and/or because IV estimates correspond to the local average treatment effect (LATE) and OLS to the ATE over the population.

[53] Appendix E presents detailed results on this IV specification, and gains further insights by using a second instrument: soil texture. Soil texture was first used as an instrument for land inequality by Cinnirella and Hornung (2016). Its main appeal is that it cannot be altered by human intervention, and hence, is truly exogenous. That said, since soil texture can affect agricultural productivity, I control for the full set of geography and climate controls, which, in combination, are important predictors of land productivity. The corresponding IV-estimates are similar to those in Table 6 (see Appendix Table E1). Furthermore, the Sargan test cannot reject the null hypothesis that both instruments—the Norman land redistribution and soil texture—are exogenous.

Table 7 Education and contemporaneous land inequality, county data

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Panel A: Board-education measures							
	School Board funds (in pence per child) from:					School Boards	Expense pence p.c.
	Taxes	Grants	Fees	Other	Total		
Effect of contemporaneous land concentration (%), without socio-economic controls:							
Estimate	− 1.9**	− 1.2**	− 0.4*	− 0.08**	− 3.51**	− 1.8**	− 3.45**
	(0.8)	(0.5)	(0.2)	(0.04)	(1.6)	(0.7)	(1.6)
Effect of contemporaneous land concentration (%), with socio-economic controls:							
Estimate	− 1.7***	− 1.0***	− 0.3***	− 0.07***	− 3.1***	− 1.7***	− 3.0***
	(0.6)	(0.3)	(0.1)	(0.02)	(0.9)	(0.6)	(0.9)
Geo. controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	768	768	768	576	768	672	479
Reports	1871-94	1871-94	1871-94	1871-94†	1871-94	1871-94†	1879-94†

Panel B: Board- and voluntary-education measures

	Teachers			Exam (% pass)			
	Certificate	Assistant	Salary	Read	Write	Arith.	Total
Effect of contemporaneous land concentration (%), without socio-economic controls:							
Estimate	− 27.0**	− 3.7**	− 116**	− 0.01	− 0.02	− 0.08*	− 0.04
	(13.1)	(1.7)	(43.4)	(0.03)	(0.05)	(0.04)	(0.03)
Effect of contemporaneous land concentration (%), with socio-economic controls:							
Estimate	− 29.3**	− 3.8**	− 97.2***	− 0.02	− 0.03	− 0.09***	− 0.04**
	(13.0)	(1.6)	(33.5)	(0.04)	(0.03)	(0.03)	(0.02)
Geo. controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	576	416	32	352	384	384	224
Reports	1879-96	1884-98†	1878	1879-90†	1879-90	1879-90	1879-90†

The sample is 32 counties and the indicated years. Estimates are for contemporaneous land concentration: the % of land by great landowners in 1870. Geo. controls as in Table 5. Socio-economic controls: income p.c. (in logs), % employed in manufacturing, % conservative votes, % non-conformist, religiosity. SE clustered by county in parenthesis; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; † Dep. var. not available in some reports (see Table A1)

in the average county, which corresponds to a 4% reduction. Sect. 6.1.3 further investigates the great landowners' support for voluntary schooling.[54]

[54] It is unlikely that this result is explained alone by the funding disadvantage of voluntary schools, which could not access local taxes. Dividing the funds from property taxes of board schools in 1873-74 (Appendix Table A2) by the total annual income of great landowners (from Bateman (1883)) suggests that a donation of only 0.25% of the great landowners' annual income would have been sufficient to compensate the funding disadvantage of voluntary schools.

Similarly, I find that children in all schools were less likely to pass the reading, writing and, especially, the arithmetics national exam in counties where land was concentrated in 1870 (cols. [4] to [7]). A one standard deviation increase in land concentration is associated to a 8 ppts drop in the probability of passing arithmetics. The pass rate, particularly in reading and writing, was very high, as the exam results were used to award Parliament grants to schools. In this light, the estimated marginal effect is considerable. As the arithmetics exam emphasized skills needed in shops or banks,[55] this also reflects a negative effect of land inequality on the accumulation of skills complementary to non-agriculture sectors.

Altogether, these results suggest that underinvestment in board schools was not compensated by voluntary schooling, slowing down human capital accumulation.

All results are robust to including the full set of geographic and climate controls. In addition, I present separate estimates controlling for socio-economic covariates from three Census records: 1871, 1881, and 1891. I include income p.c. (in logs), religiosity, and the percentage employed in manufacturing, of conservative votes, and of non-conformists for each county in each decade. Estimates with and without these covariates are very similar. This suggests that the contemporaneous effect of land concentration is not explained away by structural transformations in the period under study.[56] It also shows that the effect of land concentration is not explained away by religious interests. Non-conformists were more supportive of School Boards than the Church of England, which ran most voluntary schools (Sect. 2.1). Controlling for the percentage of non-conformists in each county and for religiosity does not alter the negative effect of land concentration on School Board activity (Panel A) and on aggregate board and voluntary schooling (Panel B). This suggests that, while religious motivations were important, land concentration affected schooling through additional mechanisms. Some of the estimates on these controls are interesting in their own right. In particular, the share of workers in manufacturing is positively associated to all education variables. This could reflect a clash between landed and industrial elites for the supply of state education (Lindert 2004; Galor and Moav 2006), or a higher demand for education in industrial areas. The next section investigates these mechanisms in detail.

Did the impact of land inequality on education change during the School Board era (1870–1902)? Appendix G1 presents similar estimates to Table 7, but allows the marginal effect of land concentration to differ over time by interacting it with year indicators. The results show that landowners opposed School Board activity throughout the School Board era, that voluntary schooling did not compensate this under-provision at any point, and that the negative effect for the accumulation of arithmetics' skills was stable throughout the period. This suggests that great landowners' economic incentives and attitudes towards the expansion of education did not change between 1870 and 1902.

Finally, Appendix G2 analyses the relation between land inequality and education activity before the School Board era. Using data from from the *Newcastle Report* (1861), I show that before 1870 voluntary schooling had not expanded more in counties where land was more concentrated. This lends credence to the results above. It shows that the reason why School Board activity was limited where land was concentrated was not that these areas were already in possession of a larger network of voluntary schools that could accommodate their school-aged population. This is important, as the 1870 Education Act and the

[55] See Appendix Table A4 for details.

[56] Admittedly, these covariates are not necessarily exogenous. That said, the fact that estimates are not significantly altered suggests that including them does not lead to a bad control problem.

activity of School Boards aimed to fill the gaps of voluntary schooling. The results also shed light on whether landowners' attitudes towards education changed in 1870. On the one hand, they suggest a continuity in landowners' preference for voluntary schooling by the Church of England's *National Society* over schools run by other institutions—such as the schools established by non-conformist societies before 1870, or the state-run schools established by School Boards after 1870. On the other hand, the effect of land concentration on the Parliament grants received by voluntary schools in 1833-58 is negative, but smaller magnitude than that on the public funds received by School Boards after 1870. This suggests that the opposition of landowners to the expansion of education intensified after 1870. The advent of the Second Industrial Revolution raised the industrial demand for human capital, providing landowners with economic incentives to oppose the expansion of education. Below I directly test this mechanism.[57]

6.1 Mechanisms

Next, I investigate five contemporaneous mechanisms through which land concentration may have affected education provision: the great landowners' economic incentives to oppose the expansion of education, their political power, their support for voluntary schooling, education demand, and the role of smaller landowners.

6.1.1 Great landowners' economic incentives

In Galor et al. (2009)'s framework, landowners have economic incentives to oppose the expansion of education because human capital is more complementary to capital than to land. In detail, mass education boosts labour productivity and wages in industry, attracting rural labour force to urban towns. This migration raises agricultural wages, and hence, reduces land values. A testable implication of this mechanism is that landowners should oppose the expansion of education more strongly where the rural labour force can emigrate more easily.

To examine this implication, I exploit the fact that the rural labour force living near large towns were the more likely to emigrate (Boyer and Hatton 1997). I regress education taxes on land concentration and an interaction with the proximity from each School Board to the nearest town of 20,000 inhabitants or more. If the landowners' opposition to the expansion of education reflects the mechanism outlined above, I expect stronger, more negative effects of land concentration near these towns, where rural workers could easily migrate. If the landowners' opposition is orthogonal to the low complementarity between human capital and land, I expect land concentration to have similar effects near to and far from towns.

Table 8 presents the results. As before, I find a strong negative association between land concentration in 1870 and School Boards' taxation. This association is significantly stronger near towns. In detail, the effect of land concentration on taxation is 0.04 ppts stronger for School Boards ten miles closer to a town. Given that the average tax rate is

[57] The appendix discusses complementary reasons for this different magnitudes. In short, before 1870 the expansion of education was smaller in scale and not funded by taxes on land, i.e., landowners were not directly liable. The distribution of public funds to local schools was centralized, less subject to capture by local elites, and channelled to anglican voluntary schools—a type of schooling preferred by landowners to the board schools established after 1870.

Table 8 Landowners' economic incentives mechanism, local data

	Dep Var: Av. tax rate for education (1873–78)					
	[1]	[2]	[3]	[4]	[5]	[6]
Land concentration 1870	−0.095***	−0.091***	−0.080***	−0.091***	−0.089***	−0.095***
	(0.020)	(0.020)	(0.021)	(0.021)	(0.021)	(0.023)
Land concentration 1870 × proximity to town	−0.004***	−0.004***	−0.003***	−0.003***	−0.003***	−0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Proximity to town	0.041***	0.041***	0.037***	0.043***	0.039***	0.045***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)
Ruggedness	–	Yes	Yes	Yes	Yes	Yes
Cereal/pasture/tuber suit.	–	Yes	Yes	Yes	Yes	Yes
Precipitation	–	–	Yes	Yes	Yes	Yes
Temperature (mean, SD)	–	–	Yes	Yes	Yes	Yes
Dist. to river & coast	–	–	–	Yes	Yes	Yes
Dist. to cathedral	–	–	–	Yes	Yes	Yes
Dist. to ind. centre	–	–	–	Yes	Yes	Yes
Log-population	–	–	–	–	Yes	Yes
Towns excluded	No	No	No	No	No	Yes
Observations	1387	1387	1387	1387	1387	1304

The sample is 1,387 School Boards. Land concentration is in 1,000s of acres. Proximity is −1× miles to nearest town of ≥ 20,000 inhabitants. Controls as in Table 4; Robust SE; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

2.5, this corresponds to a differential reduction of 1.2%. This heterogeneous effect is robust to including the full set of geographic, climate, and population controls (cols. [2]-[5]). In addition, it is not driven by urban School Boards. Column [6] excludes School Boards in towns of 20,000 inhabitants and shows that results are robust. Overall, these results suggest that the landowners' opposition to School Board activity was stronger in areas where the rural labour force was prone to emigrate, providing support for Galor et al. (2009)'s mechanism.

Importantly, the main effect of proximity to town is large and positive. That is, in areas without great landowners, School Boards ten miles closer to a town set 0.4 ppts higher taxes (16% increase). This is consistent with a strong support for School Board activity in urban areas. Insofar as industrial elites were concentrated in urban areas, it also reflects their support for the expansion of education.

To what extent was industrial support in urban areas offset by landowners' opposition? To answer this question, I compute the marginal effect of proximity to town on taxes at different levels of land concentration (see Appendix Figure A6). In areas without great landowners, School Board taxes are higher near towns because the industrial support does not face any great landowner's opposition. In areas where great landowners own ca. 10,000 acres, being one mile closer to a town is associated with two effects which cancel out. On the one hand, taxes are higher by 0.04 ppts because of industrial support in urban areas (row 3). On the other hand, taxes are lower by $10 \times 0.004 = 0.04$ ppts because of the stronger landowners' opposition near towns that can attract the rural labour force (row 2). In areas with higher land concentration, the second effect dominates. In other words, industrial support for the expansion of education is offset by landowners' opposition where land is sufficiently concentrated. This is consistent with Galor et al. (2009)'s prediction that landowners have more to loose from state education where land is concentrated. Overall, at the average value of land concentration, the effect of proximity to town is marginally not statistically different from zero (coef 0.011, s.e. 0.007). This suggests that, for the average School Board, industrial support existed but also that, as late as the 1870s, landowners could effectively offset this support and oppose local policies aimed at the expansion of education. By 1902, industrialists support was crucial to pass the Balfour Education Act (Galor and Moav 2006), suggesting a shift in the balance of power between landed and industrial elites (Lindert 2004).

6.1.2 Great landowners' political power

Land concentration may affect the provision of education through the political process. Galor et al. (2009) show that landowners had economic incentives to oppose state education, but also that this opposition required political power to be effective. Here I examine this prediction empirically.

To do so, I collect individual-level data on the political appointments of the 369 great landowners under analysis. Since School Boards operated locally, I focus on appointments that reflect local political power and ignore those that carry national influence. Specifically, I use biographies from thepeerage.com to record all appointments of great landowners to the four most important local offices in England: Lord Lieutenant, Deputy Lieutenant, High Sheriff, and Sheriff (henceforth, local offices).[58] I also record whether great landowners were elected MP. Since most MPs were elected in their local constituency, this position reflects local political power as well as national influence. Consistent with the historical evidence in Sect. 2.2, this data shows that great landowners dominated local politics: 48% were appointed to a local office, and 42% were elected MP.

I use this data to test if land concentration had a more negative effect on education provision where landowners held local political power. I conduct three exercises: In the first exercise, I regress education taxes on land concentration around each School Board and add interactions to capture the differential effect of landowners' local political power.[59] Specifically, I use the proximity from each School Board to the nearest seat of a landowner who held a local office.[60]

Table 9, columns [1] and [2] present the results. As before, I find a strong negative association between land concentration in 1870 and the contemporaneous taxation by School Boards. Importantly, this association is significantly stronger near landowners with local political power. The magnitude is sizeable: the effect of land concentration on taxation is 0.04 ppts stronger for School Boards ten miles closer to a great landowner who held a local office. Given that the average tax rate is 2.5, this corresponds to a differential reduction of 1.6%. This heterogeneous effect is robust to including the full set of geographic, climate, and population controls, although the estimate becomes less precise (col. [2]). Columns [3] and [4] present similar estimates when local political power is measured by MP elections.

In the second exercise, I examine if estimates differ by the landowners' party affiliation. Section 2.2 shows that Conservatives and Liberals had different dogmas on taxation and schooling. Hence, if land concentration distorted taxation through a political channel, we

[58] These officers were the Queen's representatives in each county.

[59] All specifications include main effects and interaction terms.

[60] Appendix Figure A7 presents analogous results for a non-linear specification where land concentration is interacted with indicators for <4, 4-7, 7-10, 10-14, and >14 mile distances.

Table 9 Political mechanism, local data

	Dep Var: Tax rate for education					
	[1]	[2]	[3]	[4]	[5]	[6]
Land concentration 1870	−0.094***	−0.083***	−0.097***	−0.083***	−0.031	−0.019
	(0.026)	(0.029)	(0.028)	(0.031)	(0.024)	(0.026)
Land concentration 1870 × proximity to LO†	−0.004**	−0.003*	–	–	–	–
	(0.002)	(0.002)				
Land concentration 1870 × proximity to MP	–	–	−0.004***	−0.003*	−0.002	−0.001
			(0.002)	(0.002)	(0.001)	(0.001)
Land concentration 1870 × Conservative MP	–	–	–	–	−0.086**	−0.074*
					(0.039)	(0.039)
Land concentration 1870		–	–	–	−0.005**	−0.005*
× Conservative MP × proximity					(0.003)	(0.003)
Observations	1387	1387	1387	1387	1387	1387
Main effects included	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Landowners' sample	All	All	All	All	MPs	MPs

The sample is 1,387 School Boards. Land concentration is in 1,000s of acres. In cols. [5] and [6], it is restricted to acres by MPs. Proximity is -1 × miles to nearest LO or MP. Conservative MP indicates if nearest great landowner was a Conservative MP (Liberal MPs are the reference group). Controls as in Table 4; Robust SE; ***p<0.01, **p<0.05, *p<0.1; † Great landowners is Lord-Lieutenant, Deputy-Lieutenant, High Sheriff, or Sheriff in England

would expect larger effects for School Boards near Conservative rather than Liberal great landowners. If, instead, the effects are orthogonal to politics, land concentration should distort taxation regardless of the landowners' political party. To test this, I estimate the first exercise's regression and add a third interaction term: an indicator variable equal to one if the nearest great landowner was a Conservative MP (Liberal MPs are the reference group).[61]

Table 9, columns [5] and [6] present the results. Conservative landowners drive both the education-landownership relationship and the differential effect of political power. In detail, increasing land concentration by 1,000 acres is associated with a reduction in tax rates by 0.03 ppts (1%) for School Boards near a Liberal MP and by 0.11 ppts (4.3%) for School Boards near a Conservative MP. That is, the negative effect of land concentration on taxation is four times larger for School Boards near a Conservative MP. In addition, for School Boards near a Liberal MP, the estimate on land concentration is close to zero and independent of the proximity to his seat. In contrast, the effect of land concentration on taxation is 0.06 ppts (2%) stronger for School Boards ten miles closer to a great landowner who was a Conservative MP. This result suggests that the different dogmas of the Conservative and Liberal parties were important determinants of the landowners' opposition to education provision. As explained in Sect. 2, parties differed on their views on taxation and schooling, as well as on their religious leanings and preference for the anglican-dominated voluntary system. The stronger opposition

[61] Since I only observe the party affiliation of MPs, I restrict the sample to MPs. That is, I measure land concentration using only the acres of landowners who were MP.

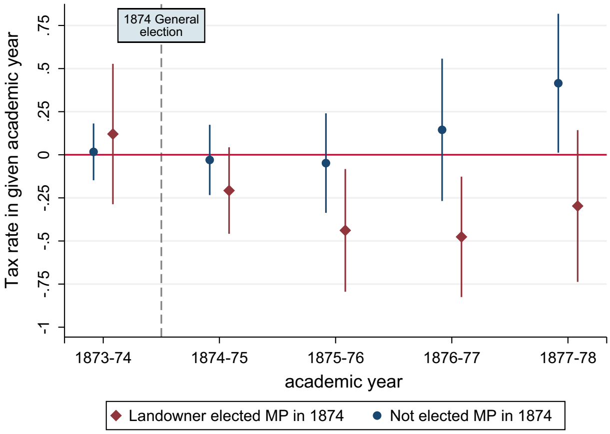

Fig. 4 Marginal effect of contemporaneous land concentration on tax rates. *Notes*: Red diamonds (blue dots) is for 491 (896) School Boards nearer to a great landowner who was elected MP (lost his seat) in 1874. Land concentration is the average acres of all great landowners elected (red) or who lost their seat (blue) within 25 mi. of each School Board. Mg. effects in standard deviations. The full set of controls in Table 4 is included; 90% robust c.i

of Conservative great landowners probably reflects a combination of economic landed interests and anglican leanings. Conversely, the small negative estimate for Liberal great landowners is consistent with two effects that cancel out: the Liberal support for School Boards and their landed interests against them.

In the third exercise, I conduct an event study on the general election in February 1874. This election provides a good test-bed to evaluate the importance of landowners' political power for School Board taxation. First, because the 1874 election "may be regarded as the first fought on the Victorian doctrines of local taxation" (Offer 1981, p.180). Second, because the election provides variation in political power across time and space: around some School Boards, great landowners became MP in 1874. Around others, great landowners lost their seat in Parliament. My data allows me to capture this variation across time and space, as I can compare School Board taxes for the academic year before the election (1873-74) and for the academic years after it (1874-75 to 1877-78).

Formally, I estimate my baseline regression for each academic year separately. I first consider School Boards closer to great landowners who were elected MP in 1874 and regress taxes on land concentration in their hands. Next, I consider School Boards closer to great landowners who lost their seat in 1874 and regress taxes on land concentration in their hands. All regressions include the full set of local geographic, climate, and population controls.

Figure 4 presents the results graphically. The estimate of land concentration on taxation is similar for all School Boards before the 1874 general election. After 1874, paths diverge. Where landowners were elected MP, land concentration is associated to lower School Board taxes: increasing land concentration by one standard deviation is associated to a decrease in School Board taxes by 0.2, 0.4, 0.5, and 0.3 ppts in the academic years from 1874-75 to 1877-78. Where landowners lost their seat, the corresponding estimates are close to zero. After 1876, they even display an increasing, positive trend. Overall, pooling the post-election academic years, I find a negative, significant association of land concentration and taxation only where landowners gained a seat in the election.

Altogether, this section suggests that, to effectively oppose local School Boards, landowners may have required considerable local political power. Although here I cannot identify the exact channels through which political power mattered, Sect. 2.2

Table 10 Voluntary vs. Board schooling, county data

	[1]	[2]	[3]	[4]	[5]
Panel A. Dep. variable: schools per sq. km					
	Board schools	Voluntary anglican	Voluntary non-conf.	Voluntary wesleyan	Voluntary catholic
Land concentration 1870	− 0.30***	0.19	− 0.24**	0.07	0.10*
	(0.11)	(0.12)	(0.12)	(0.08)	(0.05)
Geo. controls & year FE	Yes	Yes	Yes	Yes	Yes
Observations	640	640	640	640	640
Reports	1879-98	1879-98	1879-98	1879-98	1879-98

Panel B. Dep. variable: % pass in	Arithmetics	Reading	Writing
Ratio: Board to anglican voluntary	0.26***	− 0.39***	− 0.16
	(0.09)	(0.13)	(0.15)
Geo. controls & year FE	Yes	Yes	Yes
Observations	384	352	384
Reports	1879-90	1879-90†	1879-90

The sample is 32 counties and the indicated years. Land concentration is the % of land by great landowners in 1870. Controls as in Table 5. All vars. are standardized; SE clustered by county; †Not available in some reports (Table A1) $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

suggests that local political power helped landowners to influence Board elections and promote candidates pledged to the their interests.

6.1.3 Board vs. voluntary schools

Board schools funded through local taxes coexisted with voluntary religious schools funded through non-tax donations and Parliament grants. As explained in Sect. 2.2, great landowners donated large sums to voluntary anglican schools to prevent the formation of board schools. Did this support offset the negative impact on board schooling? In Sect. 6, I used aggregate measures on board and voluntary schooling to show that this was likely not the case. Here I explore this question further by examining the number of board and voluntary schools in each county and the consequences of school composition for human capital accumulation.

Table 10, Panel A presents estimates of Eq. (4), where the dependent variable is the number of schools per sq. km. To facilitate comparisons, all variables are standardized to have a mean of zero and a standard deviation of one within a year. Column [1] shows that counties where land was more concentrated in 1870 built fewer board schools. The magnitude is large: increasing land concentration by one standard deviation is associated to a reduction in board schools by 0.3 standard deviations. In contrast, column [2] shows a positive association between land concentration and voluntary anglican schools (National schools). The coefficient, however, is smaller in magnitude than that on board schools (0.19 vs. 0.3) and is not precisely estimated. In addition, Column [3] shows a strong negative association between land concentration and voluntary non-conformist schools (British &

co. schools).[62] This reflects the clash between non-conformists and anglicans—most great landowners' religion—for education provision (see Sect. 2.1). Finally, columns [4] and [5] suggest a positive association between land concentration and wesleyan and catholic schools, although the estimated magnitudes are very small.

Panel B evaluates the consequences of school composition for human capital accumulation. It shows estimates of regressing children's results in national exams on the ratio of board to voluntary anglican schools. Columns [1] to [3] show that, in counties where the school system relied more on board schools, children performed better in arithmetics, worse in reading, and not significantly different in writing.

These results certainly reflect that educational progress was made both by board and voluntary schools. They also reflect differences in the schools' curriculum, with a stronger emphasis on arithmetics in board schools and on reading and religious catechism in voluntary anglican schools. This distinction is important, as arithmetics and reading exams reflect skills with a different degree of complementarity to the expanding industrial and services sectors. Specifically, arithmetic exams emphasized skills needed in a shop or bank, such as "compound rules (money)" or "bills of parcels." In contrast, reading exams simply consisted on reading a text aloud, without evaluating comprehension (see Appendix Table A4).

Altogether, this evidence suggests that great landowners were supportive of voluntary anglican schooling, but that this support did not offset their negative effects on School Boards. This is consistent with the externalities and market failures of voluntary provision, which relied partly on non-tax donations (Galor and Zeira 1993). In addition, the composition of schools in a county is associated with the accumulation of different skills by children: arithmetics where board schools dominated; reading were voluntary anglican schools were prominent. In other words, land concentration is negatively associated to the accumulation of skills that are complementary to non-agriculture sectors. This lends further credence to the idea that landowners had economic incentives to oppose School Board activity.

6.1.4 Lack of demand for education

So far, I have argued that land concentration affected education through a supply mechanism: the great landowners' opposition to School Board activity. However, according to the conceptual framework in Sect. 2, land concentration may also affect education through a demand mechanism (Cinnirella and Hornung 2016; Ashraf et al. 2017). In detail, the demand for education may be lower among individuals living where land is more concentrated. Here I examine the importance of this demand mechanism in my setting.

To do so, I conduct two exercises. First, I use the number of pupils enrolled, attending, and presented for examination in each county between 1879 and 1891.[63] Specifically, I estimate the same specification as in Table 7 using these measures as dependent variables (results are in Appendix Table A13).[64] Land concentration in 1870 is not significantly associated to any of these measures and all estimates are close to zero: increasing land concentration by one standard deviation is associated to a reduction by less than 0.01

[62] After 1870, British & co. schools were administered locally by School Boards.

[63] Data is not available before 1879 and after 1891 I exploit the Fee Grant Act (see below).

[64] I include the full set of geographic and climate controls and year fixed effects. Since the dep. variables depend on the number of children, I control for the number of children aged 5-15.

standard deviations in the number of pupils enrolled, attending, and presented for examination.[65] Next, I compare the combined effect of these measures to that of measures of education supply.[66] To do so, I define an index based on the first principal component of each set of measures and regress them on land concentration. Increasing land concentration by one standard deviation is associated with a reduction by 0.23 standard deviations in the supply index, but only by 0.004 standard deviations in the index for pupils enrolled, attending, and presented for examination. A Wald test confirms that the effect of land concentration are larger for the supply index (p-value 0.018).

These results have to be taken with a grain of salt. The number of pupils enrolled, attending, and presented for examination reflect the demand for education by individuals, but are also affected by education supply. For example, fewer schools or larger pupil-teacher ratios may lower the quality of education, which, in turn, can reduce enrolment or attendance.

To address these issues, I conduct a second exercise. I disentangle demand from supply using a supply-side instrument: The Fee Grant Act (1891). The Act affected education supply by eliminating school fees. To achieve this, all schools received an annual Parliament grant of 10 shillings per child aged 3-15.[67] Importantly, the Act was implemented nationwide, and hence, the supply-side instrument is orthogonal to differences in land concentration.[68]

I use this supply-side instrument to estimate the demand for education—that is, the slope and the intercept of the relationship between the price (school fees) and the quantity demanded (enrolment or attendance) of education. Formally, I estimate a two-stage least square regression of the form:

$$\log demand_{c,p} = a + e \cdot \log \widehat{fees}_{c,p} + \mu_c + \nu_{c,p}, \tag{5}$$

where c indexes counties and p the period (before and after the Fee Grant Act). Variables are at their 1891 values for the period 'before', and at the average value in 1892–95 for the period 'after'. This allows a longer time horizon for the demand response. The variable $demand_{c,p}$ is either attendance or enrolment, $fees_{c,p}$ are school fees and funds from other sources (e.g., books sold) per child, and μ_c are county fixed effects. Log $fees_{c,p}$ is instrumented with the log of Parliament grants per child[69] received by each county, which the Fee Grant Act increased exogenously (and identically across counties) in 1891:

65 For examinees over 10, I find a small positive association, not significantly different from zero. Since education was compulsory between ages 5–11 from 1880, examinees over 10 likely proxy for children's participation in non-compulsory education.

66 Specifically, I consider the number of School Boards, certified teachers, class assistants, the ratio of board to voluntary schools, and expenditures per child in board schools.

67 In 1891, the average student paid a weekly fee of 2.5-3.5 pence, which sums to 8-12 shillings in a 40-week year (Report for the Committee 1891-92, p. 296). See Appendix Figure A8.

68 For example, Parliament grants increased similarly in Rutland (54.7%) and Cambridgeshire (53.1%), even though great landowners owned, respectively, 70% and 24% of the land. On average, Parliament grants increased by 57.5%. The increase displays a small standard deviation across counties (0.06) and is uncorrelated with land concentration in 1870 (-0.02).

69 The Reports of the Committee of Council on Education do not list the grant money awarded by the Fee Grant Act separately from the total Parliament grants. This is why $grants_{c,p}$ consists of the former and, formally, includes the county subscript c. That said, the variation in this variable mostly comes from p, that is, from the grant money awarded by the Free Grant Act after 1891 which all counties received at the same point in time and which, in per child terms, was identical across counties (see Appendix Figure A9).

$$\log fees_{c,p} = \alpha + \beta \cdot \log grants_{c,p} \; + \; \mu_c \; + \; \nu_{c,p} \, . \tag{6}$$

The elasticity (slope) of education demand to school fees is given by the coefficient e. The intercept is given by the constant a and by the corresponding county fixed effect, μ_c. For the average county, the intercept of education demand is $\frac{1}{N}\sum_c(a+\mu_c)$, where N is the number of counties.

Table 11 reports estimates of the education-demand elasticity and intercept. The first row considers all 40 counties.[70] Elasticities are precisely estimated. A one percent decrease in school fees increases enrolment and attendance by 0.04 and 0.06 percent respectively (cols. [1] and [3]). This relatively inelastic demand is consistent with estimates for modern higher education (Havranek et al. 2018). In addition, the intercept of education demand is fairly large, suggesting that the demand for education was not lacking.

Next, I test whether education demand was lower where land concentration was high. In the second and third row, I report the elasticity and intercept estimates for counties with land concentration below or above the median.[71] Elasticities are almost identical in counties with low and high land concentration: 0.046 vs. 0.042 for enrolment and 0.066 vs. 0.060 for attendance. Similarly, the intercept of education demand is large for both groups: 11.2 vs. 11.1 for enrolment and 11.1 vs. 11.0 for attendance.[72] Statistically, my model does not reject the null hypothesis that the estimated demands are the same in counties with low and high land inequality (see full results in Appendix Table A14).

These results suggest that education demand was relatively inelastic and that it was not lower where land was concentrated. Hence, the negative effects of land concentration likely reflect a supply mechanism (the great landowners' opposition) rather than a demand one. Why is the demand mechanism less relevant in England than in other settings such as Prussia? (Cinnirella and Hornung 2016) As explained in Sect. 2, labour coercion is central to the demand mechanism, rationalizing the rural workers' underinvestment in human capital (Ashraf et al. 2017). In turn, labour coercion was lower in England than in Prussia, where serfdom was still in use in its eastern territories well into the 19C.

6.1.5 Smaller landowners

Great landowners held 40% of the land in England and Wales in 1870 (Bateman 1883, p. 515). The remainder belonged to different classes of smaller landowners. How important were these smaller landowners for education provision? To examine this question, I use data from Bateman (1883) on the land owned by squires (1,000-3,000 acres), yeomen (100-1,000), and small proprietors (1-100) in each county and estimate the same specification as in Table 7. Instead of considering land concentration by great landowners, I now include the acres owned by each class—great landowners, squires, and

[70] Here I can include counties not fully surveyed in the *Domesday*. Hence, N=40 instead of 32.

[71] These are based on Eqs. (5) and (6). Formally, I interact school fees (log $fees_{c,p}$) and the supply-side instrument (log $grants_{c,p}$) with an indicator variable equal to one for counties with land concentration above the median.

[72] The difference correspond to only one child ($exp(0.1) = 1.1$, which is negligible compared to the average enrolment and attendance (101,535 and 80,448 children).

Table 11 Elasticity and intercept of education demand, IV estimates

	Enrolment elasticity [1]	Enrolment intercept [2]	Attendance elasticity [3]	Attendance intercept [4]
All counties	−0.044 (0.003)	12.0 (0.02)	−0.063 (0.003)	11.8 (0.02)
Low land concentration	−0.046 (0.004)	11.2 (0.01)	−0.066 (0.005)	11.1 (0.01)
High land concentration	−0.042 (0.004)	11.1 (0.01)	−0.060 (0.005)	11.0 (0.01)

Based on estimates of Eqs. (5) and (6). Intercept (for av. county) is: $\frac{1}{N}\sum_{c \in C}(a + \mu_c)$, where N is the number and C the the set of counties in each row; SE in parenthesis

yeomen—relative to the acres owned by small proprietors.[73] All regressions include the full set of controls and year fixed effects.

Table 12 presents the results for School Board funding (other education variables are in Appendix Table A15). To facilitate comparisons, all variables are standardized to have a mean of zero and a standard deviation of one within a year. As before, I find that counties raised fewer funds from taxes, Parliament grants, and school fees where great landowners owned more acres relative to small proprietors. The magnitude of the estimates are large, between 0.3 and 0.5 standard deviations. In contrast, estimates are close to and not significantly different from zero where squires owned more acres relative to small proprietors. Finally, all sources of School Board funding are positively associated with yeomen landowners. Increasing the acres owned by yeomen relative to smaller landowners by one standard deviation is associated with an increase in funds from taxes by 0.25 standard deviations. These effects are not precisely estimated, but nevertheless suggest that yeomen might have supported schooling provision—as did small landowners elsewhere in Europe (Tollnek and Baten 2017; Baten and Hippe 2018). That said, the magnitudes are about half of those estimated for great landowners, suggesting that the small landowners' support did not offset the great landowners' opposition to schooling. As argued above, this was probably because small landowners did not have the same political power and local influence as great landowners.

7 Conclusion

At the dawn of the Second Industrial Revolution, England passed the 1870 Education Act, a reform aiming to educate its workforce (McCann 1970). Overall, this had a positive impact on the expansion of education (Mitch 1992), creating 5,700 schools for 2.6 million children (Stephens 1998). However, the benefits of the reform were not evenly distributed across the country. Using a new database on 1,387 School Boards and 40 counties between 1871 and 1899, I find that education provision was lower where land was concentrated in the hands of great landowners. There, School Boards set lower local taxes for education,

[73] This inequality measure is akin to a decile dispersion ratio. I use it instead of the % of land by each class because the latter is highly collinear by construction.

Table 12 Great landowners, squires, yeomen and education provision

	School Board funds (in pence per child) from:				
	Taxes	Grants	Fees	Other	Total
	[1]	[2]	[3]	[4]	[5]
Acres by great landowners	−0.48**	−0.46**	−0.37*	−0.28*	−0.49**
vs. small proprietors	(0.19)	(0.18)	(0.19)	(0.16)	(0.19)
Acres by squires	0.03	−0.01	−0.00	0.01	0.01
vs. small proprietors	(0.26)	(0.27)	(0.22)	(0.22)	(0.26)
Acres by yeomen	0.26	0.24	0.14	0.15	0.25
vs. small proprietors	(0.22)	(0.22)	(0.17)	(0.20)	(0.22)
Observations	768	768	768	576	768
Available reports	1871–94	1871–94	1871–94	1871–94†	1871–94
Geographic controls & year FE	Yes	Yes	Yes	Yes	Yes

The sample is 32 counties and the indicated years. Land inequality is the ratio of the acres by each group to the acres by small proprietors in 1870. Groups are great landowners; squires; and yeomen. Controls as in Table 5. All variables are standardized to have mean 0 and SD 1 within each year. SE clustered by county; † Dep. variable not available for some reports (see Table A1); ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

built fewer board schools, and underspent in them. This negative effect was not offset by voluntary schooling, and as a result, children underperformed in the national exams.

I document that this negative relation of land concentration and state education has deep roots. The land redistribution after the Norman conquest of 1066, together with geographic endowments, laid the groundwork for land concentration, eventually affecting state education supply in the 19C. I also investigate the contemporary mechanisms through which land concentration undermined state education. The negative effects are stronger where the expansion of education could lead to a loss of rural labour force detrimental to landowners' interests and where great landowners were prominent political figures. They are not offset by great landowners' support for voluntary schooling nor by smaller landowners' support for the expansion of education. In addition, the demand for education by private individuals is inelastic in areas both with high and low land concentration. This suggests that the detrimental effects of land concentration on the expansion of education are the result of the great landowners' opposition through the political process.

These findings shed new light on the long-run consequences of inequality on human capital. Previous research has shown that land concentration slowed down the expansion of education in agrarian economies in the Caribbean (Engerman and Sokoloff 2000) and South America (Coastworth 1993; Nugent and Robinson 2010). Here I show similar effects within an industrial economy. This suggests that land concentration, because it affects human capital, is important for the economic and demographic changes that began after the Industrial Revolution. My results are also consistent with the idea that old landed elites opposed and industrial elites supported the supply of state education (Galor and Moav 2006; Galor et al. 2009). I also show evidence suggesting that industrial support was offset by landowners' opposition in areas where land was sufficiently concentrated—i.e., where great landowners owned around 10,000 acres or more.

By disentangling the mechanisms through which land concentration affected state education provision, this paper has important implications for public delivery systems. My findings suggest that engaging the formal, local elites might lead to capture, even in settings with considerable extension of the suffrage. In late-19C century England, entrenched landowners still retained enough local political power to oppose the expansion of state education in their domains. In other words, extended suffrage *alone* did not act as a constraint on elite capture.[74]

Finally, my results emphasize the deep roots of inequality (Engerman and Sokoloff 2000), but also that history and critical junctures can affect later economic outcomes over and above unchanging geographic factors. In England, deep-rooted regional differences in land inequality transformed into regional differences in the expansion of education. This raises important questions: Did this allow regional inequalities to persist through the Second Industrial Revolution, a period of structural economic transformation? To what extent is inequality, particularly at the top of the distribution, explained by events in the distant past in contrast to present-day factors? Which are the mechanisms through which elites, such as the English great landowners, consolidated their position? More research on the historical determinants of inequality and elite persistence can contribute to our understanding of the relation between inequality and modern outcomes.

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References

Acemoglu, Daron, Bautista, Maria Angelica, & Robinson, James A. (2008). Economic and Political Inequality in Development: the case of Cundinamarca, Colombia. In Elhanan Helpman (Ed.), *Institutions and Economic Performance*. Cambridge: Harvard University Press.

Acemoglu, Daron, & Robinson, James A. (2000). Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective. *The Quarterly Journal of Economics, 115*(4), 1167–1199.

Allen, Douglas W. (2009). A Theory of the Pre-Modern British Aristocracy. *Explorations in Economic History, 46*(3), 299–313.

Angelucci, Charles, Meraglia, Simone, & Voigtländer, Nico. (2017). The Medieval Roots of Inclusive Institutions: From the Norman Conquest of England to the Great Reform Act. Working paper 23606, NBER.

Ashraf, Quamrul, Cinnirella, Francesco, Galor, Oded, Gershman, Boris, & Hornung, Erik. (2017). Capital-Skill Complementarity and the Emergence of Labor Emancipation. Cesifo working paper series 6423, CESifo Group Munich.

Baland, Jean-Marie., & Robinson, James A. (2008). Land and power: Theory and evidence from Chile. *The American Economic Review, 98*(5), 1737–65.

[74] Elsewhere it has been argued that the extension of the franchise increased education demand (Acemoglu and Robinson 2000; Mariscal and Sokoloff 2000; Gallego 2010; Go and Lindert 2010).

Bandiera, Oriana, Mohnen, Myra, Rasul, Imran, & Viarengo, Martina. (2018). Nation-building Through Compulsory Schooling during the Age of Mass Migration. *The Economic Journal, 129*(617), 62–109. 12.
Barrett, Christopher B., Bellemare, Marc F., & Hou, Janet Y. (2010). Reconsidering Conventional Explanations of the Inverse Productivity-Size Relationship. *World Development, 38*(1), 88–97.
Bateman, John. (1883). *The Great Landowners of Great Britain and Ireland*. Harrison and Sons.
Baten, Joerg, & Hippe, Ralph. (2018). Geography, land inequality and regional numeracy in Europe in historical perspective. *Journal of Economic Growth, 23*(1), 79–109.
Beckett, J. V. (1977). English Landownership in the Later Seventeenth and Eighteenth Centuries: The Debate and the Problems. *The Economic History Review, 30*(4), 567–581.
Benjamin, Dwayne. (1995). Can Unobserved Land Quality Explain the Inverse Productivity Relationship? *Journal of Development Economics, 46*(1), 51–84.
Bhalla, Surjit S. (1988). Does Land Quality Matter?: Theory and Measurement. *Journal of Development Economics, 29*(1), 45–62.
Bhalla, Surjit S., & Roy, Prannoy L. (1988). Mis-specification in Farm Productivity Analysis: The Role of Land Quality. *Oxford Economic Papers, 40*(1), 55–73.
Boucekkine, Raouf, De la Croix, David, & Peeters, Dominique. (2007). Early literacy achievements, population density, and the transition to modern growth. *Journal of the European Economic Association, 5*(1), 183–226.
Boyer, George R., & Hatton, Timothy J. (1997). Migration and Labour Market Integration in Late Nineteenth-Century England and Wales. *The Economic History Review, 50*(4), 697–734.
British Geological Survey. (2014). Soil Parent Material 1kilometre dataset. [data collection]. British Geological Survey.
Brooke, Christopher N. L. (1961). *From Alfred to Henry III, 871–1272* (1st ed., Vol. 2). Edinburgh: Thomas Nelson and Sons Ltd.
Burke, John. (1826). *A General and Heraldic Dictionary of the Peerage and Baronetage of the United Kingdom*. Henry Colburn.
Cahill, Kevin. (2001). *Who Owns Britain*. Canongate Books Ltd.
Cinnirella, Francesco, & Hornung, Erik. (2016). Landownership concentration and the expansion of education. *Journal of Development Economics, 121*, 135–152.
Cinnirella, Francesco, & Schueler, Ruth. (2018). Nation building: The role of central spending in education. *Explorations in Economic History, 67*, 18–39.
Clark, Gregory. (2005). The condition of the working class in England, 1209–2004. *Journal of Political Economy, 113*(6), 1307–1340.
Clark, Gregory, & Gray, Rowena. (2014). Geography is not destiny: geography, institutions and literacy in England, 1837–63. *Oxford Economic Papers, 66*(4), 1042–1069.
Coastworth, John H. (1993). Notes on the Comparative Economic History of Latin America and the United States. In W. Bernecker & H. W. Tobler (Eds.), *Development and Underdevelopment in America.* New York: Walter de Gruyter.
Cokayne, George E. (1913). *The Complete Peerage of England, Scotland, Ireland, Great Britain and the United Kingdom*. The St. Catherine Press, Ltd.
Conley, T. G. (1999). GMM estimation with cross sectional dependence. *Journal of Econometrics, 92*(1), 1–45.
Cvrček, Tomáš. (2020). *Schooling under control: The origins of public education in Imperial Austria 1769–1869* (Vol. 1). Mohr Siebeck.
Dalgaard, Carl-Johan, Kaarsen, Nicolai, Olsson, Ola, & Selaya, Pablo. (2022). Roman roads to prosperity: Persistence and non-persistence of public goods provision. *Journal of Comparative Economics*. https://doi.org/10.1016/j.jce.2022.05.003
Darby, Henry Clifford, Glasscock, Robin E., Sheail, John, & Versey, George R. (1979). The changing geographical distribution of wealth in England: 1086–1334-1525. *Journal of Historical Geography, 5*(3), 247–262.
Dell, Melissa. (2010). The Persistent Effects of Peru's Mining Mita. *Econometrica, 78*(6), 1863–1903.
Deltas, George. (2003). The small-sample bias of the Gini coefficient: results and implications for empirical research. *The Review of Economics and Statistics, 85*(1), 226–234.
Doepke, Matthias, & Zilibotti, Fabrizio. (2005). The Macroeconomics of Child Labor Regulation. *The American Economic Review, 95*(5), 1492–1524.
Easterly, William. (2007). Inequality Does Cause Underdevelopment: Insights from a New Instrument. *Journal of Development Economics, 84*(2), 755–776.
Engerman, Stanley L., & Sokoloff, Kenneth L. (2000). Institutions, Factor Endowments, and Paths of Development in the New World. *Journal of Economic Perspectives, 14*(3), 217–232.

Food and Agriculture Organization of the United Nations (FAO). (2007). Food Insecurity, Poverty and Environment Global GIS Database (FGGD) [data collection]. Module 6, land productivity potential: suitability of global land area for pasture; suitability of global land area for rainfed production of cereals (low level of inputs); and suitability of global land area for rainfed production of roots and tubers (low level of inputs). http://www.fao.org/geonetwork/

Finley, Theresa, Franck, Raphaël, & Johnson, Noel D. (2021). The effects of land redistribution: Evidence from the French Revolution. *The Journal of Law and Economics, 64*(2), 233–267.

Foster, Andrew D., & Rosenzweig, Mark R. (1996). Technical Change and Human-Capital Returns and Investments: Evidence from the Green Revolution. *The American Economic Review, 86*(4), 931–953.

Gallego, Francisco A. (2010). Historical Origins of Schooling: The Role of Democracy and Political Decentralization. *The Review of Economics and Statistics, 92*(2), 228–234.

Galor, Oded, & Moav, Omer. (2002). Natural selection and the origin of economic growth. *The Quarterly Journal of Economics, 117*(4), 1133–1191.

Galor, Oded, & Moav, Omer. (2006). Das human-kapital: A theory of the demise of the class structure. *The Review of Economic Studies, 73*(1), 85–117.

Galor, Oded, Moav, Omer, & Vollrath, Dietrich. (2009). Inequality in landownership, the emergence of human-capital promoting institutions, and the great divergence. *The Review of Economic Studies, 76*(1), 143–179.

Galor, Oded, & Weil, David N. (2000). Population, Technology, and Growth: From the Malthusian Regime to the Demographic Transition and Beyond. *The American Economic Review, 90*, 806–838.

Galor, Oded, & Zeira, Joseph. (1993). Income Distribution and Macroeconomics. *The Review of Economic Studies, 60*(1), 35–52.

Go, Sun, & Lindert, Peter. (2010). The uneven rise of American public schools to 1850. *The Journal of Economic History,*, 1–26.

Gordon, P. (1974). *The Victorian School Manager: A Study in the Management of Education 1800–1902*. Woburn Press.

Green, Andy. (1990). *Education and State Formation*. MacMillan Palgrave.

Habakkuk, H John. (1940). English Landownership, 1680–1740. *The Economic History Review, 10*(1), 2–17.

Habakkuk, H John. (1950). Marriage settlements in the eighteenth century. *Transactions of the Royal Historical Society, 32*, 15–30.

Habakkuk, H John. (1994). *Marriage, Debt, and the Estates System*. Oxford University Press.

Harvey, Sally. (1971). Domesday Book and Its Predecessors. *The English Historical Review, 86*(341), 753–773.

Havranek, Tomas, Irsova, Zuzana, & Zeynalova, Olesia. (2018). Tuition fees and university enrolment: a meta-regression analysis. *Oxford Bulletin of Economics and Statistics, 80*(6), 1145–1184.

Hechter, Michael. (1976). U.K. County Data, 1851–1966. [data collection]. Colchester, Essex: UK Data Archive. SN: 430, https://doi.org/10.5255/UKDA-SN-430-1.

Heldring, Leander, Robinson, James A., & Vollmer, Sebastian. (2021). The Long-Run Impact of the Dissolution of the English Monasteries*. *The Quarterly Journal of Economics, 136*(4), 2093–2145. 08.

Hurt, John S. (1968). Landowners, Farmers and Clergy and the Financing of Rural Education before 1870. *Journal of Educational Administration and History, 1*, 6–16.

Hurt, John S. (1971). *Education in Evolution*. Paladin.

Hurt, John S. (1974). *Elementary schooling and the working classes 1860–1918*. Routledge and Kegan Paul.

Kelly, Morgan. (2019). The standard errors of persistence. *CEPR Discussion Paper*, 13783.

Lawson, John, & Silver, Harold. (2013). *A social history of education in England*. Routledge.

Leeper, Geoffrey W., & Uren, Nicholas C. (1993). *Soil Science: an Introduction*. Melbourne University Press.

Lindert, Peter. (2004). *Growing Public: Social Spending and Economic Growth since the Eighteenth Century*. Cambridge University Press.

Long, Jason. (2005). Rural-Urban Migration and Socioeconomic Mobility in Victorian Britain. *The Journal of Economic History, 65*(1), 1–35.

Long, Jason. (2006). The socioeconomic return to primary schooling in Victorian England. *The Journal of Economic History, 66*(4), 1026–1053.

Lundy, Darryl. (2018). *The Peerage: A genealogical survey of the peerage of Britain as well as the royal families of Europe* [webpage]. https://thepeerage.com.

Luterbacher, Jürg, Dietrich, Daniel, Xoplaki, Elena, Grosjean, Martin, Wanner, Heinz, Paeth, Heiko, & Steiner, Niklaus. (2006). *European seasonal temperature reconstructions* [data collection]. NOAA National Centers for Environmental Information. https://doi.org/10.25921/1hw9-nz71.

Maclure, S. (1968). *Educational Documents: England and Wales, 1816–1967* (2nd ed.). Methuen.

Mariscal, Elisa, & Sokoloff, Kenneth L. (2000). Schooling, suffrage, and inequality in the Americas, 1800–1945. In S. H. Haber (Ed.), *Political Institutions and Economic Growth in Latin America. Essay in Policy, History, and Political Economy* (pp. 159–218). Stanford: Hoover Institution Press.

McCann, W Philipp. (1970). Trade unionists, artisans and the 1870 Education Act. *British Journal of Educational Studies, 18*(2), 134–150.

McCormick, Michael, Huang, Guoping, Zambotti, Giovanni, & Lavash, Jessica. (2013). Roman Road Network (version 2008) [data collection]. Harvard Dataverse, V1. https://doi.org/10.7910/DVN/TI0KAU.

Milner, Benjamin. (2022). The impact of state-provided education: Evidence from the 1870 Education Act. Working Paper.

Mitch, David. (1992). *The Rise of Popular Literacy in Victorian England: The Influence of Private Choice and Public Policy*. University of Pennsylvania Press.

Mitch, David. (1993). The role of human capital in the First Industrial Revolution. In Joel Mokyr (Ed.), *British Industrial Revolution: An Economic Perspective* (pp. 267–307). Boulder: The Westview Press.

Mitch, David. (2019). *The Elementary Education Act of 1870: Landmark or Transition? In School Acts and the Rise of Mass Schooling, 301–324*. Springer.

Mokyr, Joel. (1993). *The British Industrial Revolution: An Economic Perspective*. Westview Press.

Newcastle Commission and others. (1861). Report of the Commissioners appointed to inquire into the state of Popular Education in England. *British Parliamentary Papers*, vol. 21.

Nugent, Jeffrey B., & Robinson, James A. (2010). Are Factor Endowments Fate? *Revista de Historia Económica / Journal of Iberian and Latin American Economic History (Second Series), 28*, 45–82.

Nunn, Nathan. (2014). Pages 347–402 in *Historical Development*, edited by Philippe Aghion and Steven Durlauf, Volume 2. North-Holland.

Nunn, Nathan, & Puga, Diego. (2012). Ruggedness: The blessing of bad geography in Africa. *The Review of Economics and Statistics, 94*(1), 20–36.

Offer, Avner. (1981). *Property and Politics 1870–1914: landownership, law, ideology and urban development in England*. Cambridge University Press.

Ordnance Survey (OS). (2018). *OS Open Rivers* [data collection]. https://www.ordnancesurvey.co.uk/business-and-government/products/os-open-rivers.html.

Overton, Mark. (1996). *Agricultural revolution in England: the transformation of the agrarian economy 1500–1850*. Cambridge University Press.

Palmer, John. (2010). Electronic Edition of Domesday Book: Translation, Databases and Scholarly Commentary, 1086. [data collection]. 2nd Edition. UK Data Service. SN: 5694, https://doi.org/10.5255/UKDA-SN-5694-1.

Ramcharan, Rodney. (2010). Inequality and Redistribution: Evidence from U.S. Counties and States, 1890-1930. *The Review of Economics and Statistics, 92*(4), 729–744.

Sanderson, Michael. (1995). *Education, Economic Change, and Society in England, 1780–1870*. Cambridge University Press.

Shirley, Evelyn Philip. (1866). *The Noble And Gentle Men Of England*. John Bowyer Nichols and Sons.

Stephens, W. B. (1998). *Education in Britain, 1750–1914 (Social History in Perspective)*. St. Martin's Press.

Stone, L., & Stone, J. F. (1984). *An Open Elite? England 1540–1880*. Clarendon Press.

Sutherland, G. (1973). *Policy-making in elementary education 1870–1895*. Oxford University Press.

Thompson, F. M. L. (1963). *English Landed Society in the Nineteenth Century*. Routledge and Kegan Paul.

Tollnek, Franziska, & Baten, Joerg. (2017). Farmers at the heart of the 'human capital revolution'? Decomposing the numeracy increase in early modern Europe. *The Economic History Review, 70*(3), 779–809.

Vollrath, Dietrich. (2009). *Geographical Elements of Farm Size Inequality in the United States*. Manuscript, University of Houston.

Wahl, Fabian. (2017). Does European development have Roman roots? Evidence from the German Limes. *Journal of Economic Growth, 22*(3), 313–349.

Williamson, Jeffrey G. (1990). *Coping with City Growth during the British Industrial Revolution*. Cambridge University Press.