Landed Elites and Education Provision in England: Evidence from School Boards, 1870-99*

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Abstract

This paper studies the relationship between landownership concentration and state-sponsored education in late-nineteenth century England. Using newly compiled data on a wide range of education measures for 40 counties and 1,387 local School Boards, I show a negative association between land inequality and human capital. To establish causality, I exploit variation in soil texture and the redistribution of land after the Norman conquest. I doing so, I document a strong persistence in inequality over eight centuries. Next, I show that the estimated effects are stronger where landlords had political power and weaker for education demand, suggesting that landownership affects state education through the political process.

Keywords: Education, land concentration, taxation, elites, persistence.

JEL classification: I25, 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

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Moav 2006). America's reversal of fortune often serves as an example: countries in South America had an unequal distribution of land, underinvested in state education, and despite being rich in the past, by the nineteenth century fell behind the United States (Engerman and Sokoloff 2000). Similarly, nineteenth century Europe experienced a reversal of fortune when Prussia overtook England as the world's industrial leader. In contrast to America's case, however, inequality is not in the spotlight as an explanation for Europe's reversal of fortune (McCloskey and Sandberg 1971). In fact, the view on landownership concentration in England is often positive, as it is traditionally associated with the agricultural revolution, and hence, with the Industrial Revolution (Allen 1992). Are the negative effects of land inequality restricted to agrarian, developing economies?

This paper studies the introduction of state education in England, and shows that land inequality had perverse effects on human capital formation also in an industrialized economy. I digitize the reports of the Committee of Council on Education—a novel dataset with a wide range of educational measures covering 40 counties and 1,387 local School Boards between 1871 and 1899. Using local data, I find that School Boards next to the largest landlords in England set lower property taxes to fund education. The estimated effects are quantitatively important: Reducing land inequality by one standard deviation would increase property tax rates by 37.5 percent. I also exploit cross-county variation to examine the effect of landownership on a wider range of education measures. I find that in counties where landownership was more concentrated the ratio of state to private schools, teacher's salaries and expenditures per pupil were lower. Also, fewer teachers and class assistants were hired. These had important consequences for human capital accumulation: children were less likely to pass the reading, writing, and arithmetics' national exams.

The relation between land inequality and human capital raises important empirical questions. First, land inequality is potentially endogenous to education provision (Easterly 2007). In light of a recent literature that highlights the persistence of inequality (Clark et al. 2014), a natural question is whether historical shocks and critical junctures can provide sources of exogenous variation in inequality. Second, it is difficult to pinpoint the causal channels through which landownership concentration undermines human capital. Elsewhere it has been argued that these negative effects are a byproduct of economic inequality,[1] the lack of private demand for education,[2] or political inequality;[3] in the sense that a small landed elite may oppose education supply if human capital and agriculture are not complementary (Galor and Moav 2006). These distinct causal channels have critically different implications when evaluating available policy instruments, e.g., land reform or public delivery systems. However, disentangling these mechanisms is difficult. Political and economic inequality are typically correlated and available data is often limited to enrollment or literacy rates, measures related both to education supply and demand.

This paper tackles these empirical questions in a novel manner. First, I present a historical source of exogenous variation in inequality in England: the Norman conquest of 1066. Second, I evaluate the three possible causal mechanisms in a unified framework: I first disentangle political from economic inequality by using individual-level data on landowners' political appointments. Next, I disentangle the supply and demand channels by exploiting a supply-shock that allows me to estimate the elasticity of the private demand for education. Two sets of interesting results emerge. On the one hand, I find that inequality persisted in England over eight centuries, from 1066 to the 1880s. On the other hand, I show that land concentration hampered state education as a result of political inequality rather than economic inequality or the lack of education demand.

Specifically, I use an instrumental variables approach that exploits two sources of exogenous variation in land inequality: one well-established and another novel. The first is is soil texture (see Cinnirella and Hornung 2016). The second is a historical 'natural experiment' that massively redistributed landownership: the Norman conquest. England had been a mosaic of landowners. After the conquest, more than half

[1]Banerjee and Newman (1993), Galor and Zeira (1993), Murphy, Shleifer, and Vishny (1989).
[2]Cinnirella and Hornung (2016), Ashraf et al. (2017).
[3]Acemoglu, Bautista, and Robinson (2008).

of the land was given to 190 Norman nobles—the ancestors of the large landowners in the nineteenth century. Using geo-referenced data from the *Domesday Book*, I show a strong persistence in land inequality, both at the county and at the local level. Importantly, the Norman conquest "resulted in largely homogeneous formal institutions across England" (Angelucci, Meraglia, and Voigtländer 2017: 1), but land was given in a more concentrated manner in areas with military thrusts specific to the eleventh century. Hence, the instrument likely satisfies the exclusion restriction. To substantiate this, I show that local differences in land inequality in 1066 are not associated to pre-conquest economic development—proxied by the density of roman roads—nor to a range of economic, political, and religious regional characteristics in the nineteenth century.

Next, I examine the mechanisms through which landownership concentration undermined state education in England. State education may be hampered by economic or political inequality (Acemoglu, Bautista, and Robinson 2008). Disentangling these two channels is empirically challenging, as economic and political inequality are usually correlated. I take advantage of the fact that peers retained political influence in the late-nineteenth century, especially at the local level (Allen 2009). Specifically, I code biographical information for 369 "large landlords" (i.e., peers who owned 2,000 acres or more) from peerage records. School Boards exposed to landowners who were MPs or held important local offices (e.g., Lord Lieutenant) systematically raised less funds for education than School Boards in areas where landowners who were not politically relevant. In other words, considerable political power is required for transforming economic inequality into unequal education provision.[4] In contrast, I find that the supply of education is positively associated to the share of manufacturing workers. This suggests that old landed elites and emerging industrialists clashed over the provision of state education (Lindert 2004; Galor and Moav 2006).

Another important distinction is whether landownership concentration reduces education supply or is associated with a low private demand for education. Elsewhere

[4]This result is not specific to my historical setting. Alatas et al. (2013) found that local leaders in modern-day Indonesia captured welfare programs only where they held formal positions.

it has been argued that the demand for education was lower where landownership was concentrated and the franchise was restricted.[5] I show that this was not the case in England. I estimate the effect of land inequality on education-demand measures (e.g., attendance) and education-supply measures (e.g., numer of schools) separately, showing that only the latter is negative. To correct for the fact that demand-variables can be affected by supply factors, I exploit a large supply shock: the Free Grant Act (1891). The Act increased education funds nationwide, and hence, independently of land concentration. I use this supply shock to estimate the elasticity of education demand to the funds invested in state-schooling. Elasticities are similar in counties with low and high land inequality. That is, where land was concentrated the demand for education was not lacking.

The empirical setting I examine offers a number of advantages. First, the data on state education is very rich. I computerize a source that, to the extent of my knowledge, remains unexplored by economists: the reports of the Committee of Council on Education. I digitize yearly data on 22 different education measures for 40 counties in 1871–99, and funds raised for education by 1,387 local School Boards in 1873–78. This allows me to evaluate many dimensions of education to which the existing literature—restricted to literacy and enrolment rates—remains silent. Importantly, I can evaluate measures of education supply and demand separately. The second advantage of my setting is that the introduction of state education in England was decentralized. This allows for plausible identification using cross-sectional variation across counties and School Boards. In each Poor Law district, School Boards could: raise funds from a rate (i.e., a property tax), build and run state schools, subsidize private schools, and create by-laws making attendance compulsory. Local landed elites, in turn, could take over over School Boards given its local nature and the election system, which practically guaranteed landed elites representation in the Board (Stephens 1998). A third advantage is that in England the landed elite was a well-

[5] Acemoglu and Robinson (2000), Engerman and Sokoloff (2000), Mariscal and Sokoloff (2000), Gallego (2010), Go and Lindert (2010). Similarly, Cinnirella and Hornung (2016) and Ashraf et al. (2017) show that the in Prussia the demand for education was lower where land was concentrated, and hence, serfom was more prevalent.

defined, well-documented group (Allen 2009). Hence, I can assess the political power of elites precisely by using biographies from peerage records.

Relative to the existing literature, I make the following contributions. First, previous work has documented a relation between land concentration and state education in the Americas[6] and in some industrial economies like United States or Prussia.[7] The advantage of my case study is that the 1870 education reform in England was less instrumental to nation-building than those of other industrial nations (Bandiera et al. 2017; Cinnirella and Schueler 2018). Hence, it constitutes a better test bed for the effects of land inequality on human capital. Clark and Gray (2014) show that landownership did not affect literacy in England in 1815–45. At that time, however, schools were not state-sponsored (Mitch 1992) and landowners subsidized them because of religious motivations or emulation (Hurt 1968; Thompson 1963). By examining the 1870 reform, hence, this paper is the first to show that land inequality distorted state education in England—an industrialized, frontier economy. Since England was the cradle of the Industrial Revolution, my results also have implications for unified growth theories that emphazise the role of human capital for technological progress and the demographic transition (Galor and Weil 2000; Galor and Moav 2002). Specifically, by finding that landed elites opposed education reforms, I show that (1) land-human capital complementarity can affect education supply, (2) that land inequality is important for the changes initiated after the Industrial Revolution, and (3) for England's loss of industrial leadership to Prussia and the United States.[8]

Second, I document a strong persistence in land inequality from the Norman conquest of 1066 to the late-nineteenth century. This finding is interesting in its own right, as it emphasizes that inequality has deep historical roots (Clark et al. 2014). Furthermore, this paper suggests that historical shocks to the land distribution can

[6] 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.

[7] See Galor, Moav, and Vollrath (2009), Vollrath (2009), and Ramcharan (2010) for the United States and Cinnirella and Hornung (2016) for Prussia.

[8] Entrepreneurs have been at the spotlight for Britain's loss of industrial leadership (McCloskey and Sandberg 1971). My results suggest that the aristocracy may have also contributed to it by depriving the masses of education.

have large economic effects centuries later. In a similar vein, Heldring, Robinson, and Vollmer (2017) 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.[9,10]

Finally, this paper is the first to compare the four causal mechanisms considered in the literature (political vs. economic inequality and supply vs. demand) in a unified framework. My findings highlight the role of political inequality (Galor and Moav 2006; Acemoglu, Bautista, and Robinson 2008). In contrast, the private demand for education does not seem to be the binding factor for the introduction of state-schooling.[11] With respect to prior work, I present a novel approach to disentangle education demand from supply based on reduced-form estimation of demand elasticity. In addition, I build a new dataset that will allow to study nineteenth-century human capital beyond the traditional measures of literacy and enrolment rates.

The paper proceeds as follows. Sections 2 and 3 describe education in nineteenth century England and the data. Section 4 presents OLS estimates. Sections 5 and 6 describe the instruments and estimate the effects of land concentration on state education. Section 7 examines the mechanisms. Finally, Section 8 concludes.

2 Historical Background: Education in England

In the Second Industrial Revolution, the demand for skilled labor increased. For example, job advertisements mentioned literacy as a desired characteristic as of the 1850s (Mitch 1993: 292). At that time, however, England lacked a state education system to meet this demand. Schooling was based on church-run Voluntary schools and fee-charging Public Schools (Green 1990). Thirty percent of the adult population could not read or write in 1851. In contrast, the illiteracy rate was 20 percent in

[9] My empirical analysis excludes Church estates. That is, results are orthogonal to any effect related to the dissolution of the monasteries.

[10] Similarly, Finley, Franck, and Johnson (2017) show that the confiscation of Church estates in the French Revolution is associated with a more efficient land use circa 1850.

[11] Acemoglu and Robinson (2000), Engerman and Sokoloff (2000), Mariscal and Sokoloff (2000), Gallego (2010), and Go and Lindert (2010).

Prussia in 1849 and 9 percent among white Americans in 1860. These countries had introduced state education at least fifty years before England (Sanderson 1995).

England introduced state-schooling in 1870 (Forster's Act) to meet the demand for an educated workforce. Importantly, Forster's education reform was less instrumental to nation-building than those of Prussia (Cinnirella and Schueler 2018) or the United States (Bandiera et al. 2017), as it is clear from his address to the House of Commons:

> Upon the speedy provision of elementary education depends our industrial prosperity ... if we leave our work-folk any longer unskilled ... they will become overmatched in the competition of the world. (Hurt 1971: 223–4)

Specifically, School Boards were initially created in the boroughs and Poor Law districts where there was a shortfall in education. Soon, they spanned most of the country. In their district, School Boards could raise funds from a property tax similar to the poor rate, build and run state schools, subsidize private schools, and create by-laws making attendance compulsory (Stephens 1998). They were also eligible for Parliamentary grants on the basis of children's performance in the national exams.[12] Before its abolition in 1902, School Boards created 5,700 state schools, providing education for 2.6 million pupils (Stephens 1998). Several Acts enforced and extended state education (see Table A.4 in Appendix A.1). For example, attendance of children aged 3-11 was compulsory from 1880, exempting children who lived two miles from a School and who had reached standard iv. Another extension was the Free Grant Act of 1891, which toppled Parlamentary grants with 10 shillings per children aged 3–15.

What was the attitude of landed elites towards education provision? While education was not state-sponsored, landed elites did not oppose it (Clark and Gray 2014). However, after 1870 they were galvanized into "a flurry of activity to ward off the dread intrusion of a School Board" (Thompson 1963: 208). The election system of Board members facilitated the take-over by landowners: only those paying an annual rent of £10 or holding land valued at £10 could vote. In addition, each voter was allowed a number of votes which he could give to three (or more) candidates. Cu-

[12] Admittedly, there was an incentive to limit education to the three Rs (reading, writing, and arithmetics) which may explain the high success rates (Green 1990: 7).

mulative voting ensured landed elites representation on the Board (Stephens 1998), which they used to undermine the provision of state education.

3 Data

This section describes the data sources and the main variables on education and landownership concentration. The instruments are described in the respective empirical sections below and in Appendix A.2.

3.1 Sources and main variables

I computerize two new datasets: the reports of the Committee of Council on Education and Bateman's (1883) *Great Landowners.* I also add peers' family seats from Burke (1826) and their biographies from `thepeerage.com`. Finally, I use the digitized version of the *Domesday Book* by Palmer (2010), the British Geological Survey (2014), and county covariates from Hechter (1976) .

State education data. To study state education, I computerize the annual reports of the Committee of Council on Education. The reports cover most of the period when local School Boards were active (1871–1899). They provide a wide range of education measures: funds from property taxes, property tax rates, Parliamentary grants, school fees, the ratio of state to private schools, teachers hired, female class assistants, teacher's salaries, etc. In addition, there are measures of human capital accumulation: the percentage of children passing the reading, writing, and arithmetic national exams in each county. Finally, the reports list measures that can be used to estimate the elasticity of education demand, such as the number of pupils attending, enroled, or examining, broken down by age and by standards.[13] For the sake of illustration, Figure A.1 in Appendix A.1 shows parts of a report.

I compiled the data at two different levels: at the local School Board and at the county level. First, I computerized the tax rates set by all 1,387 local School Boards

[13]See Table A.1 in Appendix A.1 for a detailed description of the standards.

operating in 1873–78;[14] the initial years of state-schooling. Second, I add education funds, expenditures, examination results, and demand-variables for all 40 counties in England in 1871–99. I then normalize education funds and monetary expenditures per children aged 5 to 10, as reported in the 1881 Census. Table A.1 in Appendix A.1 lists all the collected variables. In the empirical analysis, I use decade averages for the education variables rather than its yearly values. First, because some variables are not available for some years. Second, because my regressions include county covariates collected by Hechter (1976) from the UK Census, which were held every ten years.

Overall, my dataset contains 23 different education measures. This allows to evaluate many dimensions of state education and human capital to which existing historical studies—restricted to literacy and enrolment rates—remain silent.

Landownership data. The data on landownership in nineteenth-century England is from Bateman (1883). The book provides an entry for each owner of at least 3,000 acres and 1,300 owners of 2,000 acres by 1876. Entries list the landowner's family seat and the acres he owns in each county.[15] Bateman also reports, for each county, the arable land and the total acreage by owners of 3,000 acres or more.

I define landownership concentration in two ways: For the analysis at the county-level, I compute the percentage of land in each county in the hands of large landowners (i.e., 3,000 acres or more). For the analysis using local data, I use the acreage owned by each large landlord (i.e., a peer who owns 2,000 acres or more) in the area around his family seat. Specifically, I use Bateman (1883) and Burke (1826) to geo-reference the 486 family seats of all the large landlords in England.[16] I then use Bateman (1883) individual-level information to find out the lord's acreage around each seat; i.e., in the county where his seat is located.

Finally, Bateman (1883) is a cross-sectional survey, so I cannot exploit time vari-

[14]To be precise, there were 1,471 School Boards in England in 1873–78. However, 84 of them were in areas for which the *Domesday book* does not report data on landownership; i.e., where I cannot define the instrument. Hence, I exclude them from the analysis.

[15]For the sake of illustration, Figure A.2 in Appendix A.1 shows an entry for Lord Lyttelton.

[16]To be precise, I geo-referenced 532 seats. From this, I exclude the 45 seats for which the *Domesday book* does not report data on landownership in a 25-miles radius.

ation in land inequality. Since landownership was stable from 1750 (Beckett 1977: 567), I adopt a multi-level approach where education and other covariates vary both in the cross-section and over time but land inequality only varies in the cross-section.

Peer's biographies. To assess the political power of the 369 large landlords in my dataset, I code biographical information from `thepeerage.com`. The website provides a short biography for each peer based on various peerage records. Using regular expressions, I identify whether a landowner was ever Member of Parliament (MP), his political affiliation, and whether he was appointed to one of the four most important local offices: Lord Lieutenant, Deputy Lieutenant, High Sheriff, or Sheriff. See Figure A.3 and Table A.6 in Appendix A.1 for details.

Domesday Book. To reconstruct the land distribution after the Norman conquest, I use the *Domesday Book*, a survey of all landholdings in 1086. It is the oldest public record in England; no survey approaching its extent was attempted until the nineteenth century. The *Domesday* covers most of England—except northern counties and tax-exempt London and Winchester. For each mannor, it lists the owner[17] and the value of the land before and after the conquest as well as the number of mills, ploughs, population, etc. Here, I use the electronic version of the *Domesday* digitized by Palmer (2010), which provides records for 22,634 mannors in 1086.

British Geological Survey. My second instrument exploits geographical variation in soil texture. Soil texture does not change over time and cannot be altered by human intervention. Under this premise, I use modern-day data from the British Geological Survey. The data is a vector grid with 1km by 1km cells. It reports 40 soil types classified in nine categories according to the relative proportions of sand, silt, and clay and the presence of chalk and peat fragments.

3.2 Data descriptives

Here I provide summary statistics for the main variables used in the analysis (see Table A.1 in Appendix A.1 for details). The average county raised only 176.3 pence

[17] 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.

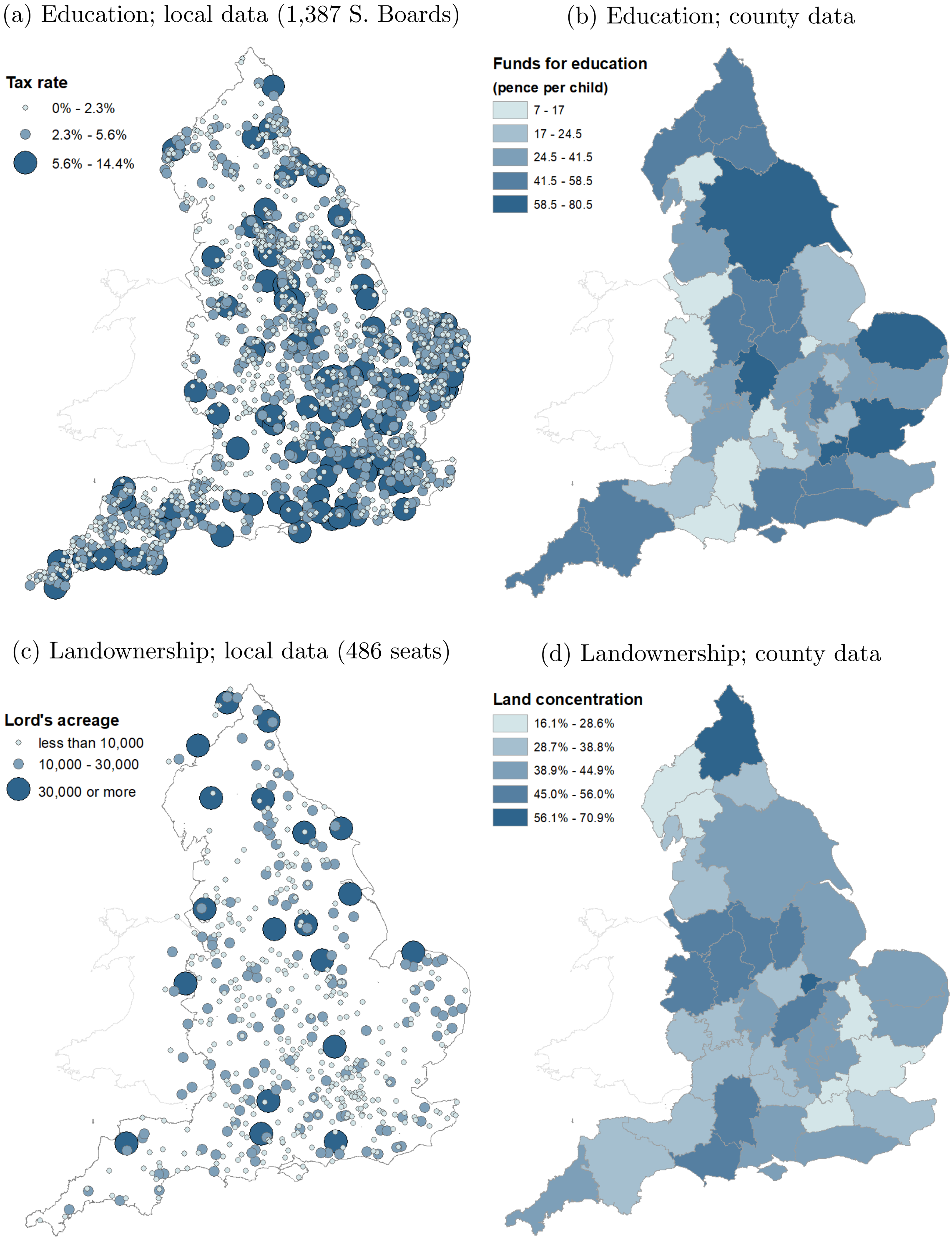
per child in 1873–78. Most of these education funds came from property taxes, although on average School Boards set a tax rate of only 2.5 percent. Funds from property taxes also present a larger standard deviation. This suggests that local differences in state-schooling were mostly associated to differences in funds raised from property taxes rather than, e.g., Parliamentary grants. Expenditures were also meagre. For example, in the average county there were 35 state schools for every 100 Voluntary schools (i.e., private schools). The percentage of children passing the national exams was high. This reflects the fact that Parliamentary grants were partly determined by exam results (Green 1990: 7). That said, there is meaningful variation across counties, especially in arithmetics. This allows me to identify whether underinvestment in state-schooling affected this dimension of human capital. Finally, the private demand for education was not lacking: Although, from 1800, education was compulsory for children aged 5–11, half of the examinees were above age 10. Many took exams for standards v to vii, above the requirements of compulsory education.

As for land inequality, it is hard to exaggerate the extent to which landownership was concentrated in England. In the average county, 41 percent of the land was owned by large landowners (i.e., owners of 3,000 acres or more). Many of them were peers who, on average, owned an estate of 7,843 acres in the county where his seats was located.[18] In Rutland, for example, more than 30 percent of the land was owned by the Duke of Rutland! These large landlords also controlled public offices. Fourty percent were MPs and 75 percent held an important local office.

Figure 1 depicts the geographical distribution of state education and land inequality. Specifically, it shows education funds from property taxes and land concentration both at the county level and using local data from 1,387 School Boards and 486 lord's seats. Two patterns emerge: First, there is variation in both variables across and within counties (and broader geographical regions). Second, the spatial distribution of education funds and land concentration are diametrical opposites. For example, few School Boards set taxes above 4.5 percent in the West Midlands (panel (a)).

[18]Since several peers complained that Bateman (1883) underestimated their possessions (p. 348), estimates of land inequality should be taken as a lower bound.

Figure 1: Land concentration and state education in the late-nineteenth century.



Notes: Values arranged using Jenks natural breaks. In panel (b), classes are based on Bateman (1883) categories. Land concentration is the percentage of land in the hands of large landowners (i.e., owners of 3,000 acres or more).

In contrast, landownership was heavily concentrated in these counties: Fourty to 60 percent of the land belonged to large landowners (panel (d)). Similarly, the largest estates, denoted by larger circles in panel (c), were mostly north of Cambridge. In contrast, School Boards imposing the largest tax rates (i.e., above 7 percent) were mostly in the South-East, where the distribution of land was *relatively* more equal.

4 OLS results

Did land inequality distort state education in England? Here I address this question using local data. I consider 1,387 School Boards operating in 1873–78 and the 486 family seats of large landlords (i.e., peers who owned 2,000 acres more). In detail, I draw a 25-mile radius around each peer's seat and identify all the School Boards in it.[19] If land inequality is negatively associated to state education, I expect School Boards next to larger landowners to raise less funds for education.

To illustrate my strategy consider Washingborough, a village in Lincolnshire. Washingborough is only 2.7 miles away from Burton House, the family seat of William Monson, 1st Viscount Oxenbridge. He was a large landlord in possession of 8,100 acres in Lincolnshire. How did the School Board in Washingborough fare with so much wealth to levy taxes on? Between 1873 and 1878, it only taxed 0.8 percent of the rateable property (i.e., land value). This was no exception. Figure 2 shows that School Boards within ten miles from Blankney Hall (e.g., Ingham, North Scarle, and Stow by Gainsborough) set tax rates below 1 percent. In contrast, only School Boards 18 miles further away from William Monson's seat (e.g., Misterton, Hibaldstow, Belchford, and Stickford) imposed tax rates above 4 percent.

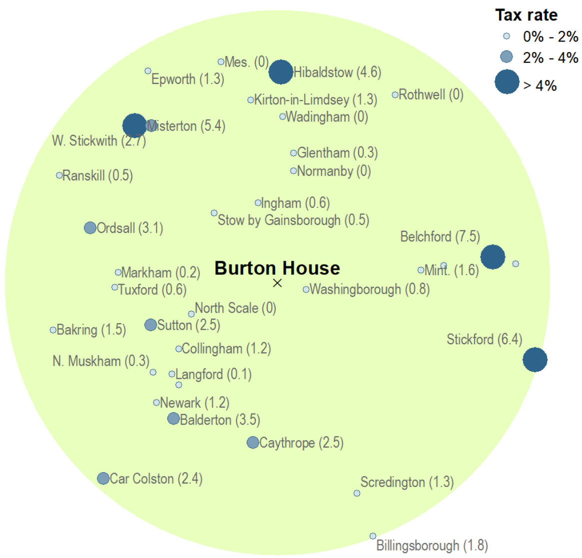
Formally, I regress the acreage of a large landlord on the property tax rate set by each School Board in a 25-mile radius:

$$edu_{b,s} = \alpha + \beta \; lord \; acreage_{s,c} + \; \mathbf{V}_c'\delta \; + \; \epsilon_{b,s,c} \; , \tag{1}$$

where $edu_{b,s}$ is the average tax rate in 1873–78 set by School Board b, which is located

[19] The results are robust to moving the cutoff to 20 miles (available upon request).

Figure 2: Burton House and the School Boards in a 25 miles radius.



Notes: Labels report the average tax rate (%) in 1873–78 in parenthesis.

in a 25-mile radius of the seat s. The variable $lord\ acreage_{s,c}$ is the acreage by the large landlord living in seat s. I consider his acreage only in the county c where his seat s is located rather than his total acreage, which may include estates elsewhere in Britain. The coefficient β captures the association between a landlord's acreage and the education provided by the nearby School Boards, which I expect to be negative. Note that this specification resembles a gravity equation in which the influence that a landlord has over a School Board depends on his wealth and on the distance between his seat and the School Board. Hence, I treat each School Board and landlord pair (b, s) as an independent observation[20] and cluster the standard errors by landlord's seat s. Alternatively, I run specifications clustering the data at the seat level or weighting pairs (b, s) by the distance to a landlord's seat. Finally, $\mathbf{V}_c$ includes county-level covariates. Alternatively, I include covariates at the School Board level.

Table 1 presents the results. There is a clear negative association between land inequality and education provision at the local level. In the baseline specification, I find that increasing the acreage of a landlord by one standard deviation (i.e., by 9,809 acres) is associated to a reduction in tax rates set by the School Boards nearby

[20]For example, the Brotton School Board (York) is within 25 miles of three seats: Duncombe, Helmsley, and Skutterskelfe. Since each lord may influence the School Board differently, I treat each pair, Brotton-Duncombe, Brotton-Helmsley, and Brotton-Skutterskelfe, as a different observation.

by 0.13 percentage points. Given that the average tax rate was only 2.54 percent, the estimated effects amount to a decrease of 5 percent.

Table 1: OLS estimates, local data.

	Dep. Variable: Tax rates (%)					
	OLS [1]	OLS [2]	OLS [3]	collapsed [4]	weighted [5]	FE [6]
Acreage of large landlord in 100s	-0.0013*** (0.0003)	-0.0006*** (0.0002)	-0.0014*** (0.0003)	-0.0015*** (0.0003)	-0.0010*** (0.0003)	-0.0017*** (0.0004)
Observations	24,701	24,701	24,701	486	24,240	24,701
R-squared	0.003	0.033	0.006	0.058	0.003	0.050
County controls	NO	YES	NO	NO	NO	NO
Local controls	NO	NO	YES	YES	YES	YES
FE	NO	NO	NO	NO	NO	Lord
Cluster s.e.	seat	seat	seat	-	seat	Lord

Note: The sample consists of 1,387 School Boards and 486 seats of large landlords (i.e., peers who owned 2,000 acres more). Each observation is a seat–School Board pair $\{s, b\}$, where School Board b is within 25 miles of seat s. In col. 4 observations are collapsed by seat and in col. 5 are weighted by the distance between School Board and seat. The Dep. Variable is the average tax rate set by School Board b in 1873–78. County controls are log income p.c., % voting conservative, % non-conformists, religiosity. Local controls are the distance from each School Board to the closest industrial city and to the closest cathedral (see Table A.7 in Appendix A.1). Constants not reported; *** p<0.01, ** p<0.05, * p<0.1.

Results are robust to including covariates that are potentially correlated with state education. Specifically, column 2 includes the following county-level covariates: employment in manufacturing, income per capita, percent voting conservative[21] and non-conformists, and religiosity. Column 3 considers two covariates at the local level: the distance from each School Board to the closest industrial center and cathedral.[22] The former captures the fact that schooling was more attractive for families who could easily migrate to an industrial center. The latter is a measure of religiosity.

Columns 3-5 examine the robustness of the results to relaxing the assumption that each School Board and landlord pair is an independent observation. First, I collapse the data at the seat level. That is, I regress each lord's acreage on the *average* tax rate raised within 25 miles from his seat. This stricter specification yields very similar results despite the lower number of observations (N=486). Second, I weight each observation using the distance between School Boards and seats. This is based on

[21] Hechter (1976) does not provide the percent voting conservative for the 1871-80 decade. I take the values of the following decade.

[22] Industrial cities are cathedrals are listed in Table A.7 in Appendix A.1.

the assumption that the influence of a landlord over a School Board decreases with the distance to his seat. I weight each seat–School Board pair (s, b) with $w_{s,b} = \frac{d_{s,b}}{dmin_b}$, where $d_{s,b}$ is the distance between s and b and $dmin_b$ is the shortest distance between School Board b and any seat in England. This gives larger weights to closer seat–School Board pairs (see Figure A.4 in Appendix A.1). Finally, column 5 includes fixed effects for each landlord. Results do not change significantly across specifications.

5 Identifying causal relationships

The previous section showed a negative association between land concentration and state education. The coefficients estimated by OLS, however, cannot be interpreted as causal. Although reverse causality is not a major issue—landownership was stable from 1750 (Beckett 1977)—unobserved heterogeneity may bias the estimates. Areas where land was more concentrated might be intrinsically different in terms of, for example, culture, and these differences might explain state education. I address endogeneity concerns using an instrumental variables approach that exploits a novel and a well-established source of exogenous variation in land inequality: the Norman conquest of 1066 and soil texture. Next, I describe the instruments and present historical evidence and several empirical exercises to validate the identifying assumptions.[23]

5.1 The Norman conquest of England (1066)

The instrument. In 1066, William the Conqueror crossed the Channel from Normandy, defeated the Anglo-Saxons in Hastings, and was proclaimed King of England. One of his first acts was to redistribute land ownership. He took one fifth of the land for himself, gave a quarter to the Church, and divided the rest among 190 Normans. My instrument exploits the fact that much of the land inequality in the nineteenth century can be traced back to 1066. Using data from the *Domesday Book*, I define my instrument as the concentration of land value by the top five Norman landowners in 1086. When using local data, I consider the top five landowners in each 25-mile radius

[23] Appendix A.2 presents examples on the construction of each instrument.

around the 486 seats of the nineteenth-century large landlords. For the county-level analysis, I consider the the five largest landowners in each county.

Ideally, I would define my instrument as land concentration in terms of acreage. Unfortunately, the *Domesday* only provides information on land values. These are based on various taxes that levy, respectively, the landholding's size and the presence of mills, markets, or justice in the landholding (Palmer 2010). To get a more natural measure for land concentration, I only use information from taxes that levy the landholding's size.[24] Mainly, I use is the "geld tax,"[25] which consisted of two shillings per hide—a land unit equivalent to 30–60 modern acres. Hence, although the instrument captures concentration of land value, it is comparable to measures of land concentration based on the size of the landholdings.

Another caveat is that the instrument is based on land values in 1086. These might reflect capital destruction or casualties related to the conquest. To address this, Appendix A.3 presents the results when I define the instrument using the pre-conquest values that the *Domesday* reports for a sub-sample of manors. Although the number of observations is reduced, my main conclusions are robust.[26]

Finally, the instrument captures land concentration in the hands of the 190 Norman lords that received land from William. In other words, I do not consider land inequality steeming from the land that William took for himself or gave to the Church. The reason is that some Crown estates were sold to the gentry between 1436 and 1688 and, especially, that the Church lost many estates in the dissolution of the monasteries (Overton 1996: Table 4.8). These two processes triggered local differences in subsequent development (Heldring, Robinson, and Vollmer 2017). Including these landholdings in the analysis, hence, would violate the exclusion restriction.

Identifying assumptions. I first show that the instrument is relevant; i.e., the Norman conquest led to a persistent increase in land inequality. To support the exclusion restriction, I present historical evidence arguing that William gave out land

[24]Considering the remaining taxes does not alter my results (results available upon request).
[25]I use information from 21,036 farms in which land value is assessed by the geld tax and 43 farms where taxes levied carucates—equivalent to 120 modern acres.
[26]Specifically, the tests for the exclusion restriction, first-stage, and second-stage results are robust.

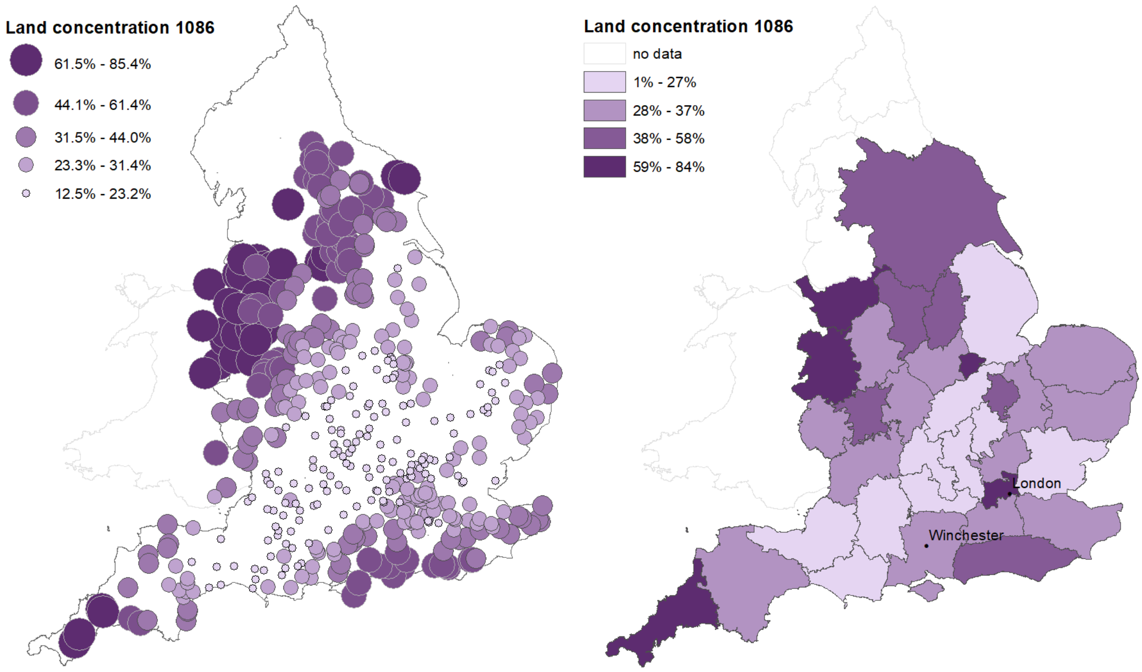
in a more concentrated manner in areas with thrusts specific to the eleventh century. Consistently, I show that William's land redistribution was othogonal to pre-conquest local economic development—proxied by the density of roman roads. Next, I argue that the conquest did not trigger persistent local differences in institutions or religion. Finally, I show that regional variation in land inequality in 1066 is not associated to a range of economic, political, and religious outcomes in the nineteenth century.

The instrument satisfies the relevance condition, that is, much of the land inequality in the nineteenth century can be traced back to the Norman conquest. Figure 3 displays the distribution of landownership after the Norman conquest, both at the county and local level. The figure looks remarkably similar to that of the nineteenth century. For example, in Warwickshire 42 percent of the land value was in the hands of the top five Norman landowners in 1066. Eight centuries later, 35 percent of the land was owned by large landowners. In contrast, in the South (excluding Sussex) the land grab by the Normans was smaller and so was landownership concentration in the nineteenth century. The persistence of land inequality is also evident at the sub-county level. Local data shows that there is a strong spatial correlation between the location of the largest estates in nineteenth-century England and the degree of land inequality in 1066 (Figure 1 (c) and Figure 3 (a)).

Even if there is a strong persistence in landownership from 1066, the relevance condition could be violated if William's conquest did not lead to more land inequality because landownership was already concentrated before 1066. This was not the case: Anglo-Saxon England had been a mosaic of landowners (Cahill 2001). To confirm this, I identify the 4,690 farms given to 29 Norman nobles who fought in the decisive Battle of Hastings and/or appear in the Bayeux Tapestry—a Norman embroidery depicting the conquest of England. Table 2 lists the number of owners in these farms before and after the conquest. For example, in Buckinghamshire, 285 farms which used to have 181 different owners became the possession of only 10 Norman lords. Overall, the surveyed farms saw a 93 percent reduction in the number of landowners. In other words, the conquest was a massive shock to the distribution of land.

Figure 3: Landownership concentration after the Norman conquest

(a) Local data (b) County data



The validity of the identification strategy, hence, rests on the exclusion restriction; i.e., that the redistribution of land after the Norman conquest had no impact on late-nineteenth century state education other than through land concentration. While the exclusion restriction cannot be tested directly, I discuss historical evidence and perform several empirical exercises to support its validity.

A potential concern is that if William gave the richer lands to few of his companions, the land distribution would reflect underlying economic factors, which could directly affect state education in the nineteenth century. The historical evidence powerfully suggests that William's land redistribution was not driven by economic factors but by factors specific to 1066. Under the feudal system, those who received land had to provide the King with a number of knights proportional to the size of their landholdings.[27] Hence, larger landholdings were given in conflicting areas—e.g., where Anglo-Saxons threatened with rebellion—as a defence against these thrusts (Brooke 1826). In sum, the regional variation in landownership concentration after

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

Table 2: The redistribution of land after 1066.

County	Sample farms	Landowners		
		Before 1066	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	1,032	224	11	-95.1
Northamptonshire	186	71	9	-87.3
Oxfordshire	113	16	9	-43.8
Somerset	193	90	8	-91.1
Suffolk	1,724	468	13	-97.2
Warwickshire	140	72	10	-86.1
Total	4,690	1,516	100	-93.4

Note: The sample consists of 4,690 farms given to 29 Norman nobles who fought in the Battle of Hastings and/or appear in the Bayeux Tapestry. See Table A.8 in Appendix A.1 for the list of nobles and the sources used.

1066 steems mostly from thrusts that were specific to post-conquest England, were eventually controlled, and hence, would not have a direct impact on later outcomes.

To substantiate this, I show that the geographical pattern of landownership in 1086 is orthogonal to measures of pre-conquest economic development. To proxy for the latter, I exploit local differences in the density of roman roads—which promoted economic development by facilitating trade and fostering city growth. Importantly, even though Roman Britain collapsed long before the Norman conquest, elsewhere it has been shown that the density of roman roads can reflect economic conditions centuries later (Wahl 2017; Dalgaard et al. 2018).[28]

Table C.1 explores correlation patterns between the density of roman roads c.410 and land concentration in 1086, by grid cells of 10x10. The correlation coefficients are very small (0.055) and not significantly different from zero. For example, roman roads covered most of the area surrounding Chester and Oxford (see Figure A.6 in Appendix A.1). These areas, however, ended up with very different land distributions after the conquest. While William gave large landholdings to the top five landlords around Chester, he redistributed landownership more equally in Oxford. This result is robust to defining road density using only major roman roads.

[28]Roman roads constitute a better proxy for early economic development than roman settlements, as the urban network realigned after the collapse of Roman Britain (Michaels and Rauch 2018).

Table 3: Tests for the exclusion restriction.

Correlation between the Norman instrument and...	pre-conquest outcomes		late-nineteenth century outcomes				
	Roman road density ($\frac{km}{km^2}$) all (1)	major (2)	land con. in 19C (3)	income pc (log) (4)	% cons-ervative (5)	% non-confor. (6)	relig. (7)
Correlation (ρ):	0.055	0.055	0.482***	-0.137	0.182	-0.061	-0.149
N:	473	473	32	32	32	32	32
Unit:	grid cell	grid cell	county	county	county	county	county
Ho:	-	-	-	$\rho_1=\rho_2$	$\rho_1=\rho_3$	$\rho_1=\rho_4$	$\rho_1=\rho_5$
Prob:	-	-	-	0.01	0.19	0.03	0.01

Note: Grid cells are 10x10 miles cells. To test the equality of two correlation coefficients, I use the Fisher r-to-z transformation. *** p<0.01, ** p<0.05, * p<0.1

Even if William's land reform was not driven by economic factors, the exclusion restriction could be violated if the Norman conquest triggered local differences in institutions or religion within England. This scenario is unlikely. According to Angelucci, Meraglia, and Voigtländer (2017), the conquest "resulted in largely homogenous formal institutions across England" (p.1). In other words, the Normans introduced many institutional and religious reforms (e.g., feudalism, re-organization of the church), but they did so nationwide. Furthermore, the authors show that local differences in institutions emerged later when some boroughs were granted a *Charter of Liberties* (before 1348). These boroughs were typically close to Roman roads (p.3)—which as shown before is orthogonal to the land redistribution of 1066. In sum, the Norman reforms were nationwide, and local differences in institutions emerged later on from factors uncorrelated with landownership.

I confirm this hypothesis by showing that land concentration in 1066 is not associated with a range of political, religious, and economic regional characteristics in the late-nineteenth century. Table C.1 (cols. 3 to 7) provides correlation coefficients between land concentration in 1066 and, respectively, late nineteenth-century land concentration, income per capita, votes for the conservatives, proportion of non-conformists, and religiosity. All variables are at the county level. I only find a significant correlation in landownership: land inequality in Norman times is strongly associated with land inequality eight centuries later. In contrast, the correlation coefficients are small (and not significantly different from zero) for income per capita, votes for the conservatives, proportion of non-conformists, and religiosity in the 1870s. Three of these coefficients are significantly different from that capturing the correlation between land inequality in 1066 and in the nineteenth century (see last row).

Overall, these results suggest that the land redistriution after the Norman conquest (1) does not reflect underlying economic factors and (2) did not trigger persistent local differences in economic performance, political preferences, or religious composition. Only land inequality seems to have deep roots in the Norman conquest.

5.2 Soil texture

The instrument. The texture of a soil is determined by the percentage of sand, silt, and clay and by the presence of chalk and peat. Soil texture is strongly related to landownership concentration. Specifically, sandy and chalky soils do not retain water well, are drought-prone, and hence, are 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.

I define the instrument as the percentage of sandy and chalky soils; i.e., textures that lead to landownership concentration. Specifically, I use data from the British Geological Survey and calculate the percentage of land under chalky soils, sandy loam soils (50-80% sand), loam soils (30-55% sand), and clayey loam soils (20-50% sand). I do so for each county and each 25-mile radius around the 486 seats in the analysis. 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)—and soils with peat fragments. The latter are usually very fertile, and hence, less prone to land concentration. Finally, I consider *pure* sand (90–100% sand) as part of the reference group. The reason is that pure sand is usually next to rivers or the coast. Being very profitable for trade, these areas likely experienced population pressure and a strong demand for land, and hence, less landownership concentration.[29]

Identifying assumptions. Elsewhere it has been shown that soil texture is relevant for land concentration in India and Prussia.[30] Figure A.5 in Appendix A.1 suggests that this is also the case in England. Soil texture and land inequality are strongly related, both at the county and at the local level. For example, in counties in the West Midlands and in the North-East sandy and chalky soils prevail. These are also the areas where land was more concentrated and where the largest estates were located (see Figure 1, panel (c) and (d)). In contrast, in the South East soil quality is higher and landownership was more fragmented.

Soil texture likely satisfies the exclusion restriction. First, because it is truly exogenous: it does not change over time and cannot be altered by human intervention (Cinnirella and Hornung 2016). This contrasts instruments based on crop composition (Easterly 2007; Vollrath 2009), which to some extent can be manipulated by farmers. Second, soil texture is arguably excludable. Angelucci, Meraglia, and Voigtländer (2017) show that the quality of the soil did not affect whether a borough received a *Charter of Liberties*, which led to inclusive institutions and the representation of merchants' interests in Parliament in the long run. In other words, soil texture likely did not trigger differences in local institutions that may affect education provision. Admitedly, soil texture and agricultural productivity affect farmer's wages and their demand for state education. Although this is a valid theoretical concern, Section 7 shows that education demand was not the main driver for state-schooling in England.

6 Instrumental variables' results

In this section, I estimate an IV model with the Norman conquest of 1066 and soil texture as sources of exogenous variation in landownership. I examine education outcomes at two levels: First, I use local data from 1,387 School Boards as in Section 4. Second, I exploit cross-county variation to examine the effect of landownership con-

[29]See Table B.1 in Appendix A.2 for details.

[30]For India, see Bhalla (1988), Bhalla and Roy (1988),Benjamin (1995),Barrett, Bellemare, and Hou (2010). For Prussia, see Cinnirella and Hornung (2016).

centration on a wider range of educational measures between 1871 and 1899. Two sets of interesting results emerge: First-stage results document a strong persistence in land inequality over eight centuries. Second-stage results show that land concentration had a negative, causal effect on state education in England.

Formally, landownership concentration in the late-nineteenth century is treated as an endogenous variable and modeled as:

$$land_r = \kappa + \lambda \; land1066_r + \sigma \; soil \; texture_r \; + \; \nu_r. \tag{2}$$

For the county-level analysis, r is a county. For the analysis using local data from 1,387 School Boards and 486 seats, r is a 25-mile circle around each seat. The variable $land1066_r$ is the percentage of the total land value in r that was given to the top five Norman noblemen after 1066; $soil\ texture_r$ is the percentage of sandy and chalky soils in r. For the county level analysis, $land_r$ is the percentage of land in county r in the hands of large landowners (i.e., owners of 3,000 acres or more). For the analysis using local data, $land_r$ is the acreage of a large landlord (i.e., a peer who owns 2,000 acres or more) living in seat r.[31]

The second stage takes the form of equation (1) when using local data. For the analysis at the county-level, the second stage is:

$$edu_{r,t} = \alpha + \beta \; \hat{land}_r \; + \; \mathbf{V}'_{r,t}\delta \; + \; \epsilon_{r,t} \; , \tag{3}$$

where $edu_{r,t}$ is an education measure in county r at decade $t \in \{1870s, 1880s, 1890s\}$ and $\hat{land}_r$ is the (instrumented) share of county r in the hands of large landowners (i.e., owners of 3,000 acres or more).[32] As before, $\mathbf{V}_{r,t}$ is a vector of county-level covariates, including employment in manufacturing among others.[33]

[31]Note that the first stage excludes county covariates. The reason is these are uncorrelated with nineteenth-century land concentration. In fact, they are realized after Bateman's (1883) data was collected. Including these covariates in the first stage would only reduce its strength. In Appendix A.1, Tables C.1 and C.2, I estimate the same IV model including all covariates in the first stage and correcting for weak instruments. Results are robust.

[32]I use a panel of 32 counties and 3 decades where landownership only varies across counties. This multi-level approach is justified because landownership was stable from 1750 (Beckett 1977: 567).

[33]Note that I use a triangular IV model in which the treatment and the instruments vary by region, whereas education measures can also vary over time. To fit this model, I estimate the recursive system defined by the first and the second stage by maximum likelihood.

6.1 First-stage: Long-run persistence in land inequality

Table 4 presents the first-stage results. I find a strong persistance in land inequality over eight centuries, from 1066 to the late-nineteenth century. Local data regressions reveal that the largest estates in nineteenth-century England arose in areas where land was more concentrated in Norman times (cols. 1 and 3). In detail, increasing land concentration in 1086 by one percentage point is associated with an increase by 120 of the acreage of large landlords in the nineteenth century. At the county-level, I find that a one percentage point increase in the land owned by the top five landowners in 1086 is associated to an increase of 0.3 percentage points in the land owned by large landowners in the nineteenth century (cols. 5 and 7). The magnitude of the persistence in land inequality is very large. In terms of standard deviations, increasing land inequality in 1066 by one standard deviation would increase land inequality in the nineteenth century by half a standard deviation. In Table A.3, Appendix A.1, I show that this result does not hinge on an arbitrary definition of land inequality: choosing the share of land in the hands of the top five, top three, or top ten landowners yields similar estimates.

Overall, this finding is interesting in its own right, as it emphasizes that land inequality in England has deep historical roots.

Table 4: First-stage results.

	Local data analysis			**County-level analysis**		
Dep. Var:	Acres of large landlords in 1870s			Land concentration in 1870s		
	(1)	(2)	(3)	(5)	(6)	(7)
Land concentration in 1086	1.23***	-	1.16***	0.27***	-	0.26***
	(0.28)		(0.27)	(0.09)		(0.08)
Sandy and chalky soils	-	1.25***	1.13***	-	0.40**	0.40***
		(0.37)	(0.37)		(0.15)	(0.13)
Observations	486	486	486	32	32	32
F-stat	20.0	11.5	15.0	9.1	7.0	10.3

Note: In cols. (4) to (6), the sample comprises 25-mile radius around each of the 486 country seats of large landlords. In cols. (1) to (3), the sample is all counties in England fully surveyed in the *Domesday Book*. Acres of large landlords is in 100s of acres. *** p<0.01, ** p<0.05, * p<0.1.

In addition, first-stage results suggest that in areas where the soil exhibits poorer quality (i.e., sandy and chalky soils), larger estates emerge (cols. 2 and 3) and land becomes more concentrated (cols. 6 and 7). This relation between soil texture and land inequality is consistent with previous findings for India[34] and late-nineteenth century Prussia (Cinnirella and Hornung 2016). Finally, the F-statistic is large when using local variation. In the county-level specification, it is obviously smaller but above the standard threshold of 10.

6.2 Second-stage: Land concentration and state education

Local data. First, I estimate the effect of land inequality on state education using local data from 1,387 School Boards and 486 seats. Table 5 presents the corresponding second-stage estimates. Land concentration had a strong, negative effect on state education. Increasing the acreage of a landlord by one standard deviation (i.e., by 9,809 acres) would reduce tax rates set by the School Boards in a 25-miles range by 1.5 percentage points. Given that the average tax rate was only 2.54 percent, the estimated effects amount to a decrease of 59 percent.

Results are robust to including covariates that are potentially correlated with state education: employment in manufacturing, income per capita, percentage voting conservative and non-conformists, and religiosity (col. 2) and the distance to the closest industrial center and cathedral (col. 3). Furthermore, estimates are robust to collapsing the data at the seat level (col. 4) and to weighting each observation using the distance between School Boards and seats (col. 5). Finally, I include fixed-effects for each landlord (col. 6). The fixed effects are highly significant, suggesting that lord's characteristics had strong effects on state education. In the next Section, I will explore these characteristics and show that landlords with political power opposed education supply more effectively.

Note that the IV estimates are an order of magnitude larger than the OLS. A potential explanation is that culture is an ommitted variable that is positively correlated

[34] Bhalla 1988; Bhalla and Roy 1988; Benjamin 1995; Barrett, Bellemare, and Hou 2010

Table 5: IV estimates for the effect of landownership on state education, local data.

	Dep. Variable: Tax rates (%)					
	IV [1]	IV [2]	IV [3]	collapsed [4]	weighted [5]	FE [6]
Acreage of large landlord in 100s	-0.015*** (0.004)	-0.006*** (0.002)	-0.015*** (0.004)	-0.016*** (0.003)	-0.012*** (0.004)	-0.014*** (0.004)
F-stat, 1st stage	15.0	15.0	15.0	15.0	15.0	15.0
Observations	24,701	24,701	24,701	486	24,240	24,701
County controls	NO	YES	NO	NO	NO	NO
Local controls	NO	NO	YES	YES	YES	YES
FE	NO	NO	NO	NO	NO	Lord
Cluster s.e.	seat	seat	seat	-	seat	Lord

Note: The sample are 1,387 School Boards and 486 seats of large landlords. Each observation is a seat–School Board pair $\{s, b\}$, where School Board b is within 25 miles of seat s. In [4] observations are collapsed by seat and in [5] are weighted by the distance between School Board and seat. The Dep. Variable is the average tax rate set by School Board b in 1873–78. County controls are log income p.c., % voting conservative, % non-conformists, religiosity. Local controls are the distance from each School Board to the closest industrial city and to the closest cathedral (Table A.7 in Appendix A.1). Constants not reported; *** p<0.01, ** p<0.05, * p<0.1.

both with land inequality and state education. This is consistent with previous findings by Clark and Gray (2014), who show that culture in Northern Engand—where land inequality was also high—was strongly affected by the highly literate Scottish society, generating a demand for education. The IV model corrects for this omitted variable problem. Specifically, the Norman conquest is orthogonal to local differences in culture which could have affected state education (see discussion above).

County data. Next, I examine the effect of land inequality on a broader range of education measures by exploiting cross-county variation. Table 6 presents second-stage estimates of equation system 2 and 3. Counties in which land was more concentrated raised less funds from property taxes and received fewer Parliamentary grants (Panel A). Consequently, these counties under-provided state education: fewer School Boards were established and the system relied on existing Voluntary schools (i.e., private schools) rather than on state schools. Similarly, expenditure in state schools, expenditure per pupil, the number of teachers hired, and teacher's salaries were scarcer (Panel B). Note that land inequality had a strong effect on the number of classroom assistants. This suggests that the opposition of landowners to state education was more effective over more 'discretionary' expenditures. Finally, Panel

C shows that land inequality had important consequences for human capital accumulation: Children in counties where land was concentrated were less likely to pass the reading, writing and, especially, the arithmetics' national exam.

The magnitudes are large. Decreasing land concentration by one standard deviation (i.e., by 10 percentage points) would increase funds from property taxes, teacher's salaries, and the percentage of children passing arithmetics by half a standard deviation (30 pence per child, £4, and 2.6 percentage points, respectively) and expenditures per pupil by a third of a standard deviation (16 pence). These magnitudes are comparable to those estimated by OLS (see Table A.2 in Appendix A.1).

Finally, note that more industrial counties (i.e., counties with a large share of employment in manufacturing) raised more funds, had higher expenditures, and higher success rates in the national exams. The opposite effect of land concentration and manufacturing is consistent with two theories. On the one hand, it could reflect a clash between landed and industrial elites for the supply of state education (Lindert 2004; Galor and Moav 2006). On the other hand, it could be a byproduct of a higher demand for education in industrial aeras. Next, I investigate the mechanisms through which landownership concentration undermined human capital.

7 Mechanisms

This section investigates the mechanisms through which landownership concentration undermined human capital in late-nineteenth century England. First, I evaluate whether land concentration affected human capital through economic inequality or the political process. Second, I examine whether land inequality reduced education-supply or is associated with a low private demand for education.

7.1 Political inequality vs. economic inequality

In the previous section, I documented a negative effect of land concentration on state education. This effect could be the result of economic or political inequality (Ace-

Table 6: IV estimates for the effect of landownership on state education, by county.

Panel A. Funding (pence p.c.)	Rates	Grants	Fees	Other	Total
Land concentration (%)	-3.05**	-2.07**	-0.39	-0.05*	-7.12*
	(1.32)	(0.96)	(0.28)	(0.03)	(3.80)
Employed in manufacturing (%)	2.52***	1.92***	0.57***	0.07***	6.93***
	(0.42)	(0.32)	(0.10)	(0.02)	(1.05)
F-stat (1st-stage)	10.3	10.3	10.3	10.3	10.3
Observations	96	96	96	96	96
County controls	YES	YES	YES	YES	YES
Available reports	1871–94	1871–94	1871–94	1871–94	1871–94†

Panel B. Expenditures	Schools		Teachers			pence	
	School Boards	State to private	Cert. teacher	Class assist.	Teacher salaries‡	per pupil	for State school (pc)
Land conc.	-1.65**	-0.40	-20.11	-8.50***	-107.8*	-1.57**	-4.87*
	(0.73)	(0.46)	(15.11)	(3.00)	(65.1)	(0.78)	(2.74)
Emp. manu.	0.75	0.03	33.21**	3.33*	69.72**	0.20	3.36***
	(0.56)	(0.17)	(14.67)	(1.73)	(32.4)	(0.29)	(0.84)
F-stat (1S)	10.3	10.3	10.3	10.3	10.3	10.3	10.3
Obs.	96	96	96	96	32	96	64
County co.	YES	YES	YES	YES	YES	YES	YES
Av. reports	1871–94†	1879–98	1879–96	1884–98†	1878	1879–98	1879–94†

Panel C. Outcomes	% passes in			
	Reading	Writing	Arith.	Total
Land concentration (%)	-0.18*	-0.15*	-0.26***	-0.16**
	(0.10)	(0.08)	(0.09)	(0.07)
Employed in manufacturing (%)	0.10***	0.15***	0.19***	0.11***
	(0.02)	(0.03)	(0.03)	(0.02)
F-stat (1st-stage)	10.3	10.3	10.3	10.3
Observations	64	64	64	64
County controls	YES	YES	YES	YES
Available reports	1879–90	1879–90	1879–90	1879–90

Note: The sample consists of a panel of 32 counties and 3 decades (1870s, 1880s, and 1890s). I exclude the counties not fully surveyed in the *Domesday book*; i.e., Cumber, Durham, Lancaster, Monmouth, Northumber, Westmore, Middlesex, and Hants. Land concentration is the % of land in a county owned by large landowners (i.e., owners of 3,000 acres or more). Education measures are decade averages. County controls are log income p.c., % voting conservative, % non-conformists, religiosity. Constants not reported. Standard errors clustered by county; *** p<0.01, ** p<0.05, * p<0.1.

† These dependent variables are not available for some reports. See Table A.1 for details.

‡ Teacher's salaries are total expenditures in salaries (in 1878–79) divided by the average number of certificate teachers and class assistants (fem.) in the corresponding decade.

moglu, Bautista, and Robinson 2008). On the one hand, where economic inequality is high the poor may not invest in human capital (Banerjee and Newman 1993; Galor and Zeira 1993) and education supply may be dwarfed (Murphy, Shleifer, and Vishny 1989). On the other hand, the ownership of land was linked to political power. Therefore, land concentration reflects not only economic but also political inequality, in the sense that decisions are taken by a small landed elite. Landed elites may oppose state schooling, as human capital and agriculture are not complementary and also to reduce the mobility of the rural labor force (Galor and Moav 2006; Galor, Moav, and Vollrath 2009). In addition, since state education was mostly funded with property taxes, this opposition should be stronger where land is more concentrated (Thompson 1963: 208). Here, I disentangle economic and political inequality, and show that land concentration affected state education through the latter.

Disentangling political and economic inequality is a major empirical challenge, since they usually come hand in hand. To gauge the political power of landowners, I exploit the fact that England had a well-defined political elite, the peerage:

> It is hard to exaggerate the extent to which the [peerage] ruled Britain through its control over what we now call public offices. Both houses of Parliament were controlled by them until the turn of the twentieth century. The King's household, which evolved into the executive arm of the government, was the domain of the aristocracy, as were the great offices and tenures of state. The army and navy officers were drawn from the aristocracy, as were the judges, justices of the peace, and other local administrators. (Allen 2009: p. 301)

Importantly, this political elite is well-documented. Using `thepeerage.com`, I code the biographies of 369 large landlords (i.e., peers who owned 2,000 acres or more) and identify their appointments as MPs and/or the most important local offices: Lord Lieutenant, Deputy Lieutenant, High Sheriff, or Sheriff.

Formally, I estimate the IV model in equations (1) and (2) for two subsamples: School Boards in a 25-mile radius of a politically relevant landlord vs. School Boards in a 25-miles radius of a landlord who never held an important political office. If the effects are driven by economic inequality, land concentration should harm state education independently of the political power of landowners. In contrast, if the effects are driven by political inequality, School Boards under the influence of a politically relevant landlord should suffer more.

Table 7 presents the results. In the baseline specification, I find a strong negative effect of landownership on the tax rates set by School Boards (col. 1). The estimated effect disappears when the sample is restricted to landlords who were not elected Member of Parliament (MP). In other words, School Boards operated normally in areas with high economic inequality but where landowners were not politically relevant. Similarly, the ideology of these landowners significantly affected the supply of education near their domains. Increasing the landholdings of a nearby lord by one standard deviation (i.e., by 9,809 acres) would reduce tax rates by 0.5 percentage points for School Boards under the influence of a liberal landlord (col. 2), and by 1.6 percentage points for School Boards near a conservative landowner (col. 3).[35] In other words, the effect of landownership on state education is three times stronger for School Boards near Conservative landlords.

These results have to be taken with a grain of salt. First, because splitting the sample diminishes the strength of the instruments. To correct for weak instruments, I report confidence intervals based on Moreira's (2003) conditional likelihood ratio (CLR) approach.[36] The confidence intervals overlap, that is, the estimated effects are not statistically different across subsamples. Second, while being elected MP reflects political power, it mostly carries influence at the national level. In contrast, landlords who took over School Boards were likely those who held local political power (see Stephens 1998 for historical evidence).

In panel B, I address these issues by focusing on local political power. The baseline specification in column 1 reports, again, the main result of the paper: a strong negative effect of land inequality on the property tax rates set by School Boards. The estimated effect is much smaller for School Boards near landlords who were not

[35]Liberal landlords were members of a liberal party (Libs or Whigs) or a liberal political club (Brooks, Reform, or Devonshire). Conservatives were members of a conservative party (Tories and Unionists) or club (Carlton, Junior Carlton, Conservative, and St. Stephen's).

[36]In detail, I estimate an instrumental variables' model including all the covariates in the first stage and then calculate the corresponding CLR confidence intervals.

Table 7: Political mechanism, local data IV estimates.

	[1]	[2]	[3]	[4]
Panel A. Parliament	Dep. Variable: property tax rate (%)			
	baseline	no MP	Liberal MP	Tory MP
Acres of large landlord (in 100s)	-0.015***	-0.011	-0.005***	-0.016***
	(0.004)	(0.009)	(0.002)	(0.004)
Ho:	-	$\beta(1) = \beta(2)$	-	$\beta(4) = \beta(5)$
prob > χ^2	-	0.61	-	0.01**
95% c.i. (β)	[-0.02,-0.01]	-	-	-
CLR 95% c.i. (β)	-	[$-\infty$, $+\infty$]	[-0.01,-0.00]	[-0.03,-0.01]
F-stat (first-stage)	15.0	3.6	8.7	5.9
Observations	24,701	13,668	3,506	5,785
Controls	local	local	local	local
Panel B. Local power	Dep. Variable: property tax rate (%)			
		local appointments		
	baseline	none	none in England	
Acres of large landlord (in 100s)	-0.015***	-0.009***	-0.010***	
	(0.004)	(0.003)	(0.003)	
Ho:	-	$\beta(1) = \beta(2)$	$\beta(1) = \beta(3)$	
prob > χ^2	-	0.03**	0.048**	
F-stat (first-stage)	15.0	13.2	14.8	
Observations	24,701	10,754	12,188	
Controls	local	local	local	

The baseline sample is as in Table 5. Cols. 2 to 4 restrict the sample to landlords older than 21 in 1882. Local controls are the distance from each School Board to the closest industrial city and to the closest cathedral. Conditional likelihood ratio (CLR) 95% c.i. are reported when instruments are weak. Standard errors clustered by seat; *** p<0.01, ** p<0.05, * p<0.1.

appointed to a local post (col. 2). A Wald test confirms that the two estimated coefficeints are different. In other words, the work of School Boards was more distorted where landowners controled local political offices than where they did not, independently of the level of economic inequality.

Admittedly, landlords who did and did not hold political power are intrinsically different. To address this issue, I consider landlords who were not appointed to a local post in England, even though many were Lord Lieutenants, Sheriffs, etc. in Ireland or Scotland, far away from their estates. In other words, these landlords were politically relevant, but lacked the power to influence decisions around their estates. The estimated coefficient is similar to that in column 2, and significantly lower than the baseline estimate. That is, landlords could take over School Boards more effectively if they held political power in the area where the latter operated.

In sum, the evidence suggests that landownership affected state education through the political process rather than through economic inequality. In other words, considerable *de facto* political power was required for transforming economic inequality into unequal education provision.

7.2 Demand vs. supply

So far I argued that the estimated effects reflect the opposition of landed elites to education supply. These estimates, however, could also be explained by a lower private demand for education in areas where land was more concentrated. This demand channel has been emphasized in other settings. For example, in the United States and in South America the demand for education was lower where inequality was high and the franchise was restricted.[37] Late-nineteenth century England seems to fit into this story. Although two in three males were enfranchised by 1884, landownership was still a condition to vote,[38] and hence, where land was concentrated the franchise was more restricted. Was the demand for education also lower in these areas?

To gauge the demand for education and disentangle it from education supply, I first estimate the effect of land inequality on education-demand measures (e.g., attendance) and education-supply measures (e.g., schools) separately. Next, I estimate the elasticity of attendance and enrolement to a shock that increased education supply nationwide: the Free Grant Act of 1891. I find that the elasticity of education demand was not lower where land inequality was prominent.

Education-demand and land inequality. Using county-level data before 1891, I estimate the IV model in equations (2) and (3) with the number of pupils enroled, attending, and presented for examination as dependent variables.[39] These variables likely reflect education-demand. From 1880, education was compulsory between ages 5–11. However, the law exempted children who had reached standard iv and those

[37] Acemoglu and Robinson (2000), Engerman and Sokoloff (2000), Mariscal and Sokoloff (2000), Gallego (2010), and Go and Lindert (2010).

[38] Men paying an annual rental of £10 and owners of land valued at £10 had the vote.

[39] As these variables depend on the number of children, I add children aged 5–15 as a covariate.

who lived more than two miles from a school, as did many rural children. Hence, high enrolment and attendence indicates a large private demand for education in rural areas. In addition, examinees over age 10 and examinees for standards v–vii capture non-compulsory education demand.

Table 8 presents the results. The estimates for enrolment, attendence, examinees under age 10, and for standards i–iv are mostly non-significant but positive. This suggests that, if anything, there was not a lack of education-demand in rural areas with land inequality. Similarly, land inequality has a positive and significant effect on non-compulsory education-demand (i.e., examinees over age 10 and for standards v–vii). The magnitudes, however, are small. For example, increasing land inequality by one standard deviation (i.e., by ten percentage points) would increase the examinees over age 10 by 0.05 standard deviations (i.e., by 1,351).

Table 8: Demand vs. supply variables, cross-county IV estimates.

			Presented for exam				PCA	
	Pupils enroled	Pupils attend.	under ten	over ten	Stand. i–iv	Stand. v–vii	dem.	supply
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Land concentration	301.5	97.4	79.9	135.1*	184.2*	64.8**	0.004*	-0.042***
	(209.9)	(150.7)	(57.3)	(69.6)	(98.6)	(29.8)	(0.002)	(0.016)
Ho:	-	-	-	-	-	-		$\beta(7)=\beta(8)$
$prob>\chi^2$:	-	-	-	-	-	-		0.004***
F-stat, 1S	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
Obs.	96	96	64	64	64	64	64	64
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Reports	1879-91	1879-90	1879-90	1879-90	1879-90	1883-90	-	-

Note: The sample is a panel of counties and decades. In cols. 7 and 8, the Dep. Variable is the (standarized) first component of a principal components analysis (PCA) with variables reflecting education demand and supply. Controls are % in manufacturing, log income p.c., % voting conservative, % non-conformists, religiosity, and children aged 5–15. Constants not reported. Standard errors clustered by county; *** p<0.01, ** p<0.05, * p<0.1.

Next, I compare the demand and supply channels. I define two indexes based on the first principal component from, respectively: the aforementioned education-demand measures; and measures capturing education supply.[40] Both indexes are standardized to have zero mean and standard deviation equal to one. The demand

[40] Specifically, I consider the number of School Boards, the ratio of state to private schools, teachers hires, class assistants, expenditures per pupil and per state school.

for education is positively affected by land concentration, although the magnitude is small (col. 7). In contrast, land inequality has a strong, negative effect on education supply (col. 8). Increasing land inequality by one standard deviation would decrease by 0.4 standard deviations the index of education supply. Wald tests confirm that the effect of landownership on education supply is larger than on education demand.

Elasticity estimates. The previous education-demand variables could be partly affected by supply factors. For example, underinvestment in education may result in larger pupil-teacher ratios or lower quality of education, which, in turn, may reduce enrolment or attendance. Here, I disentangle demand from supply factors by exploiting a supply-shock that increased education funds nationwide, independently of regional differences in land inequality: the Free Grant Act of 1891. I use this shock to estimate the elasticity of education demand to the funds invested in state-schooling. Then, I compare elasticities in counties with high vs. low land inequality.

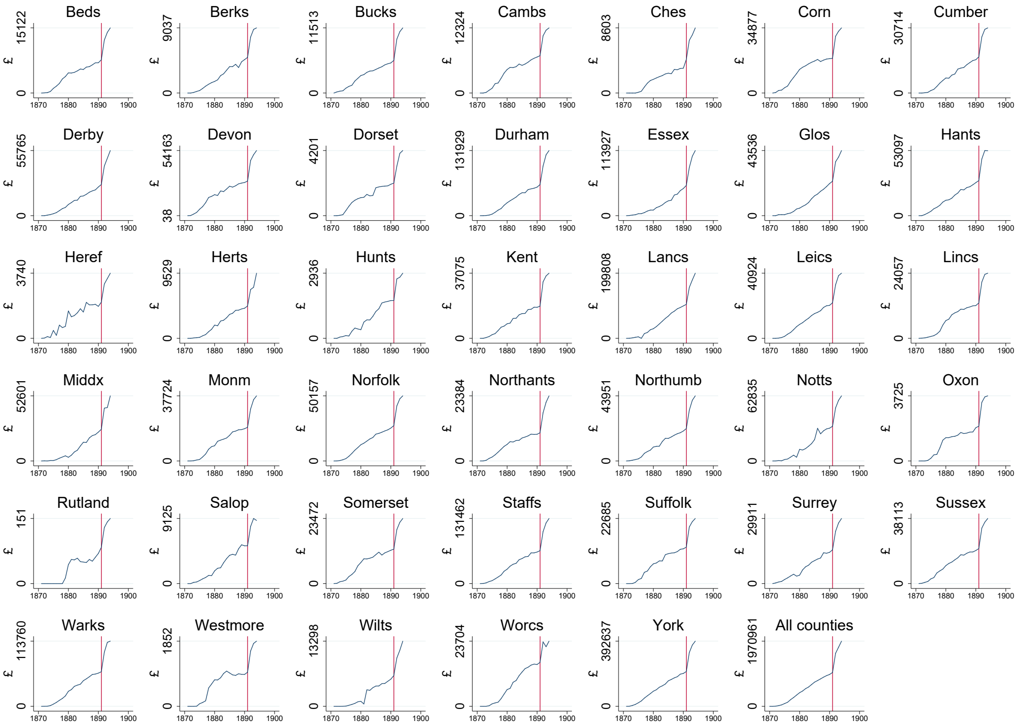
The Free Grant Act increased Parliamentary grants annually by 10 shillings per children aged 3–15. In the average county, grants increased by 57.5 percent, which constitutes a substantial shock to education supply. More importantly, the Act was implemented nationwide, and hence, the shock was orthogonal to differences in landownership concentration. Figure 4 illustrates this by plotting Parliamentary grants overtime, by county. Counties with high and low land concentration saw similar increases after 1891. In Rutland, where 70 percent of the land was in the hands of large landowners, grants increased by 54.7 percent. Similarly, in Cambridgeshire grants rose by 53.1 percent, even if land concentration was *only* 24 percent. Overall, the growth rate of grants displays a small standard deviation (0.06) and is uncorrelated with landownership concentration (-0.02).

I estimate the elasticity of education demand using a two-stage least square regression of the form

$$\log demand_{c,p} = a + e \cdot \log funds_{c,p} \ + \ \mu_c \ + \ \nu_{c,p} \ , \tag{4}$$

where c indexes counties and p denotes the period (before and after the Free Grant Act). Variables are at their 1891 values for the period ‘before’, and at the average

Figure 4: Supply shock after the Free Grant Act (1891)



Notes: The figure plots Parliament grants overtime. The vertical line indicates the Free Grant Act.

value in 1892–95 for the period 'after'. This allows a longer time horizon for the demand response. The variable $demand_{c,t}$ is either attendence or enrolment, $funds_{c,t}$ are total education funds per child, and μ_c are county fixed effects. The log of $funds_{c,t}$ is instrumented with the log of Parliament grants per child, which increased exogenously after the Free Grant Act. The coefficient e, hence, captures the elasticity of the demand for education to the funds invested in state-schooling.

Table 8 reports estimates of equation 4. In Col. 1, I consider all 40 counties.[41] Elasticities are large and precisely estimated: a one percent increase in education funds increases enrolment and attendance by 0.37 and 0.53 percent respectively. In cols. 2 to 4, I test whether the elasticity of education demand was lower where land concentration was high. This would reflect a lack of private demand for education. Specifically, I split the sample into counties with land concentration below or above the median. Elasticities are almost identical across samples: 0.38 vs. 0.37 for enrolment and 0.54 vs. 0.53 for attendance. Wald tests cannot reject that the estimated

[41]The number of counties is larger than the baseline sample (N=32) because here I can include counties not fully surveyed in the *Domesday book*.

elasticities are the same in counties with low and high land inequality (col. 4).

Altogether, these results show that where land was concentrated the demand for education was not lacking. The estimated negative effects of landownership concentration, hence, reflect the opposition of landed elites to education supply.

Table 9: Demand elasticity estimates.

	[1] All	[2] Low land concentr.	[3] High land concentr.	[4] Ho: $e(2)=e(3)$
Panel A. Second-stage:				
elasticity enroled	0.37***	0.38***	0.37***	p-val.=0.85
	(0.03)	(0.05)	(0.04)	
elasticity attend	0.53***	0.54***	0.53***	p-val.=0.88
	(0.04)	(0.07)	(0.04)	
Panel B. First-stage (Dep. variable: log *education funds*):				
log *Parliament grants*	0.32***	0.33***	0.31***	-
	(0.03)	(0.05)	(0.04)	
F-stat	171.3	92.46	291.6	-
Observations	80	40	40	80
County FE	YES	YES	YES	YES

Note: The table displays elasticity estimates based on equation 4. The sample is a panel of 40 counties in two periods: before and after the Free Grant Act. All variables are at their 1891 values for the period ‘before’, and at the average values in 1892–95 for the period ‘after’. *Parliament grants* and *education funds* are pence per child. In cols. 2 and 3 the sample is split by counties below and above the median land concentration (40 percent); *** p<0.01, ** p<0.05, * p<0.1.

8 Conclusion

At the dawn of the Second Industrial Revolution, England failed to educate their workforce (Sanderson 1995). I show that this was the result of the opposition of entrenched, landed elites to the supply of state education. Using a new database on 1,387 School Boards and 40 counties between 1871 and 1899, I find that landownership concentration had a strong, negative effect on various dimensions of state education, such as funds raised from property taxes, schools built, teachers hired, expenditures, or exam results. I address endogeneity concerns by adopting an instrumental variables approach based on soil texture and the Norman conquest of 1066. Finally, I examine the causal channels through which land inequality undermined state education. The effects are larger where landowners were prominent political figures than where land concentration only reflects economic inequality. In contrast, the elasticity of education demand to education funds was not lower where landownership was more concentrated. This suggests that the detrimental effects of land inequality on human capital were engendered by the political opposition of landed elites to education supply rather than by economic inequality or the lack of private demand for education where land was concentrated.

These findings contribute to a vast literature that studies the long-run consequences of inequality on human capital. Previous research has shown that inequality in the form of landownership concentration slowed down the introduction of state education in agrarian economies like the US South (Vollrath 2009), the plantation economies in the Caribbean (Engerman and Sokoloff 2000), and South America (Coastworth 1993; Nugent and Robinson 2010). Here I show that land inequality can also distort state education in an industrialized economy like late-nineteenth century England. This suggests that landownership concentration, by affecting human capital formation, is an important factor for the economic and demographic changes that began after the Industrial Revolution. Furthermore, my results are consistent with the idea that old landed elites opposed and emerging industrialists supported the supply of state education (Galor and Moav 2006; Galor, Moav, and Vollrath 2009). In contrast, my findings do not support the idea that land inequality is associated with a lack of private demand for education. In other words, the private demand for education was not the binding factor for state-schooling in England.[42]

By disentangling the causal mechanisms through which land inequality undermined human capital, this paper has important implications for policies aimed redistribution, human capital formation, or public delivery systems. Specifically, my findings suggest that engaging the formal, local elites might lead to capture, even in industrializing contexts with considerable extension of the franchise. In late-nineteenth century England, two in three males had the vote. However, entrenched, landed

[42] Acemoglu and Robinson (2000), Engerman and Sokoloff (2000), Mariscal and Sokoloff (2000), Gallego (2010), and Go and Lindert (2010).

elites still retained *de facto* political power to oppose the supply of state education. In other words, extended suffrage *alone* did not act as a constraint on elite capture.

Finally, my paper emphasizes the "deep roots" of inequality (Clark et al. 2014). Specifically, I document a strong persistence in land inequality over eight centuries, from the Norman conquest of 1066 to the late-nineteenth century. On the one hand, this raises important questions for future research. To what extent the current land inequality in England (Cahill 2001) can be traced back to the Normans? Which are the mechanisms through which landed elites persisted over centuries, despite structural economic transformations such as the Industrial Revolution? On the other hand, my paper represents a first step in the direction of using historical shocks and critical junctures as sources of exogenous variation in inequality. This approach opens a new range of possibilities to study the causal effects of inequality on public policy or economic growth.

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Online Appendix

Appendix A. Additional figures and tables

Figure A.1: Report from the Committee of Council in Education, 1883–84

Panel A: Funding

School Board and County.	INCOME. 1. Grants from the Committee of Council on Education.	2. Amount paid to the Treasurer by the Rating Authority.	2. Equivalent to a Rate per £ on the Rateable Value of the District, of	3. School Fees, and Books, &c. sold to Children.	4. Endowment.	5. Contributions in aid of Industrial Schools.	6. Loans.	7. Income arising from other Sources.	Total Receipts.
BERKS.	£ s. d.	£ s. d.	d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Reading -	1,576 12 3	4,600 0 0	7·	646 11 7	- -	- -	4,104 0 0	- -	10,927 3 10
Balking -	50 0 6	40 0 0	1·75	11 8 7	- -	- -	- -	- -	101 9 1
Chieveley -	116 5 0	{ 180 0 0 { 43 15 0	6· —	} 41 18 0	22 7 11	- -	- -	1 9 6	405 15 5
Cholsey -	151 14 4	120 0 0	2·25	71 11 5	- -	- -	- -	- -	343 5 9
Earley -	421 19 9	850 0 0	8·75	153 13 6	- -	- -	- -	- -	1,425 13 3
East Ilsley -	80 18 1	60 0 0	3·5	31 8 10	- -	- -	- -	4 2 5	176 9 4
Inkpen -	65 10 0	130 0 0	9·5	33 10 10	- -	- -	- -	4 8 3	233 9 1
Leckhampstead -	30 5 0	60 0 0	6·	12 8 10	12 7 11	- -	- -	17 1	115 18 10
SuttonCourtney	- -	20 0 0	1·	- -	- -	- -	- -	- -	20 0 0
Tilehurst -	172 1 0	300 0 0	2·75	96 7 3	- -	- -	- -	- -	568 8 3
Total -	2,665 5 11	6,403 15 0	- -	1,098 18 10	34 15 10	- -	4,104 0 0	10 17 3	14,317 12 10

Panel B: Expenditures

EXPENDITURE. Expenses 1. of Administration. Election Expenses.	1. Salaries of Officers of the Board.	1. Legal and other Expenses of Administration.	2. Expenses of Maintenance of Public Elementary Schools.	3. Contributions towards, or Expenses of, Industrial Schools.	4. Capital Charges. Purchase of Land, and Erection, Enlargement, or Alteration of School Buildings.	4. Furnishing School Buildings.	5. Loans. Repayment of Principal of Loans.	5. Interest on Loans.	6. Expenses not included under foregoing Heads.	Total Expenditure.	Liabilities on 29th September 1883. For Loans.	Other Liabilities.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
10 13 6	369 14 4	127 2 5	5,038 15 8	22 16 6	3,499 9 0	608 15 8	418 15 10	850 19 2	- -	10,947 2 1	25,645 14 10	—
- -	10 0 0	3 4 10	91 18 8	- -	- -	- -	- -	- -	- -	105 3 6	- - -	18 3 7
- -	22 10 0	26 4 11	376 5 2	- -	2 18 0	- -	- -	- -	- -	427 18 1	- - -	43 8 3
- -	37 6 8	7 14 6	289 6 4	- -	- -	- -	15 11 6	52 12 6	- -	402 11 6	1,488 0 0	15 17 9
- -	95 0 0	13 16 7	1,036 0 0	- -	- -	- -	51 1 9	142 4 6	- -	1,338 2 10	4,025 2 8	—
- -	4 0 0	3 1 1	137 18 10	- -	- -	- -	- -	- -	- -	144 19 11	- - -	54 11 5
- -	10 0 0	2 5 6	160 3 8	- -	- -	- -	12 7 2	44 19 1	- -	229 15 5	1,271 18 6	—
- -	12 0 0	2 2 0	84 8 8	- -	- -	- -	4 2 5	14 19 7	- -	117 12 8	423 17 2	3 5 8
- -	10 0 0	4 3 7	- - -	- -	- -	- -	- -	- -	- -	14 3 7	—	—
- -	123 19 0	11 3 9	446 0 4	- -	- -	3 0 0	70 3 6	105 19 3	- -	740 5 10	2,596 9 6	—
10 13 6	674 10 0	200 19 2	7,660 17 4	22 16 6	3,502 7 0	611 15 8	572 2 2	1,211 14 1	- -	14,467 15 5	35,451 2 8	135 6 8

Panel C: Outcomes

County.	Accommodation.	Number of Scholars on Registers.	Average Number of Scholars in Attendance.	Number of Scholars presented for Examination: Under Ten Years.	Over Ten Years.	In Standards I.—III.	IV.	V.	VI.	VII.	Number of Scholars presented, Ex. Standard VI.	Per-centage of Scholars who passed in Reading.	Writing.	Arithmetic.
Bedford - -	30,627	25,949	19,671	7,370	6,143	10,355	1,988	849	318	3	40	82·78	80·63	78·24
Berkshire - -	41,057	36,740	28,713	10,021	9,786	14,086	3,331	1,762	588	40	25	85·68	81·98	74·84
Buckingham -	36,422	32,698	23,949	8,714	8,055	12,564	2,638	1,090	433	44	41	84·39	78·11	76·58
Cambridge -	36,224	32,121	23,197	8,878	7,811	12,530	2,519	1,137	432	71	27	86·57	76·97	73·00

Figure A.2: Lord Lyttelton, Bateman's *Great Landowners*

*** LYTTELTON, Lord, Hagley Hall, Stourbridge. 𝕾.			
Coll. Eton, Trin. Cam.	Worcester . .	5,907 .	9,170
Club. Brooks's.	Hereford . .	1,032 .	1,093
b. 1842, s. 1876, m. 1878.			
Sat for E. Worcestershire.		6,939 .	10,263

Notes: The last two columns correspond to acreage and annual land rents respectively.

Figure A.3: Henry Herbert, 4th Earl Carnavon, thepeerage.com

Henry Howard Molyneux Herbert, 4th Earl of Carnarvon

M, #60563, b. 24 June 1831, d. 28 June 1890

Last Edited=23 Jul 2014
Consanguinity Index=0.0%

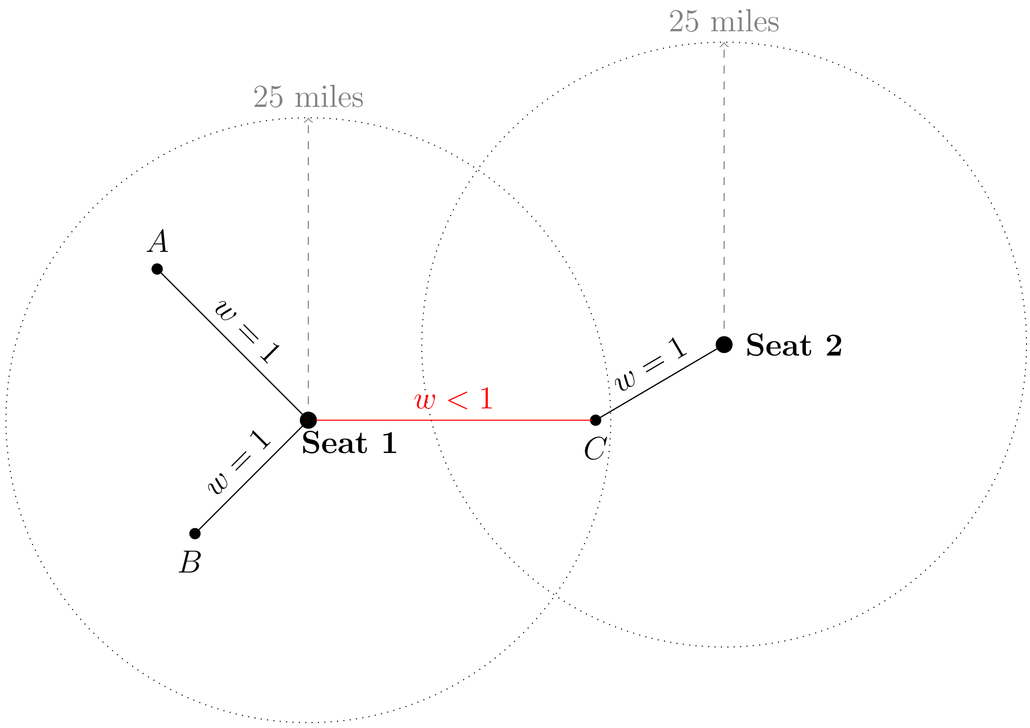
Henry Herbert, 4th Earl of Carnarvon [1]

Henry Howard Molyneux **Herbert**, 4th Earl of Carnarvon was born on 24 June 1831 at Grosvenor Square, London, England.[2] He was the son of Henry John George **Herbert**, 3rd Earl of Carnarvon and Henrietta Anna **Howard**.[3] He married, firstly, Lady Evelyn **Stanhope**, daughter of George **Stanhope**, 6th Earl of Chesterfield and Hon. Anne Elizabeth **Weld Forester**, on 5 September 1861 at Westminster Abbey, Westminster, London, England.[4] He married, secondly, Elizabeth Catherine **Howard**, daughter of Henry **Howard** and Charlotte Caroline Georgina **Long**, on 26 December 1878.[5] He died on 28 June 1890 at age 59 at 43 Portman Square, London, England.[6] He was buried at Highclere Castle, Newbury, Berkshire, England.[6] His will was proven (by probate), at £313,259 gross and £242,419 net.[6]

He was styled as *Lord Porchester* between 1833 and 1849.[2] He was educated between 1844 and 1848 at Eton College, Windsor, Berkshire, England.[7] He matriculated at Christ Church, Oxford University, Oxford, Oxfordshire, England, on 17 October 1849.[2] He succeeded to the title of *4th Earl of The Town and County of Carnarvon [G.B., 1793]* on 10 December 1849.[5] He succeeded to the title of *4th Baron Porchester of Highclere, co. Southampton [G.B., 1780]* on 10 December 1849.[5] He graduated from Christ Church, Oxford University, Oxford, Oxfordshire, England, in 1852 with a Bachelor of Arts (B.A.)[2] He held the office of Constable of Carnarvon Castle in 1854.[2] He held the office of Under-Secretary of State for the Colonies between 1858 and 1859.[2] He held the office of High Steward of Oxford University between 16 April 1859 and 1890.[2] He was awarded the honorary degree of Doctor of Civil Law (D.C.L.) by Oxford University, Oxford, Oxfordshire, England, on 10 June 1859.[2] He was awarded the honorary degree of Doctor of Law (LL.D.) by Cambridge University, Cambridge, Cambridgeshire, England, on 3 June 1864.[2] He held the office of Secretary of State for the Colonies between 1866 and 1867.[5] He was invested as a Privy Counsellor (P.C.) on 6 July 1866.[2] He held the office of Secretary of State for the Colonies between February 1874 and February 1878.[5] He was invested as a Fellow, Royal Society (F.R.S.) on 8 April 1875.[2] He was invested as a Fellow, Society of Antiquaries (F.S.A.) on 6 April 1876.[2] He held the office of President of the Society of Antiquaries between 1878 and 1885.[2] He held the office of Deputy Lieutenant (D.L.) of Nottinghamshire.[5] He gained the rank of Honorary Colonel in the service of the 2nd Volunteer Battalion, Hampshire Regiment.[5] He held the office of High Steward of Newbury in 1884.[2] He held the office of Lord-Lieutenant of Ireland between June 1885 and January 1886.[2] He held the office of Lord-Lieutenant of Hampshire between 1887 and 1890.[5]

He was "very cultivated and refined, he has a manner which is too mincing to inspire confidence... he wants both grip and grit."[6]

Figure A.4: Example for the weights used in Table 1, col. 5



Notes: In this example I consider three School Boards (A, B, and C) and two seats. In the baseline specification, I treat each pair A-Seat1, B-Seat1, C-Seat1, and C-Seat2 as a different observation. Note that, as the 25-mile radius around Seat 1 and Seat 2 overlap, C is paired twice, once with Seat 1 and once with Seat 2. In contrast, in Table 1, col. 5, I weight each School Board-seat pair with $w_{s,b} = \frac{d_{s,b}}{dmin_b}$, where $d_{s,b}$ is the distance between School Board b and seat s and $dmin_b$ is the shortest distance between b and any seat in the sample. In this example, the pairs A-Seat1, B-Seat1, and C-Seat2 have a weight equal to one. In contrast, since $dist_{Seat\ 1,C} > dmin_C = dist_{Seat\ 2,C}$ the pair C-Seat1 receives a lower weight. The underlying assumption is that the influence of a lord over a School Board decreases with distance, so C-Seat1 should weight less than C-Seat2.

Figure A.5: Soil texture instruments.

(a) Soil texture; local data

(b) Soil texture; county data

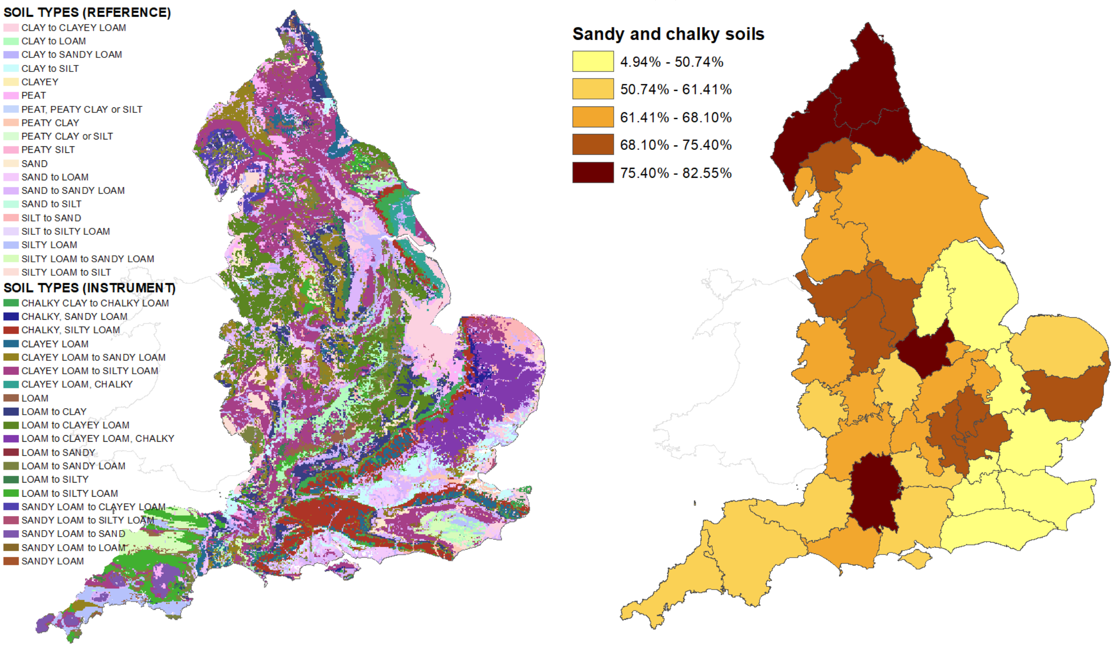
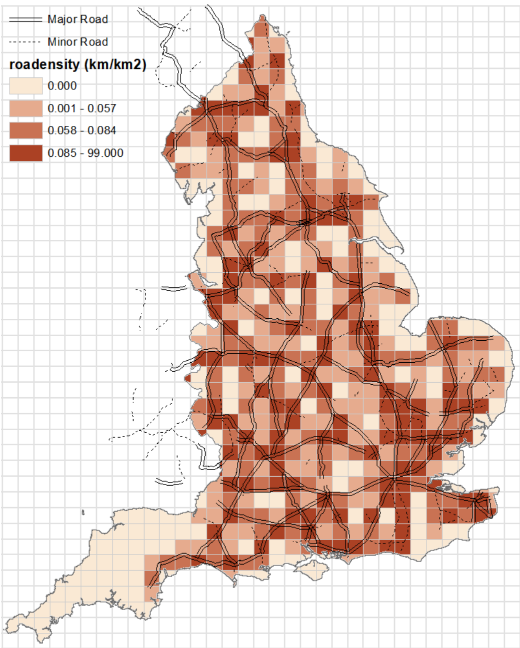
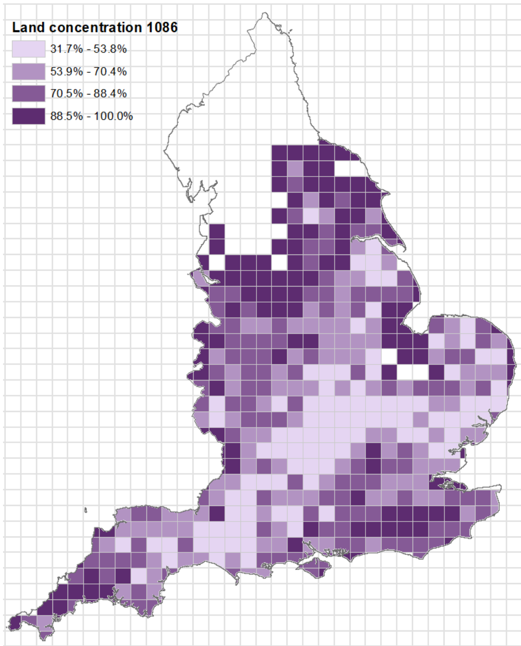


Figure A.6: Roman roads and the Norman land redistribution

(a) Roman roads



(b) Landownership after 1066



Notes: Data on roman roads is from McCormick et al. (2013).

Table A.1: Descriptive statistics.

	mean	sd	N	variation	available reports	unit
Panel A: Education.						
A1. Funding:						
Tax rate	2.54	2.20	1,387	School Board	1873–78	average %
Property tax funds	72.2	65.3	120	county×decade	1871–94	pence per child
Parliamentary grants	44.1	49.7	120	county×decade	1871–94	pence per child
Fees and books sold	16.0	14.7	120	county×decade	1871–94	pence per child
Total incomes	176.3	188.0	120	county×decade	1871, 1878–94	pence per child
A2. Expenditures:						
School Boards	34.41	38.01	120	county×decade	1871–1894*	number
State to private schools	35.23	20.75	120	county×decade	1879–98	ratio
Certificate teachers	896.5	1089	120	county×decade	1879–96	number
Class assistants	167.3	149.4	120	county×decade	1884–98†	number
Salaries teachers (tot.)	22,689	52,457	40	county	1878	pounds
Expen. per pupil	467.0	46.4	120	county×decade	1879–98	pence per child
Expen. on state schools	146.9	86.4	80	county×decade	1879–94‡	pence per child
A3. Outcomes:						
Reading exam	90.89	3.45	80	county×decade	1879–90	% passing
Writting exam	82.29	3.80	80	county×decade	1879–90	% passing
Arithmetics exam	78.08	4.72	80	county×decade	1879–90	% passing
A4. Demand:						
Enroled	98,158	128024	120	county×decade	1879–96	number
Pupils attending	76,678	99,362	120	county×decade	1879–90	number
Examinees (under 10)	22,773	29,671	80	county×decade	1879–90	number
Examinees (over 10)	25,097	34,291	80	county×decade	1879–90	number
Examinees (Std. i-iv)	32,264	41,628	80	county×decade	1879–90	number
Examinees (Std. v-vii)	16,938	24,026	80	county×decade	1883–90	number
Panel B: Land concentration and political power.						
Land concentration	40.99	10.68	40	county	-	% in county
Acreage of large landlord	7,843	9,809	486	lord's seat	-	acres in county
Large landlord is MP	41.2	49.3	369	lord	-	%
Large landlord, local power	74.3	81.5	369	lord	-	%
Panel C: Instruments.						
Land concentration (1086)	37.22	17.15	32	county	-	% in county
Sandy and chalky soils	62.58	14.04	39§	county	-	% in county
Land concentration (1086)	33.26	15.87	486	lord's seat	-	% in 25 mi.
Sandy and chalky soils	60.69	11.91	486	lord's seat	-	% in 25 mi.

* Not available for 1887, 1889, and 1892.
† Not available for 1895 and 1896.
‡ Not available for 1880.
§ Monmouthshire not considered as nowadays is part of Wales.
Note: The sample of counties are all counties in England. Note that this is different from the sample used in the regression analysis, which excludes counties not fully surveyed in the Domesday book. Reports refer to academic years; e.g., the 1878 report refers to the academic year 1878–79. Land concentration is the percentage of a county's land in the hands of large landowners (i.e., owners of 3,000 acres or more). Large landlords are peers who own 2,000 acres or more. Acreage of large landlord are the acres in the county where his seat is located. Local power indicates appointments to Lord Lieutenant, Deputy Lieutenant, High Sheriff, or Sheriff. Land concentration after 1066 is the percentage of the total land value in the hands of the top five landowners, excluding the King and the Church. Examination standards are in Table A.3.

Table A.2: OLS estimates, by county

Panel A. Funding (pence per child)

	Rates	Grants	Fees	Other	Total
Land concentration (%)	-1.98***	-1.38***	-0.23	-0.05***	-4.50**
	(0.69)	(0.46)	(0.15)	(0.02)	(2.14)
Employed in manufacturing (%)	2.50***	1.91***	0.57***	0.07***	6.88***
	(0.41)	(0.32)	(0.10)	(0.02)	(1.05)
Observations	96	96	96	96	96
Adjusted-R2	0.362	0.333	0.344	0.241	0.320
County controls	YES	YES	YES	YES	YES
Available reports	1871–94	1871–94	1871–94	1871–94	1871–94†

Panel B. Expenditures

	Schools		Teachers			pence	
	School Boards	State to private	Cert. teacher	Class assist.	Teacher salaries‡	per pupil	for State school (pc)
Land conc.	-0.90**	-0.59***	-14.54*	-4.01***	-81.78**	-0.73**	-3.26***
	(0.38)	(0.20)	(7.56)	(1.09)	(31.24)	(0.30)	(1.15)
Emp. manu.	0.74	0.03	33.26**	3.37*	71.36*	0.21	3.36***
	(0.59)	(0.15)	(15.03)	(1.74)	(35.34)	(0.28)	(0.85)
Observations	96	96	96	96	32	96	64
Adjusted-R2	0.216	0.377	0.230	0.243	0.440	0.394	0.382
County co.	YES	YES	YES	YES	YES	YES	YES
Av. reports	1871–94†	1879–98	1879–96	1884–98†	1878	1879–98	1879–94†

Panel C. Outcomes

	% passes in			
	Reading	Writing	Arith.	Total
Land concentration (%)	-0.11**	-0.08**	-0.14***	-0.10***
	(0.04)	(0.04)	(0.03)	(0.02)
Employed in manufacturing (%)	0.10***	0.15***	0.19***	0.11***
	(0.03)	(0.03)	(0.03)	(0.02)
Observations	64	64	64	64
Adjusted-R2	0.270	0.410	0.415	0.483
County controls	YES	YES	YES	YES
Available reports	1879–90	1879–90	1879–90	1879–90

Note: The sample consists of a panel of 32 counties and 3 decades (1870s, 1880s, and 1890s). I exclude the counties not fully surveyed in the *Domesday book*; i.e., Cumber, Durham, Lancaster, Monmouth, Northumber, Westmore, Middx, and Hants. Land concentration is the % of land in a county owned by large landowners (i.e., owners of 3,000 acres or more). Education measures are decade averages rather than annual values. County controls are log income, % voting conservative, % non-conformists, religiosity. Constants not reported. Standard errors clustered by county; *** p<0.01, ** p<0.05, * p<0.1. † These dependent variables are not available for some reports. See Table A.1 for details. ‡ Teacher's salaries are total expenditures in salaries (in 1878–79) divided by the average number of certificate teachers and class assistants (fem.) in the corresponding decade.

Table A.3: First-stage results using top 3, top 5, top 10 Norman landowners.

	(1)	(2)	(3)	(4)	(5)
Panel A. Local data analysis					
	Dep. Var.: Acreage of large landlords in 19C (100s)				
Land concentration in 1086 (%)					
top five (baseline)	1.23***	-	1.16***		
	(0.28)		(0.27)		
top three				1.10***	
				(0.29)	
top ten					1.19***
					(0.27)
Sandy and chalky soils (%)	-	1.25***	1.13***	1.11***	1.22***
		(0.37)	(0.37)	(0.37)	(0.36)
Observations	486	486	486	486	486
R-squared	0.040	0.023	0.058	0.052	0.061
F-stat	20.0	11.5	15.0	13.3	15.8
Panel B. County-level analysis					
	Dep. Var.: Land concentration in 19C (%)				
Land concentration in 1086 (%)					
top five (baseline)	0.27***	-	0.26***		
	(0.09)		(0.08)		
top three				0.26***	
				(0.08)	
top ten					0.26***
					(0.08)
Sandy and chalky soils (%)	-	0.40**	0.40***	0.39***	0.39***
		(0.15)	(0.13)	(0.13)	(0.13)
Observations	32	32	32	32	32
R-squared	0.23	0.19	0.42	0.39	0.41
F-stat	9.1	7.0	10.3	9.5	9.9

Note: In panel A, the sample comprises 25-mile radius around each of the 486 country seats of large landlords (i.e., peers who owned 2,000 acres or more in the 1880s). In panel B, the sample is all counties in England fully surveyed in the *Domesday Book*. Land concentration in 1066 is the share of land value in each geographical region that is owned by the top five, top three, and top ten Norman noble landlords respectively. *** p<0.01, ** p<0.05, * p<0.1.

Table A.4: Elementary Education Acts, 1870 to 1902.

Year	Act	Description
1870	Education Act	Introduction of state-schooling.
1873	Education Act	School attendance condition for outdoor relief.
1876	Sandon's Act	Creates School Attendance Committees.
1879	Industrial School	School Boards to manage Industrial Schools.
1880	Mundella's Act	Attendance compulsory for children aged 5–10. Children living two miles away from a school or those who had reached standard IV.
1890	Education Code	Reform of the standards of education.
1891	Free Grant	Virtually establishes free elementary schooling.
1893	Blind and Deaf	Special schools for blind and deaf children.
1893	School Attendance	Attendance compulsory for children aged 5–11.
1899	School Attendance	Attendance compulsory for children aged 5–12.
1902	Balfour's Act	Abolishes School Boards.

Source: Stephens (1998).

Table A.5: Examination standards

Standard i	
Reading	One of the narratives next in order after monosyllables in an elementary reading book used in the school.
Writing	Copy in manuscript character a line of print, and write from dictating a few common words.
Arithmetic	Simple addition and subtraction of numbers of not more than four figures, and the multiplication table to multiplication by six.
Standard ii	
Reading	A short paragraph from an elementary reading book.
Writing	A sentence from the same book, slowly read once, and then dictated in single words.
Arithmetic	The multiplication table, and any simple rule as far as short division (inclusive).
Standard iii	
Reading	A short paragraph from a more advanced reading book.
Writing	A sentence slowly dictated once by a few words at a time, from the same book.
Arithmetic	Long division and compound rules (money).
Standard iv	
Reading	A few lines of poetry or prose, at the choice of the inspector.
Writing	A sentence slowly dictated once, by a few words at a time, from a reading book, such as is used in the first class of the school.
Arithmetic	Compound rules (common weights and measures).
Standard v	
Reading	A short ordinary paragraph in a newspaper, or other modern narrative.
Writing	Another short ordinary paragraph in a newspaper, or other modern narrative, slowly dictated once by a few words at a time.
Arithmetic	Practice and bills of parcels.
Standard vi	
Reading	To read with fluency and expression.
Writing	A short theme or letter, or an easy paraphrase.
Arithmetic	Proportion and fractions (vulgar and decimal).

Source: Revised code of Regulations, 1872

Table A.6: Political appointments

Panel A. Member of Parliament	
MP	*Member of Parliament.*
Tory	*MP for the Conservative party or the Unionists and/ or member of Carlton, Jun. Carlton, Conservative, St. Stephen's Club.*
Liberal	*MP for the Liberal party, the Whigs, or the Liberal Union and/or member of Brook's, Devonshire, Reform Club.*
Panel B. Local appointments (*local*)	
Lord Lieutenant	*Monarch's representative in a county.*
Deputy Lieutenant (D.L.)	*Assistant to the Lord Lieutenant.*
High Sheriff	*Monarch's judicial representative in the county.*
Sheriff	*Monarch's judicial representative in cities/boroughs.*

Source: thepeerage.com.

Table A.7: List of industrial cities and cathedrals

Industrial centers:	*Birmingham, Bradford, Bristol, Coventry, Derby, Leeds, Liverpool, London, Manchester, Newcastle, Nottingham, Prescot, Preston, Sheffield, and Southampton.*
Cathedrals:	*Bristol, Canterbury, Carlisle, Chester, Chichester, Durham, Ely, Exeter, Gloucester, Hereford, Lichfield, Lincoln, London, Manchester, Newcastle, Norwich, Oxford, Peterborough, Ripon, Rochester, Salisbury, Southwell, St Albans, Truro, Wakefield, Wells, Winchester, Worcester, and York.*

Notes: Industrial centers are from Landes (1998): p. 216. I also include the city of Southampton, which played a significant role in the Industrial Revolution (Rance 1986, pp. 9597) but is not listed in Landes (1998). Cathedrals are all Anglican cathedrals established in England before 1900.

Sources: Edwards, David L. (1989) *The Cathedrals of Britain*, Norwich: Pitkin Pictorials; Landes, David S. (1998) *The Wealth and the Poverty of Nations*, London: W. W. Norton & Company; Rance, Adrian (1986) *Southampton. An Illustrated History*: Milestone.

Table A.8: List of Companions of William the Conqueror

Source A. Douglas, D.C. and Greenaway, G.W. (Eds.) 1959. *English Historical Documents 1042-1189*. "William of Poitiers: the Deeds of William, Duke of the Normans and King of the English," & "The Bayeux Tapestry."	
Robert de Beaumont, 1st Earl Leicester	p. 227
William, Count Evreux	p. 227-8
Walter Giffard, Lord Longueville	pp. 227-8
Hugh de Grandmesnil	pp. 227-8
William Malet, Lord Graville	p. 229
Hugh de Montfort	pp. 227-8
William de Warenne, 1st Earl Surrey	pp. 227-8
Source B. Named in the Bayeux Tapestry.	
Odo, Bishop of Bayeux, later Earl Kent	
Eustace II, Count Boulogne	
Turstin FitzRolf	
Robert, Count Mortain	
Source C. Battle Abbey Roll, copies published by Leland, Holinshed and Duchesne.	
William de Bertram, Lord Briquebec	
Henry de Ferrers	
William de Percy, 1st Baron Percy	
Urse d'Abetot le Spencer	
Source D. Cokayne, G. *The Complete Peerage of England.*	
Richard Bigod AND Robert Bigod	vol. IX
Hugh d'Avranches, 1st Earl Chester	vol. III, p. 165.
Geoffrey de Mowbray, Bishop Coutances	vol. XII-1, App. L, pp. 47-8
Source E. Barlow, F. 1983. *William Rufus.* University of California Press.	
Baldwin Fitz Gilbert	p. 162
Richard Fitz Gilbert	p. 162
Source F. Other.	
Hugues de Beauchamp, Viscount Stafford	Bannerman, W.B. 1912. *Micellanea genealogica et heraldica*
Humphrey de Bohun	Bigelow, M. 1896. "The Bohun Wills," *American Historical Review*, 1:3, 414–15.
Robert, Count of d'Eu	Van Houts, E. (Ed.) 2000. *The Normans in Europe.* Manchester Univ. Press, p. 130
Hugh II de Gournay	Sanders, I. J. 1963. *English Baronies.* Clarendon Press.
Ilbert and Walter de Lacy	Adalae Comitissae (To Countess Adela), by Baudri, abbot of Bourgeuil
Sir Geoffrey de Mandeville	Planche, J.R. 1874. *The Conqueror and his Companions.* Tinsley Brothers.
Roger de Montgomerie, Earl Shrewsbury	Lee, S. (Ed.) 1897. *Dictionary of National Biography.* London: Smith, Elder & Co., vol. 49, p. 101.
Alan Rufus, 1st Lord of Richmond	Oxford Dictionary of National Biography

Notes: This table provides the list of 29 Normans used in Table 2. These are Norman nobles for which historical evidence proves they fought in the Battle of Hastings and/or appear in the Bayeux Tapestry—a Norman embroidery depicting the conquest of England.

Appendix B. Construction of the instruments

This appendix describes the construction of the two instruments used in the empirical analysis: the redistribution of land after the Norman conquest of England in 1066 and soil texture. Specifically, it provides two examples on the construction of the instrument for the county of Berkshire.

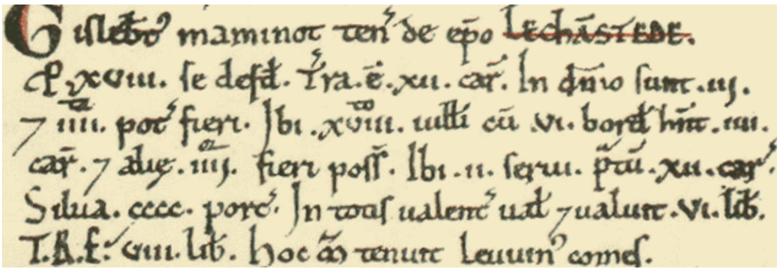
B. 1 Landownership concentration in 1066

My first instrument exploits the fact that much of the land inequality in the nineteenth century can be traced back to the Norman conquest of 1066 and the redistribution of land by William the Conqueror. Specifically, I use data from the *Domesday Book* and identify the share of land (value) in the hands of top landowners after 1066 in different areas of the territory.

Data. The *Domesday* is a survey of all landholdings in England commisioned in 1086 by William the Conqueror. Its main purpose was to determine what taxes had been owed during the reign of Edward the Confessor. This explains why (1) the survey reports land values and not acreage and (2) London and Winchester—tax-exempt cities—were not surveyed. The lands in the north, yet to be conquered, were also excluded. In total, the *Domesday* names 13,418 places.

For the sake of illustration, Figure B.1 shows the entry in the *Domesday book* corresponding to Leckhampsted, a small village in Berkshire. Gilber Maminot, a trusted collaborator of William,[43] was the lord in 1086. He had replaced Earl Leofwin, the Anglo-Saxon lord before the conquest. The land in Leckhampsted was worth £6, it was populated by 32 households (including two slaves), and counted 12 ploughs and 400 pigs.

Figure B.1: *Domesday Book* (1066), entry for Leckhampsted



Hundred: *Stotfold.*
Value in 1086: *£6.*
Population: *32 households (2 slaves).*
Other resources: *Meadow 12 ploughs. Woodland 400 pigs.*
Lord in 1066: *Earl Leofwin.*
Lord in 1086: *Gilbert Maminot.*

All the information is available in electronic format in Palmer (2010). The digitization of the *Domesday Book* was a monumental effort undertaken by various

[43] William the Conqueror sent Gilber Maminot to Rome to obtain the Pope's blessing after the battle of Hastings. Charles Carlton, 1986, *Royal childhoods*, Taylor & Francis p. 24.

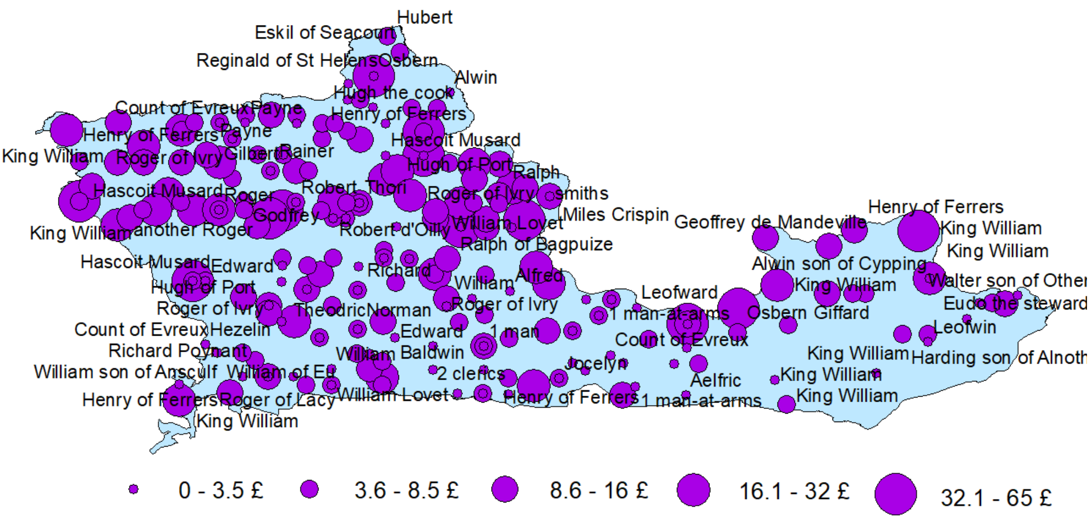
contributors over a long period, including Dr. Natasha Hodgson, Dr and Mrs. Thorn, the Phillimore and Co Ltd., and government typists under an ESRC-funded research project during the 1980s.

Example. I define my instrument as the share of the total land value in a particular territory owned by the top five Norman landowners after 1066. As explained in the main text, I exploit land values based on taxes that levy the size of the landholdings. Specifically, I use information from 21,036 farms in which land value was assessed by the geld tax—consisting of two shillings per hide (30 to 60 acres). I also consider 43 farms in which the land value is assessed from taxes on carucates—equivalent to 120 modern acres. In addition, to avoid endogeneity concerns described in the text, I exclude the King and the Church from the analysis. That is, I do not consider the land inequality steeming from the fifth of the land that King William took for himself and from the quarter of the land that was given to the Church.

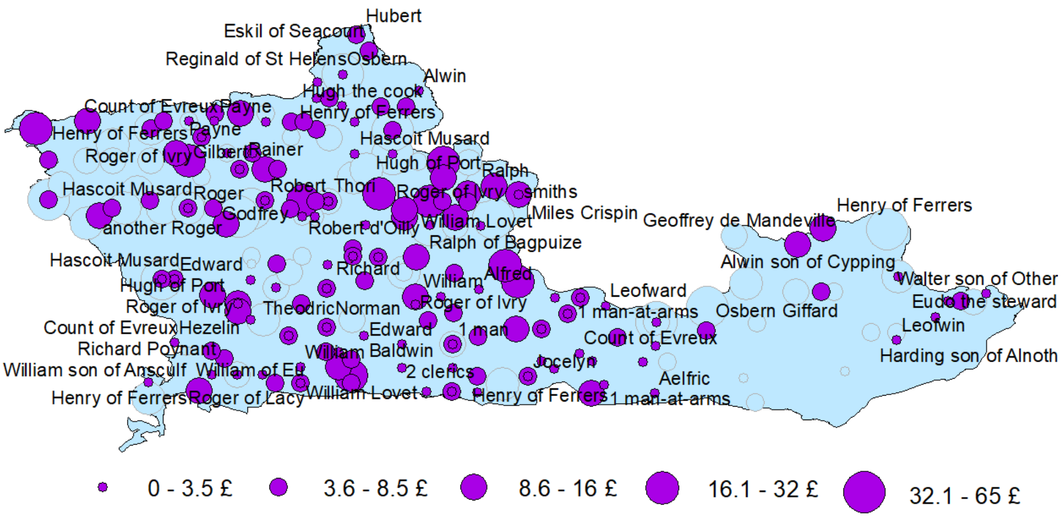
For the sake of illustration, Figure B.2 shows how I construct this instrument for the county of Berkshire. Panel (a) shows the geographical location of all the farms surveyed in the *Domesday*. Larger circles correspond to more valuable farms. As explained above, these land values are assessed mainly from the geld tax, which levied acreage and not the mills, markets, etc. in the area. The first step is to remove all the landholdings that William took for himself and the lands given to the Church—see panel (b). Next, I identify the top landowners. In Berkshire, the top five landowners after 1066 were Henry of Ferrers (£49.8), Geoffrey de Mandeville (£49), Walter Giffard (£39.1), Robert d'Oilly (£39.06), and William, son of Ansculf (£34). In total, 19.24 percent of the total land value in Berkshire was owned by these top five landowners.

Figure B.2: Construction of the *Domesday* instrument, Berkshire example

(a) All surveyed farms



(b) Excluding the King and the Church



Top five share (instrument): *19.24 %*

B. 2 Soil texture

To address endogeneity concerns in the relation between land inequality and education, I also exploit exogenous variation in soil texture. Here I discuss in detail why certain soil textures are associated with land inequality and present an example on how I constructed the instrument.

Theory. The texture of a soil crucially affects how well it retains storm water (Leeper and Uren 1993), and hence, how suited it is for agriculture. At the same time, areas where the soil is less suited for agriculture are subject to lower population pressure and a weaker demand for land, which leads to a more concentrated landownership.[44] My instrument is the percentage of land in a particular area under soil textures associated with worse storm water retention, and hence, with more landownership concentration.

Which are these soil textures? Soil texture is determined by the percentage of sand, silt, and clay. Sand particles are relatively round as compared to silt and clay particles. Since the space between particles is larger, storm water is not retained well in soils with a relatively large sand component (Leeper and Uren 1993). This can lead, for example, to frequent droughts. In addition, the presence of chalk and peat fragments in the soil also affects infiltration rates of storm water. Peaty soils are usually very fertile and hold much moisture,[45] while chalky soils are alkaline, drought-prone, and poorer in nutrients.[46] In sum, soils with a larger sand component and with chalk fragments are less suited for agriculture, and hence,

[44] Bhalla (1988), Bhalla and Roy (1988), Benjamin (1995), Barrett, Bellemare, and Hou (2010), and Cinnirella and Hornung (2016).

[45] Robert E. Stewart. 2017. "Agricultural technology." *Encyclopaedia Britannica*. https://www.britannica.com/technology/agricultural-technology.

[46] Brady, Nyle C. and Ray R. Weil. 2010. *Elements of the nature and properties of soils* (3rd Ed.) N.J.: Pearson Prentice Hall.

should be associated with more landownership concentration. In contrast, silty, clayey, or peaty soils are less drought-prone, experienced a stronger demand for land, and therefore, should be associated with a more fragmented landownership.

Example. To construct the soil-texture instrument I use data from the British Geological Survey (2014). This survey classifies 40 soil types into nine broad categories according to the relative proportions of sand, silt, clay, chalk, and peat fragments. I construct my instrument as the percentage of sandy and chalky soils in a given area. Table B.1 summarizes how I sorted soil types into the instrument and the reference group. The instrument considers soils where sand is the largest component: sandy loam soils (50–85% sand), loam soils (30–55% sand), and clayey loam soils (20–50% sand). The instrument also includes the percentage of chalky soils, which as explained above are also drought-prone and hence less suited for agriculture. On the other hand, the reference group includes silty loam soils (0–50% sand), clay soils (0–40% sand), silt soils (0–40 % sand), and soils with peat fragments, which are usually very fertile. Note that "pure" sand soils (90–100% sand) are included in the reference group. The reason is that these soils are typically found next to rivers or the coastline which, while very bad for agriculture, may have been very profitable for trade for example. It is reasonable to conjecture that these areas also experienced a high population pressure and a strong demand for land, and therefore, that landownership might have ended up more fragmented.

For the sake of illustration, Figure B.3 shows how I construct the soil-texture instrument for the county of Berkshire. Panel (a) displays the raw data from the British Geological Survey. The dataset is a vector grid with 1km x 1km cell dimensions. Each cell presents information on soil texture, classified in the 40 categories described above. To construct the instrument, I calculate the percentage of territory under chalky soils and soils with a larger sand component (i.e., sandy loam soils, loam soils, and clayey loam soils). In the case of Berkshire, this amounts to 59.9 percent. These are mostly lands in the west and north of the county, as illustrated in panel (b). In detail, the soils in the west of Berkshire are predominantly chalky, and hence, are included in the instrument. In contrast, the lands in the fertile south east are dominated by clay to silt, and therefore, are included in the reference group.

Finally, panel (c) illustrates why I include "pure" sand soils (90–100% sand) in the reference group. Note that the areas where sand is predominant are next to rivers Loddon and Pang, the Holy Brook channel, and the Kennet and Avon Canal. Although these soils may not be ideal for agriculture, owning a plot of land next to a river or a canal may have been very profitable. It is reasonable to conjecture that these areas experienced a strong demand for land, and therefore, that landownership might have ended up more fragmented than what its agricultural productivity may suggest.

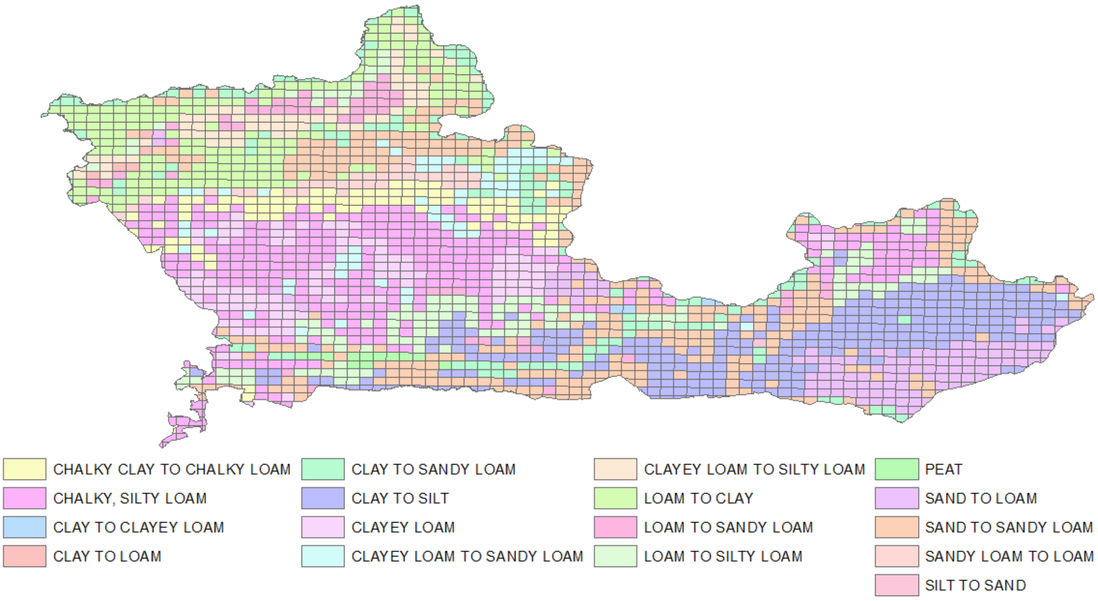
Table B.1: Soil-texture categories in the British Geological Survey (2014).

Soil group	IV group	% sand	% clay	% silt	soils in British Geological Survey (2014)
Sandy loam	instrument	50–85	0–35	0–45	*Sandy loam; Sandy loam to clayey loam; Sandy loam to loam; Sandy loam to sand; Sandy loam to silty loam.*
Loams	instrument	30–55	5–25	30–50	*Loam; Loam to clay; Loam to clayey loam; Loam to sandy; Loam to sandy loam; Loam to silty; Loam to silty loam.*
Clayey loam	instrument	20–50	25–40	20–50	*Clayey loam to sandy loam; Clayey loam to silty loam.*
Chalk	instrument	-	-	-	*Chalky clay to chalky loam; Chalky sandy loam; Chalky silty loam; Locally chalky.*
Silty loam	reference	0–50	0–40	50–100	*Silty loam; Silty loam to sandy loam; Silty loam to silt.*
Clay	reference	0–40	40–100	0–40	*Clay to clayey loam; Clay to loam; Clay to sandy loam; Clay to silt; Clayey.*
Silt	reference	0–40	0–40	40–100	*Silt to sand; Silt to silty loam.*
Peat	reference	-	-	-	*Peat; Peat and peaty clay or silt; Peaty clay; Peaty clay or silt; Peaty silt; Locally peaty.*
‘Pure’ sand	reference†	90–100	0–15	0–15	*Sand; Sand to loam; Sand to sandy loam; Sand to silt.*

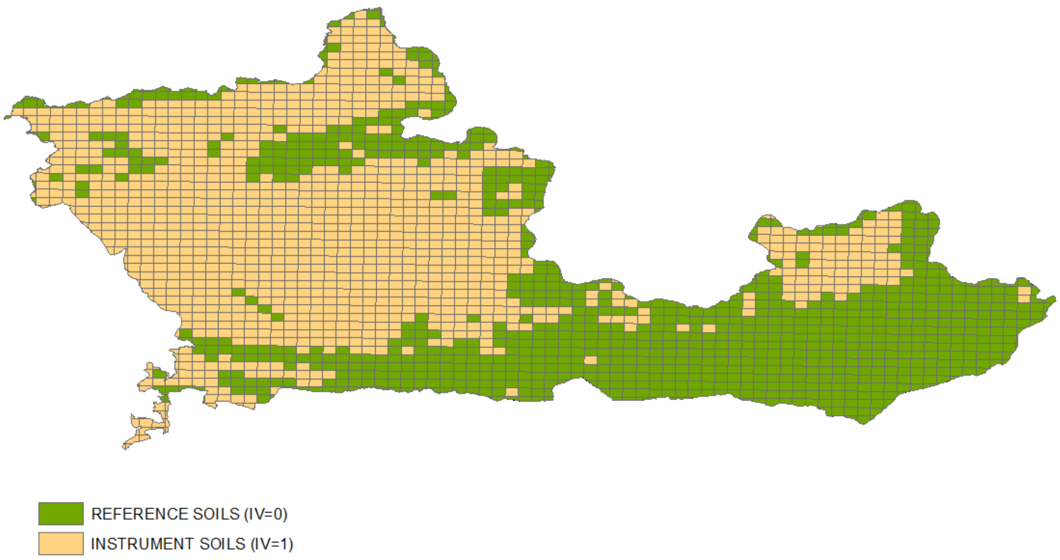
Notes: The % of sand, clay and silt is inferred from the USDA textural triangle.
† I include *‘Pure’ Sand* in the reference group because these soils are found next to rivers or the coastline, and hence, may have been well-suited for trade and other economic activities.

Figure B.3: Construction of the soil-texture instrument, Berkshire example

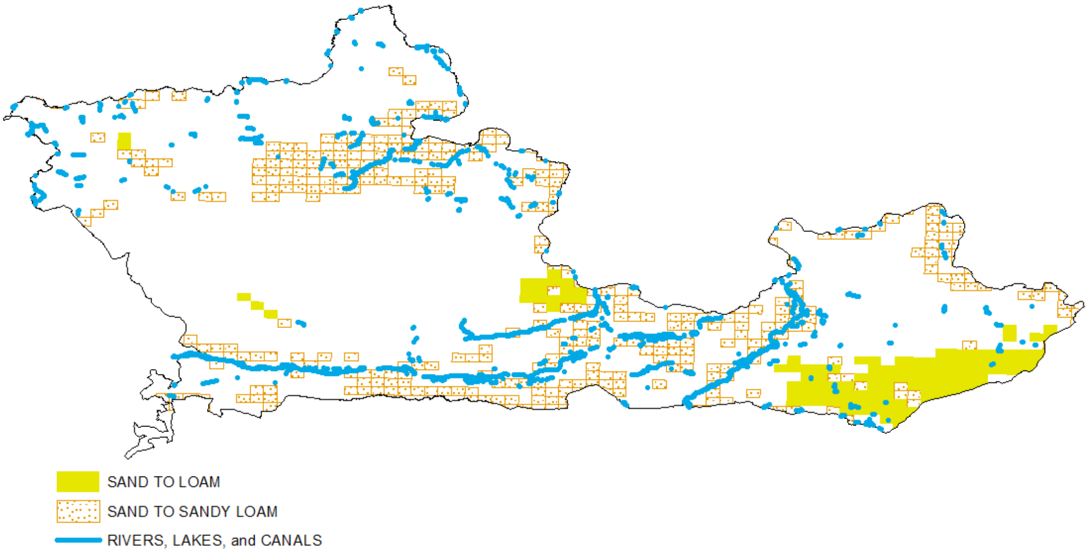
(a) British Geological Survey



(b) Soil-texture instrument



(c) Sand soils and rivers



Appendix C. Robustness using 1066 values

In the paper, I define the Norman conquest instrument as the concentration of land value in the hands of the top five Norman landowners. These land values are for 1086, twenty years after the conquest. Hence, they might reflect the destruction, casualties of battles, etc. related to the conquest and its aftermath. This is potentially problematic, particularly if the capital losses in 1066 triggered persistent local differences in economic development, that, eight centuries later, affected education provision. To address this concern, here I show that my main conclusions are robust to defining the instrument using pre-conquest land values.

The *Domesday book* typically reports a pre-conquest and a post-conquest land value. The former corresponds to 1066, the later to 1086. Here I define my instrument as the concentration of land value by the top five Norman landowners, measured using the 1066 land values instead of the values corresponding to 1086. As before, I use land values from taxes that levy the size of the landholdings and not the value of mills, markets, justice, etc. Mainly, I use information from the geld tax—consisting of two shillings per hide (30 to 60 acres). Also, I do not consider the lands that King William took for himself and the quarter of the land that was given to the Church.

The advantage of constructing the instrument using 1066 land values is that it does not reflect the destruction associated with the conquest and its aftermath. However, this comes at the cost of fewer observations. The *Domesday Book* provides 22,634 records (19,172 geo-located), one for each 1086 landholder. While 88.03 percent of these records report the land value in 1086, only 55.57 list land values in 1066. For example, for the analysis using local data, I can construct the instrument for 427 out of the 486 seats considered in the analysis.

First, I show that the empirical tests for the exclusion restriction are robust to defining the instrument using pre-conquest land values. Table **??** reports correlation coefficients between land concentration in 1066 and a range of pre-conquest and nineteenth century variables. Columns (1) and (2) show that William's land redistribution was not driven by economic factors. Specifically, the geographical pattern of landownership in Norman times, measured using 1066 values, is orthogonal to the density of roman roads—a proxy for pre-conquest economic development. As before, these measures are calculated for 10x10 mile grid cells. The correlation coefficients are very small, not significantly different from zero, and very similar to those obtained in Table C.1, where the instrument was defined using 1086 values.

In columns (3) to (7) I report correlation coefficients between the instrument, measured using 1066 values, and late nineteenth-century outcomes. If the Norman conquest triggered local differences other than land inequality that persisted overtime, we should observe significant correlations. In contrast, the table shows that land concentration in Norman times is associated only with land concentration in the nineteenth century. The correlation coefficients are much smaller (and not significantly different from zero) for income per capita, votes for the conservatives, the proportion of non-conformists, and religiosity in the 1870s. Three out of these four coefficients are significantly different from that capturing the association between land concentration in 1066 and in the late-nineteenth century. These results are very similar to those reported in Table C.1.

Overall, defining the instrument using 1066 values does not alter the fact that land inequality after the Norman conquest (1) does not reflect underlying pre-conquest economic factors; and (II) did not trigger persistent differences across counties in economic performance, political preferences, or religious composition. In other words, the validity of the exclusion restriction does not hinge on the fact that my baseline instrument, defined using 1086 land values, may reflect the destruction associated with the conquest and its aftermath.

Table C.1: Tests for the exclusion restriction.

Correlation between the Norman instrument and...							
	pre-conquest outcomes		**late-nineteenth century outcomes**				
	Roman road density ($\frac{km}{km^2}$) all	Roman road density ($\frac{km}{km^2}$) major	land con. in 19C	income pc (log)	% conservative	% non-confor.	relig.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation (ρ):	0.055	0.055	0.477***	-0.140	0.189	-0.066	-0.148
N:	394	394	32	32	32	32	32
Unit:	grid cell	grid cell	county	county	county	county	county
Ho:	-	-	-	ρ_1=ρ_2	ρ_1=ρ_3	ρ_1=ρ_4	ρ_1=ρ_5
Prob:	-	-	-	0.01	0.21	0.03	0.01

Note: Grid cells are 10x10 miles cells. To test the equality of two correlation coefficients, I use the Fisher r-to-z transformation. *** p<0.01, ** p<0.05, * p<0.1

Next, I show that first-stage results are not altered when the instrument is defined using pre-conquest land values. Table C.2 reports first-stage results using the baseline instrument and the alternative instrument based on 1066 land values. As before, I find a strong persistance in land inequality over eight centuries. The largest estates in nineteenth century England arose in areas where land had been more concentrated in Norman times (cols. 1 and 3). In detail, increasing land concentration in Norman times by one percentage point is associated with an increase by 120 of the acreage of large landlords in the nineteenth century, no matter if the instrument is defined using 1066 or 1086 land values. Similarly, for the average county, a one percentage point increase in the land owned by the top five Norman landowners is associated to an increase of 0.26–27 percentage points in the land owned by large landowners in the nineteenth century, independently of whether the former is measured using 1066 or 1086 land values (cols. 5 and 7).

In sum, these results suggest that the persistence of land inequality from 1066 to the late-nineteenth century does not depend on whether the instrument is defined using 1066 or 1086 land values. In other words, it is unlikely that the capital losses associated to the conquest and its aftermath alone drive the persistence of land inequality in England.

Table C.2: First-stage results, using 1066 values.

	Local data analysis				**County-level analysis**			
Dep. Var:	Acres of large landlords in 19C (100s)				Land concentration in 19C			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land concentration after Norman conquest:								
using 1086 land values (baseline)	1.23***	1.16***	-	-	0.27***	0.26***	-	-
	(0.28)	(0.27)			(0.09)	(0.08)		
using 1066 land values (alternative)	-	-	1.21***	1.10***	-	-	0.26***	0.26***
			(0.30)	(0.30)			(0.09)	(0.08)
Sandy and chalky soils (%)	-	1.13***	-	1.15***	-	0.40***	-	0.40***
		(0.37)		(0.36)		(0.13)		(0.13)
Observations	486	486	427	427	32	32	32	32
R-squared	0.040	0.058	0.036	0.059	0.23	0.42	0.23	0.41
F-stat	20.0	15.0	15.9	13.2	9.1	10.3	8.8	10.1

Note: In cols. (1) to (4), the sample comprises 25-mile radius around each of the 486 country seats of large landlords (i.e., peers who owned 2,000 acres or more in the 1880s). In cols. (5) to (8), the sample is all counties in England fully surveyed in the *Domesday Book*. Land concentration after Norman conquest is the concentration of land value in the hands of the top five Norman noble landlords. This is calculated using pre-conquest land values from 1066 and post-conquest land values from 1086. *** p<0.01, ** p<0.05, * p<0.1.

Finally, Tables C.3 and C.4 present second-stage estimates for the effect of land concentration on state education at the local and county level repectively. In both tables, land concentration is instrumented with soil texture and the concentration of land (value) after the Norman conquest, defined using 1066 values.

Local-level estimates are very similar to those obtained with the baseline instrument: School Boards' near large landowners raised fewer funds for education. The magnitude of the estimates is similar as before. For example, increasing by one standard deviation the landholdings of a nearby lord (i.e., by 9,809 acres) would reduce tax rates by 1.7 percentage points.

As before, results are robust to including covariates that are potentially correlated with state education (cols. 2 and col. 3) or to relaxing the assumption that each School Board and landlord pair (b, s) is an independent observation (cols. 4 and 5). In detail, collapsing the data at the seat level (col. 4) and weighting each observation using the distance between School Boards and seats (col. 5) does not alter the main conclusion that School Boards next to large landowners raised less funds for education. Finally, col. 6 includes fixed-effects for each landlord and shows that results are robust.

Table C.4 presents second-stage estimates for a wider range of education outcomes using county data. Results are very similar to those in Section 6: Counties in which landownership was more concentrated raised fewer funds from taxes on property and received fewer grants from the Committee of Education (panel A). In these counties, fewer School Boards were created, less money was spent per pupil, and investments in state schools were lower. Also, fewer teachers and class assistants were hired and their salaries were lower (panel B). As a result of this under-investment, children's human capital deteriorated: they were less likely to pass the national reading, writing, and especially, arithmetics' exam (panel C).

The magnitudes are comparable to the baseline estimates. As before, decreasing landownership concentration by one standard deviation (i.e., by 10 percentage points) would increase the funds raised from property taxes and the percentage of children passing arithmetics by half a standard deviation (30 pence per child and 2.6 percentage points, respectively).

In sum, this appendix shows that my main conclusions are robust to defining the Norman instrument using pre-conquest land values. Specifically, the tests for the exclusion restriction, first-stage results, and second-stage results are not altered when the instrument is defined using land values from 1066 instead of 1086. In other words, it is unlikely that the capital losses, casualties of battles, etc. associated with the conquest and its aftermath are driving my results, even if these are reflected in the 1086 land values used in the baseline instrument.

Table C.3: IV estimates for the effect of landownership on state education, local data.

	Dep. Variable: Tax rates (%)					
	IV	IV	IV	collapsed	weighted	FE
	[1]	[2]	[3]	[4]	[5]	[6]
Acreage of large landlord (100s)	-0.017***	-0.009***	-0.018***	-0.018***	-0.015***	-0.016***
	(0.004)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
F-stat from first-stage	15.0	15.0	15.0	15.0	15.0	15.0
Observations	21,970	21,970	21,970	427	21,561	21,970
County controls	NO	YES	NO	NO	NO	NO
Local controls	NO	NO	YES	YES	YES	YES
FE	NO	NO	NO	NO	NO	Lord
Cluster s.e.	seat	seat	seat	-	seat	Lord

Note: This table reports IV estimates for the effect of landownership on state education. Landownership is the acreage of the late-nineteenth century large landowners (i.e., peers who owned 2,000 acres or more). This is instrumented with the concentration of land (value) after the Norman conquest and soil texture. Differently to the main specification, the former is defined using pre-conquest land values. The sample consists of 1,387 School Boards operating in 1873–78 and 427 seats of large landlords. As before, each observation is a seat–School Board pair $\{s, b\}$, where School Board b is within a 25-mile radius of seat s. In col. 4 observations are collapsed by seat and in col. 5 are weighted by the distance between School Board and seat. County controls are log income, % voting conservative, % non-conformists, religiosity (Hechter 1976). Local controls are the distance from each School Board to the closest industrial city and to the closest cathedral. Industrial cities and Cathedrals listed in Table 5. Constants not reported. *** p<0.01, ** p<0.05, * p<0.1.

Table C.4: IV estimates using 1066 values, by county.

Panel A. Funding (pence p.c.)	Rates	Grants	Fees	Other	Total
Land concentration (%)	-3.09**	-2.14**	-0.40	-0.05*	-7.21*
	(1.33)	(0.96)	(0.28)	(0.03)	(3.81)
Employed in manufacturing (%)	2.52***	1.88***	0.57***	0.07***	6.93***
	(0.41)	(0.32)	(0.10)	(0.02)	(1.05)
Observations	96	96	96	96	96
County controls	YES	YES	YES	YES	YES

Panel B. Expenditures	Schools		Teachers			pence	
	School Boards	State to private	Cert. teacher	Class assist.	Teacher salary	per pupil	for State school (pc)
Land conc.	-1.69**	-0.43	-18.58	-8.67***	-110.88*	-1.60**	-4.97*
	(0.74)	(0.47)	(13.26)	(3.07)	(65.95)	(0.80)	(2.77)
Emp. manu.	0.75	0.04	27.99**	3.33*	70.84*	0.20	3.36***
	(0.56)	(0.15)	(12.44)	(1.73)	(32.33)	(0.29)	(0.84)
Observations	96	96	96	96	32	96	64
County controls	YES	YES	YES	YES	YES	YES	YES

Panel C. Outcomes	% passes in			
	Reading	Writing	Arith.	Total
Land concentration (%)	-0.17*	-0.15*	-0.26***	-0.16**
	(0.10)	(0.08)	(0.09)	(0.07)
Employed in manufacturing (%)	0.05	0.15***	0.19***	0.11***
	(0.05)	(0.03)	(0.03)	(0.02)
Observations	64	64	64	64
County controls	YES	YES	YES	YES

Note: This table reports IV estimates for the effect of land concentration on state education. Land concentration is the % of land in a county owned by large landowners (i.e., owners of 3,000 acres or more). This variable is instrumented with the concentration of land (value) after the Norman conquest and soil texture. Differently to the main specification, the former is defined using pre-conquest land values. The sample consists of a panel of 32 counties and 3 decades (1870s, 1880s, and 1890s). County controls are log income, % voting conservative, % non-conformists, religiosity. Constants not reported. Standard errors clustered by county; *** p<0.01, ** p<0.05, * p<0.1

Appendix D. Robustness: IV specification

In Section 6, I use a triangular IV model in which land inequality and the instruments vary in the cross-section, whereas education measures can also vary over time. Consequently, the first stage excludes the vector of late-nineteenth century county covariates (i.e., employment in manufacturing, income per capita, percentage voting conservative and non-conformists, and religiosity). The reason is these are uncorrelated with nineteenth-century land concentration. In fact, they are realized after Bateman's (1883) data was collected. Including these covariates in the first stage only reduces its strength.

To show that my results do not hinge on this specification, here I estimate a "classic" IV model including all covariates in the first stage and correcting for weak instruments. As in the paper, I perform this exercise at two levels. First, I exploit cross-county variation to examine the effect of landownership concentration on a wide range of educational measures between 1871 and 1899. Next, I use local data from 1,387 School Boards and 486 seats.

D. 1 Estimates using county data

First, I show that my county-level results are also robust to an alternative IV specification including all covariates in the first stage and correcting for weak instruments. Formally, I estimate the following instrumental variables model by limited information maximum likelihood (LIML):

$$edu_r = \alpha + \beta \; \hat{land}_r \; + \; \mathbf{V}_r' \delta \; + \; \epsilon_r \; , \tag{5}$$

where $\hat{land}$ is estimated from:

$$land_r = \kappa + \lambda \; land1066_r + \sigma \; soil \; texture_r \; + \; \nu_r . \tag{6}$$

where edu_r is an education measure in county r. Note that, in contrast to the baseline specification, here I do not exploit time variation in education measures. That is, education measures are averages between 1871 and 1899. The variable $land_r$ is the share of county r in the hands of large landowners (i.e., owners of 3,000 acres or more). Finally, $\mathbf{V}_c$ includes the aforementioned county-level covariates (employment in manufacturing, income per capita, percentage voting conservative and non-conformists, and religiosity), which are now included in the first-stage.

Including the county-level covariates in the first stage considerably reduces the size of the F-statatistic, inducing a weak instruments problem. To correct for this, I calculate p-values based on: Moreira's (2003) conditional likelihood ratio (CLR); the Lagrange multiplier K; a combination of the K and J overidentification tests; and Anderson-Rubin's test (AR).

Table C.1 presents these alternative estimates. Results are highly robust. Counties in which landownership was more concentrated raised fewer funds from taxes on property and received fewer Parliamentary grants (panel A). In these counties, fewer School Boards were created, less money was spent per pupil, and investments in state schools were lower. Also, fewer teachers and class assistants were hired and their salaries were lower (panel B). As a result of this under-investment, children's human capital deteriorated: they were less likely to pass the national arithmetics' exam (panel C).

D. 2 Estimates using local data

I estimate the following instrumental variables model by limited information maximum likelihood (LIML):

$$edu_{b,r} = \alpha + \beta \; lord \; \hat{acreage}_{r,c} + \; \mathbf{V}_c'\delta \; + \; \epsilon_{b,r,c} \; , \tag{7}$$

where $lord \; \hat{acreage}$ is estimated from:

$$lord \; acreage_{r,c} = \kappa + \lambda \; land1066_r + \sigma \; soil \; texture_r \; + \; \mathbf{V}_c'\delta + \; \nu_{r,c}. \tag{8}$$

where r is a 25-mile circle around each seat. The variable $edu_{b,r}$ is the average tax rate in 1873–78 set by School Board b, which is located in a 25-mile radius of the seat r and $lord \; acreage_{s,c}$ is the acreage by the large landlord living in seat s. I consider his acreage only in the county c where his seat s is located rather than his total acreage, which may include estates elsewhere in Britain. The instruments are $land1066_r$ (the percentage of the total land value in r that was given to the top five Norman noblemen after 1066); and $soil \; texture_r$ (the percentage of sandy and chalky soils in r). Finally, $\mathbf{V}_c$ includes the aforementioned county-level covariates: employment in manufacturing, income per capita, percentage voting conservative and non-conformists, and religiosity. Alternatively, I include covariates at the School Board level: the distance to the closest cathedral and the closest industrial center.

As before, I calculate p-values based on: Moreira's (2003) conditional likelihood ratio (CLR); the Lagrange multiplier K; a combination of the K and J overidentification tests; and Anderson-Rubin's test (AR).

Table C.2 shows that results are robust to this alternative specification. Overall, land concentration had a strong, negative effect on state education. Increasing the acreage of a landlord by one standard deviation (i.e., by 9,809 acres) would reduce tax rates set by the School Boards in a 25-miles range by 1.5 percentage points, the same effect as in the baseline specification used in the paper. As before, results are robust to including county-level covariates (col. 2) or local level covariates—i.e., the distance to the closest industrial center and cathedral (col. 3). Furthermore, estimates are robust to collapsing the data at the seat level (col. 4), to weighting each observation using the distance between School Boards and seats (col. 5), and to including fixed-effects for each landlord (col. 6).

Table C.1: IV with all covariates in first-stage and weak instruments, county data

Panel A. Funding (pence p.c.)

	Rates	Grants	Fees	Other	Total
Land concentration (%)	-3.05	-1.50	-0.48	-0.04	-6.98
CLR 95% c.i.	[-5.5, -0.9]	[-3.4, 0.2]	[-1.0, -0.0]	[-0.1, 0.0]	[-13.6, -1.0]
K p-value	*0.01****	*0.09**	*0.05**	*0.25*	*0.03***
K-J p-value	*0.01***	*0.11*	*0.07**	*0.30*	*0.03***
AR p-value	*0.02***	*0.15*	*0.11*	*0.48*	*0.06**
Observations	32	32	32	32	32

Panel B. Expenditures

	Schools		Teachers			pence	
	School Boards	State to private	Cert. teacher	Class assist.	Teacher salary	per pupil	for State school (pc)
Land conc.	-1.74	-0.40	-36.28	-7.00	-162.2	-1.04	-5.76
CLR 95 c.i.	[-3.3, -0.4]	[-1.0, 0.2]	[-66.7, -8.7]	[-12.5, -2.3]	[-326, -59]	[-2.7, 0.5]	[-9.8, -2.7]
K p-val.	*0.01***	*0.34*	*0.01***	*0.00****	*0.01***	*0.19*	*0.00****
K-J p-val.	*0.02***	*0.00****	*0.02***	*0.01****	*0.02***	*0.23*	*0.00****
AR p-val.	*0.04***	*0.00****	*0.04***	*0.02***	*0.02***	*0.43*	*0.00****
Obs.	32	32	32	32	32	32	32

Panel C. Outcomes

	% passes in			
	Reading	Writing	Arithmetics	Total
Land concentration (%)	-0.13	-0.10	-0.19	-0.14
CLR 95% c.i.	[-0.3, 0.0]	[-0.3, 0.0]	[-0.4, 0.0]	[-0.3,-0.0]
K p-value	*0.12*	*0.18*	*0.06**	*0.02***
K-J p-value	*0.14*	*0.22*	*0.07**	*0.02***
AR p-value	*0.08**	*0.31*	*0.16*	*0.02***
Observations	32	32	32	32

Note: This table presents the results from an IV specification estimated using LIML. In contrast to Table 6, here I include all the covariates in the first stage and correct for weak IV. The table reports p-values based on: Moreira's (2003) conditional likelihood ratio (CLR); the Lagrange multiplier K; a combination of the K and J overidentification tests; and Anderson-Rubin's test (AR). The sample consists of a cross-section of 32 counties (i.e., I do not exploit time variation over decades). Education measures are averages between 1871 and 1899. I exclude the counties not fully surveyed in the *Domesday book*. Land concentration is the % of land in a county by large landowners (i.e., owners of 3,000 acres or more). This is instrumented with landownership in 1066 and soil texture. County controls are log income, % voting conservative, % non-conformists, and religiosity. To fit the first stage, controls take their 1871 values; *** p<0.01, ** p<0.05, * p<0.1

Table C.2: IV with all covariates in first-stage and correcting for weak instruments, local data

	Dep. Variable: Tax rates (%)					
	weak IV [1]	weak IV [2]	weak IV [3]	collapsed [4]	weighted [5]	FE [6]
Acreage of large landlord (100s)	-0.015	-0.006	-0.015	-0.017	-0.012	-0.008
CLR 95% c.i.	[-0.033, -0.012]	[-0.044, -0.005]	[-0.040, -0.013]	[-0.040, -0.014]	[-0.037, -0.009]	[-0.039,-0.006]
K p-value	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****
K-J p-value	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****
AR p-value	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****
Observations	24,705	24,705	24,705	486	24,705	24,705
County controls	NO	YES	NO	NO	NO	NO
Local controls	NO	NO	YES	YES	YES	YES
FE	NO	NO	NO	NO	NO	Lord
Cluster s.e.	seat	seat	seat	-	seat	Lord

Note: This table presents the results from an IV specification estimated using LIML. In contrast to Table 6, here I include all the covariates in the first stage and correct for weak IV. The table reports 95% confidence intervals based on Moreira's (2003) conditional likelihood ratio (CLR) and p-values based on the Lagrange multiplier K; a combination of the K and J overidentification tests; and Anderson-Rubin's test (AR). As before, the sample consists of 1,387 School Boards operating in 1873–78 and 486 seats of large landlords (i.e., peers who owned of 2,000 acres more in the 1880s). Each observation is a seat–School Board pair $\{s, b\}$, where School Board b is within a 25-mile radius of seat s. In col. 4 observations are collapsed by seat and in col. 5 are weighted by the distance between School Board and seat. Acreage of grat lord (100s of acres) is instrumented with landownership in 1066 and soil texture. County controls are log income, % voting conservative, % non-conformists, religiosity (Hechter 1976). Local controls are the distance from each School Board to the closest industrial city and to the closest cathedral. Constants not reported. Standard errors clustered as indicated; *** p<0.01, ** p<0.05, * p<0.1.